Environmental Impact Report for the Rancho Viejo Solar Project in Santa Fe County, New Mexico

JULY 2024

PREPARED FOR

Rancho Viejo Solar, LLC

PREPARED BY

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ENVIRONMENTAL IMPACT REPORT FOR THE RANCHO VIEJO SOLAR PROJECT IN SANTA FE COUNTY, NEW MEXICO

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EXECUTIVE SUMMARY

Rancho Viejo Solar, LLC (Rancho Viejo), is proposing to build the Rancho Viejo Solar Project (Project), which will include a 96-megawatt (MW) solar facility, a 48MW/192 megawatt-hour (MWh) battery energy storage system (BESS), a substation, a generation tie-in line, an access road, an aboveground water storage tank, and an operations building on private land in Santa Fe County, New Mexico. The Project will be located approximately 3 miles south of Santa Fe city limits and approximately 4.2 miles east of La Cienega. This environmental impact report (EIR) was prepared to evaluate Rancho Viejo's application to Santa Fe County in compliance with Santa Fe County's Sustainable Land Development Code, which was adopted in Ordinance 2016-9 on December 13, 2016.

To facilitate Project planning and alternatives development and consideration, environmental surveys were performed for the Project area, including biological, cultural, and aquatic resources surveys. Atwell, LLC (Atwell), conducted an extensive desktop review of publicly available information from a variety of sources including federal and state agencies, local government offices, geographic information system (GIS) databases, and other relevant databases and technical resources to characterize the Project area and identify potential constraints associated with wildlife and other sensitive natural resources. The results of this desktop analysis are included in a habitat characterization report (Atwell 2020a). Atwell conducted a special-status species survey in June 2021 to assess the potential for gray vireos (*Vireo vicinior*), burrowing owls (*Athene cunicularia*), and other special-status species to nest within the Project area. The results of this survey are included in a special-status species report (Atwell 2021). Atwell also completed a Class I archaeological records search. Following the review of the New Mexico Cultural Resource Information System (NMCRIS) database and historical records, Atwell conducted a reconnaissance of the Project area on October 6 and 7, 2020. The results of this survey were incorporated into a Class I cultural resources inventory report (Atwell 2020b). SWCA was contracted to conduct biological surveys and a Class III cultural resources inventory of the Project area. The results of these surveys are incorporated into standalone biological and cultural survey reports (SWCA 2022a, 2022b). Refer to Sections 3.4 and 3.5 for additional details. SWCA completed an aquatic resources field survey for the Project on April 4 through 11, 2022 (SWCA 2022c). Refer to Section 3.14 for information on resources identified during this study.

Based on the resource surveys and desktop analyses described above, Rancho Viejo developed a Project layout that will avoid sensitive environmental resources to the extent possible within feasibility constraints. On November 4, 2021, Rancho Viejo presented the proposed Project to the Santa Fe County Technical Advisory Committee (TAC) at a pre-application meeting. In a letter dated March 29, 2022, the TAC identified relevant issues and follow-up action to be addressed by Rancho Viejo; however, no areas of potential controversy were identified (Appendix A).

The issues to be resolved in this EIR include the analysis of potential effects to air resources; biological resources; cultural, historic, archaeological, and religious resources; geological, paleontological, and soil resources; geographic resources; health and safety; land use; minerals and mining resources; noise resources; socioeconomic resources; roads; water resources; and visual resources. The analysis evaluates impacts to these resources associated with the construction, operation and maintenance, and decommissioning of the Project within an approximately 1,143-acre analysis area. This EIR identifies resource-specific environmental protection measures (EPMs) that will be implemented to avoid and minimize significant impacts from the Proposed Action (Table ES.2). This EIR also evaluates impacts associated with the No Action Alternative (no Project). Based on the analysis presented in the EIR and summarized below in Table ES.1, there will be no significant impacts resulting from the Proposed Action and no additional mitigation measures, beyond the EPMs set forth herein, are required. The Rancho Viejo Solar Project is not expected to unduly impair important environmental values.

Table ES.1. Proposed Action Impacts Summary by Resource

Resource	Proposed Action
Air Resources	Localized short-term increase in emissions and fugitive dust from construction equipment and vehicles during the construction period and minimal emissions from equipment and access road use during regular maintenance. With implementation of EPMs, impacts will be less than significant. See Section 3.3.
Biological Resources	Direct removal of vegetation during construction; indirect impacts to vegetation productivity and community composition due to fugitive dust and an increased risk for introduction and spread of noxious weeds. Direct removal of wildlife habitat during Project construction and short-term disturbances to local wildlife from construction noise and traffic. With implementation of EPMs, impacts will be less than significant See Section 3.4.
Cultural, Historic, Archaeological, and Religious Resources	No effects to cultural, historic, archaeological, or religious resources. See Section 3.5. This broad statement does not address the two (2) arch sites on the property.
Geologic, Paleontological, and Soil Resources	Direct impacts to Holocene valley fill deposits and Ancha Formation during construction. Low potential for impacts to paleontological resources due to lack of exposed geologic unit. Direct impact to up to 680 acres of soils within solar facility footprint and increased erosion during construction. With implementation of EPMs, impacts will be less than significant. See Section 3.6.
Geographic Resources	Indirect temporary impacts to nearby areas of critical environmental concern (ACECs), El Camino Real de Tierra Adentro National Historic Trail (NHT), and Galisteo Preserve during construction. With implementation of EPMs, impacts will be less than significant. See Section 3.7.
Health and Safety	EPMs will be implemented to minimize potential exposure to hazardous materials during construction. Additional EPMs will be implemented to reduce fire risks, including banning smoking and non-construction flame sources outside of vehicles, establishing safety guidelines for construction flame and spark sources, equipping vehicles with fire suppression tools and equipment, and implementing the measures in the Project's BESS Pre-Incident Plan (Appendix B). Permanent facilities will be operated and maintained in accordance with industry standards for safety and site security and will be fully fenced facilities that will preclude public access. With implementation of EPMs, impacts will be less than significant. See Section 3.8.
Land Use	Private grazing that currently occurs in the analysis area will terminate prior to construction of the transmission facilities; therefore, no impacts to the available foraging habitat for grazing will occur. No impacts to recreation. The Project will be consistent with the Santa Fe County SGMP (Santa Fe County 2015) and the appropriate County permits will be obtained. With implementation of EPMs, impacts will be less than significant. See Section 3.9. Also need to obtain the required state and federal permits.
Minerals and Mining Resources	No change in access to existing mines. Permanent solar facility will impact the ability to access surface and subsurface mineral deposits. Impacts will be less than significant. See Section 3.10
Noise Resources	Short-term impacts to the closest sensitive receptor may occur during the construction period. Once in operation, the Project will have a negligible effect on ambient noise levels beyond the immediate vicinity of the Project area. With implementation of EPMs, impacts will be less than significant. The 2024 noise technical report (Appendix C) indicates noise levels during construction would dissipate below background levels within 0.15 to 1.2 miles from the Project area. Operational noise would not be able to be perceived by a human observer. See Section 3.11.
Socioeconomics	Short-term construction-related revenue increases for the surrounding county and businesses. No long-term changes to the area's population or housing characteristics are anticipated as the construction work force is anticipated to commute from larger population centers. Long-term impacts include an estimated $6.1 million in applicable gross receipts taxes and $10 million in indirect benefit to the County, schools, and college districts. Impacts will be less than significant. See Section 3.12.
Traffic and Roads	Short-term increase in traffic on the local roads during the construction and decommissioning phases, with a negligible increase during operations and maintenance. With implementation of EPMs, impacts will be less than significant. See Section 3.13.
Water Resources	Less than 0.1-acre impact to one ephemeral drainage (Gallina Arroyo) during construction. Potential indirect impacts to surface water resources from stormwater runoff during construction. Construction water use will be minimal, and there will be minimal long-term water use associated with operations and maintenance. With implementation of EPMs, impacts will be less than significant. See Section 3.14. Need to verify
Visual Resources	Short-term visual impacts range from low to moderate due to construction crews, potential fugitive dust plumes, and installation of Project components. Long-term visual impacts include operation and maintenance of Project components and range from low to high. With implementation of EPMs, and depending on the final transmission line design, impacts are expected to be less than significant. See Section 3.15.

Table ES.2. Proposed Environmental Protection Measures

Resource	Proposed Action
Air Resources	• All fossil fuel–fired construction equipment will be maintained in accordance with manufacturer recommendations to minimize construction-related combustion emissions. • The idling time of fossil fuel–fired construction equipment will be limited, unless idling must be maintained for proper operation (e.g., drilling, hoisting, and trenching). • The speed of vehicles within construction sites will be limited during construction to help reduce the amount of fugitive dust generated. Look at as a condition to limit the dust from the road. • Water trucks or other dust suppression measures as required by the NMED Air Quality Bureau will be used to help reduce fugitive dust from construction activities.
Biological Resources	• Temporarily disturbed areas will be revegetated to the extent practicable in order to meet SWPPP requirements and performance standards for runoff and erosion control. Seed mixture and seeding rates will be developed through consultation with the local agency, experts, or landowner preference. Needs to also comply with SLDC. • Compacted soils will be restored as closely as possible to preconstruction conditions as required for ground stabilization and erosion control. • Trash and food debris will be disposed of properly. • The perimeter fence will be a wildlife-friendly agricultural woven-style fence with 10-foot poles. • Wildlife that have entered the work area will be allowed to leave the area on their own. • Environmental awareness training will be provided to all construction personnel working on the Project. • Trenches, excavations, and uncapped pipe segments will be checked for wildlife entrapment (New Mexico Department of Game and Fish 2022). • Personnel will comply with all posted and established Project speed limits. • Vegetation will be cleared outside the nesting season (March 15–September 15) where feasible to discourage birds from establishing nests in Project work areas. • The worker environmental awareness program will include training specific to avoidance of migratory birds and active migratory bird nests during the nesting season from March 15 to September 15. If active nests are found in the analysis area during construction, a biologist will be contacted to evaluate the activity status of the nest. The nest will be avoided until determined inactive by a biologist. • To avoid impacts to nesting burrowing owls, preconstruction nesting surveys will be conducted up to 2 weeks beforehand to establish the occupancy status of any potentially suitable nesting burrows detected within the analysis area. Rancho Viejo will coordinate with NMDGF for the appropriate avoidance buffers and survey protocol. • Facilities will be designed to discourage their use as perching or nesting substrates by birds, including designing aboveground transmission and facilities to follow established APLIC guidelines (APLIC 2006, 2012) to minimize bird collisions and avoid electrocution of raptors. APLIC guidelines will be considered at all stages of Project design and operation. • Micro-siting will be completed during engineering design to further minimize impacts to sensitive biological resources to the extent practicable. • If present, milkweed vegetation removal will be minimized to the greatest extent possible. • Rancho Viejo developed and will implement a vegetation and noxious weed management plan (Appendix F) for the control of noxious weeds and invasive species that could occur as a result of new surface disturbance activities at the site. Performance standards will be used to evaluate the success of the vegetation management plan. This is a requirement of the SLDC • If required as part of the SWPPP, a native seed mixture will be applied to all temporary disturbance areas, followed by applications of mulch as required to provide additional erosion control. • Construction activities will generally be limited to the least noise-sensitive times of day (i.e., daytime between 7 a.m. and 7 p.m.), unless necessary due to weather, safety, or schedule constraints. Construction equipment will be equipped with manufacturers' standard noise control devices or better (e.g., mufflers, engine enclosures). • A worker environmental awareness program will be implemented to train facility personnel regarding their responsibilities to conserve protected resources that are located on-site and associated treatment measures.

Resource	Proposed Action
Cultural, Historic, Archaeological, and Religious Resources	• Avoidance of LA 200751 by at least 100 feet will occur as a result of a revised site plan by Rancho Viejo. Fencing around the protected area will need to be installed during construction to identify the area. • Avoidance of LA 200751 will be achieved by constructing a new alignment of the access road to the Project. The site will be avoided by at least 100 feet. This area will also need fencing while the road is being constructed. • A Tribal monitor may be present during construction, and Rancho Viejo will make the Project site available to the Tribal monitor during construction upon request. However, the Tribal monitor's presence is voluntary and not required for construction activities to proceed.
Geologic, Paleontological, and Soil Resources	• Construction will not be conducted during wet conditions when soils are saturated. • To the extent possible, topsoil will be placed separately from subsoils/bedrock during excavation and not comingled and will be replaced in reverse order of excavation. • Erosion will be reduced by applying and maintaining standard erosion and sediment control methods. These may include using certified weed-free straw wattles and bale barriers and silt fencing. Specific erosion and sediment control measures will be specified in a SWPPP. The SWPPP will include performance standards to evaluate the success of erosion control measures. • A SPCC plan will be prepared by Rancho Viejo. A dedicated concrete cleanout will be required for the project. • Hazardous materials will not be drained onto the ground or into streams or drainage areas. • Construction waste including trash, other solid waste, petroleum products, and other potentially hazardous materials will be removed to a disposal facility authorized to accept such materials. • Contractors will implement a hazard communication program for any on-site hazardous materials to include training, labeling, and posting of Safety Data Sheets (SDSs). Fuels and petroleum-based products will be stored in approved containers and away from excavated areas. Waste motor oil, hydraulic fluid, and liquid gear lube will be stored in approved containers in isolated areas and removed to an authorized disposal facility monthly and in accordance with the regulations of NMED. All equipment using hydraulic hoses and cylinders will be inspected for leaks. Any equipment found to have petroleum leaks that cannot be repaired immediately will be removed from service and replaced. • Contractors will have proper training, spill kits will be on-site, and any leaking equipment will be repaired immediately. In the event contaminants are released, in addition to the requirements outlined in the environmental report, Rancho Viejo will adhere to the notification policies contained in 20.6.2.1203 NMAC.
Geographic Resources	• All fossil fuel–fired construction equipment will be maintained in accordance with manufacturer recommendations to minimize construction-related combustion emissions. • The idling time of fossil fuel–fired construction equipment will be limited, unless idling must be maintained for proper operation (e.g., drilling, hoisting, and trenching). • The speed of vehicles within construction sites during construction will be limited to help reduce the amount of fugitive dust generated. • Water trucks or other dust suppression measures as required by the NMED Air Quality Bureau will be used to help reduce fugitive dust from construction activities. • The applicable permits needed to transport equipment and materials will be obtained from Santa Fe County. NMDOT will also need to issue permits for oversized loads and hazardous materials. • Proper construction techniques and best management practices will be employed to minimize impacts to local roads. • Visual impacts during construction will be reduced by minimizing areas of surface disturbance as practical, controlling erosion, using dust suppression techniques as practical, and, if applicable, restoring exposed soils as closely as possible to their original contour and vegetation. • Construction activities will primarily be limited to daytime hours. If night work is required during construction, lighting will be the minimum necessary for safety, and lighting will not be left on when not in use. Any work outside normal hours (7am to 6pm) will require permission from Santa Fe County.

Resource	Proposed Action
Health and Safety	• A SPCC plan will be prepared by Rancho Viejo. • Rancho Viejo, or its contractors, will be responsible for fencing the site during construction to restrict access to the public for safety. • Hazardous materials will not be drained onto the ground or into streams or drainage areas. • Construction waste including trash, other solid waste, petroleum products, and other potentially hazardous materials will be removed to a disposal facility authorized to accept such materials. • Contractors will implement a hazard communication program for any on-site hazardous materials to include training, labeling, and posting of SDSs. Fuels and petroleum-based products will be stored in approved containers and away from excavated areas. Waste motor oil, hydraulic fluid, and liquid gear lube will be stored in approved containers in isolated areas and removed to an authorized disposal facility monthly and in accordance with regulations of NMED. All equipment using hydraulic hoses and cylinders will be inspected for leaks. Any equipment found to have petroleum leaks that cannot be repaired immediately will be removed from service and replaced. • Contractors will have proper training, there will be spill kits on-site, and any leaking equipment will be repaired immediately. In the event contaminants are released, in addition to the requirements outlined in the environmental report, Rancho Viejo will adhere to the notification policies contained in 20.6.2.1203 NMAC. • A Preliminary Hazard Mitigation Analysis (HMA) has been prepared for the project (Appendix H). A Final HMA will be performed as part of the detailed engineering process. This HMA will include site and product specific fire risk assessment and a first responder plan (Appendix G). Local first responders will have access to these reports. Rancho Viejo will provide on-site and in-person training to the local responders prior to commercial operation of the system. There are no special materials required to respond to a fire event for the containerized BESS units. Only standard water application to the adjacent BESS containers is required, and this is only in the case where all internal fire suppression systems may fail. All information required by the first responders will be included in the first responder plan part of the HMA. • If a battery fire is initiated, the enclosures planned for this site will release fire suppressant in large concentrations directly into the initiating cell, removing heat and preventing thermal runaway throughout the enclosure. UL 9540 certification addresses safety and requires UL 9540a test results to be available for review. The UL 9540a tests of this system indicate adequate prevention of thermal runaway. The Rancho Viejo Energy Storage solution will achieve UL 9540 certification prior to site commercial operation. • Wildland fire prevention measures will be used during construction, including limiting vehicle travel to and within construction areas to only essential vehicles, establishing parking guidelines in remote areas, banning smoking and non-construction flame sources outside of vehicles, and establishing safety guidelines for construction flame and spark sources. • Rancho Viejo and its contractors, as appropriate, will initiate discussions with local fire districts and regional fire prevention staff prior to construction to discuss emergency procedures. • As appropriate, vehicles will be equipped with fire suppression tools and equipment. Fire suppression equipment may include, but will not be limited to, shovels, buckets, and fire extinguishers. • Smoking and equipment parking will be restricted to approved areas. • Rancho Viejo and/or its contractors will fuel all highway-authorized vehicles off-site or in approved areas to minimize the risk of fire. Fueling of construction equipment that is transported to the site and is not highway authorized will be done in accordance with regulated construction practices and applicable federal, state, and local laws. • Federal and state occupational health and safety standards will be established for the Project, such as OSHA's Occupational Health and Safety Standards. Additionally, a hazardous materials management plan will be developed for the management of hazardous materials, in coordination with those requirements under the Project's SPCC plan and SWPPP. • A safety plan will be developed prior to construction for contractors working at the site. The plan will include items such as location of nearest medical emergency facilities, agency contacts and procedures, and inclement weather procedures. • Construction is unlikely but could lead to the inadvertent excavation of pipes containing asbestos, or soils contaminated with asbestos fines/fragments. In the event such fragments/soils are excavated, Rancho Viejo will analyze such fragments/soils, and if the fragments/soils exceed more than 1% asbestos, the asbestos waste will be disposed of by an approved commercial hauler in accordance with New Mexico Solid Waste Rules.

Resource	Proposed Action
Land Use	• Compacted soils will be restored as closely as possible to preconstruction conditions as required for ground stabilization and erosion control. • Rancho Viejo will develop and implement a noxious weed and control management plan for the control of noxious weeds and invasive species that could occur as a result of new surface-disturbing activities at the site. • If required as part of the SWPPP, a native seed mixture will be applied to all temporary disturbance areas, followed by applications of mulch as required to provide additional erosion control. • Rancho Viejo will coordinate with military bases and aviation facilities as needed. This is a requirement of the SLDC • Construction activities will generally be limited to the least noise-sensitive times of day (i.e., daytime between 7 a.m. and 7 p.m.), unless necessary due to weather, safety, or schedule constraints. Construction equipment will be equipped with manufacturers' standard noise control devices or better (e.g., mufflers, engine enclosures).
Minerals and Mining Resources	No EPMs are proposed for this resource. Rancho Viejo will coordinate with any pertinent mineral and oil and gas rights holders, and there are no plans for mining in the analysis area.
Noise Resources	• Construction activities will generally be limited to the least noise-sensitive times of day (i.e., daytime between 7:00 a.m. and 7:00 p.m.), unless necessary due to weather, safety, or schedule constraints. • Construction equipment will be equipped with manufacturers' standard noise control devices or better (e.g., mufflers, engine enclosures).
Socioeconomics	The Rancho Viejo Solar Project socioeconomic impacts will be incremental and short term; therefore, no EPMs are proposed.
Traffic and Roads	• The applicable permits needed to transport equipment and materials will be obtained from the County. • Construction speed limits will be established. • Proper construction techniques and best management practices will be employed to minimize impacts to local roads.

Resource	Proposed Action
Water Resources	• Impacts to any potentially jurisdictional WOTUS will be covered under NWP 14 or NWP 57 as long as impacts are below the 0.5-acre threshold. The use of an NWP will trigger USACE coordination and National Historic Preservation Act Section 106 consultation and coordination with NMED. • A SWPPP will be developed and implemented as required by the NMED Surface Water Quality Bureau and obtain coverage under a National Pollution Discharge Elimination System Construction General Permit from the EPA pursuant to Section 402 of the Clean Water Act, 33 United States Code 1342. The SWPPP may include measures such as silt barrier fences to control runoff, sediment traps and basins, and minimizing exposed soils by using temporary and permanent seeding and mulching. • Disturbed areas will be restored to their original condition to the extent practicable in order to meet SWPPP requirements for runoff and erosion control. Seed mixture and seeding rates will be developed through consultation with the local agency, experts, or landowner preference. • Equipment will be properly maintained for fluid leaks. • Spills will be cleaned up immediately. • Matting and other temporary protective measures will be used on jurisdictional wetlands that cannot be avoided. • An appropriate buffer zone of up to 50 feet around wetlands will be established as necessary to reduce disturbance. • Rancho Viejo will span and avoid placing structures in ephemeral floodplains and other surface water features, where feasible. • Collection/lines, cables, and access roads will be designed to minimally intersect the floodplain and will not change the base flood elevation or otherwise affect the floodplain. The placement of poles and structures for overhead collection will minimally intersect the floodplain without affecting the base flood elevation. If practicable, at the end of construction, underground collection cable trenches will be reclaimed to pre-existing contours without affecting the floodplain. • Rancho Viejo will comply with Sections 401 and 404 of the Clean Water Act and obtain all necessary permits. All impacts to WOTUS will be evaluated against the requirements of the USACE for NWP, as applicable. • Rancho Viejo will implement appropriate erosion control measures in areas with slopes, as provided in the SWPPP. To the extent practicable, temporary access roads will be designed following existing landform contours, where practicable, and revegetated with native or similar grasses, shrubs, or forbs, or as agreed to with the landowner. • Hazardous materials will not be drained onto the ground or into streams or drainage areas. • Construction waste including trash, other solid waste, petroleum products, and other potentially hazardous materials will be removed to a disposal facility authorized to accept such materials. • Contractors will implement a hazard communication program for any on-site hazardous materials to include training, labeling, and posting of SDSs. Fuels and petroleum-based products will be stored in approved containers and away from excavated areas. Waste motor oil, hydraulic fluid, and liquid gear lube will be stored in approved containers in isolated areas and removed to an authorized disposal facility monthly and in accordance with regulations of NMED. All equipment using hydraulic hoses and cylinders will be inspected for leaks. Any equipment found to have petroleum leaks that cannot be repaired immediately will be removed from service and replaced. • Contractors will have proper training, spill kits will be on-site, and any leaking equipment will be repaired immediately. In the event contaminants are released, in addition to the requirements outlined in the environmental report, Rancho Viejo will adhere to the notification policies contained in 20.6.2.1203 NMAC. • Compacted soils will be restored as closely as possible to preconstruction conditions as required for ground stabilization and erosion control. • If required as part of the SWPPP, a native seed mixture will be applied to all temporary disturbance areas, followed by applications of mulch as required to provide additional erosion. • Erosion will be reduced by applying and maintaining standard erosion and sediment control methods. These may include using certified weed-free straw wattles and bale barriers and silt fencing. Specific erosion and sediment control measures will be specified in a SWPPP. • BESS battery enclosures have an ingress protection (IP) rating of IP55, which will prevent fluids from leaking at low pressure. FK-5-1-2 fire suppression injection system will be applied inside the BESS enclosure and any breach would only occur at temperatures above the boiling point of the injection system thereby limiting the discharge of fluids to the ground.

Resource	Proposed Action
Visual Resources	• Visual impacts will be reduced during construction by minimizing areas of surface disturbance as practical, controlling erosion, using dust suppression techniques as practical, and, if applicable, restoring exposed soils as closely as possible to their original contour and vegetation. • Construction activities will primarily be limited to daytime hours. If night work is required during construction, lighting will be the minimum necessary for safety, and lighting will not be left on when not in use. • Compacted soils will be restored as closely as possible to preconstruction conditions as required for ground stabilization and erosion control. • If required as part of the SWPPP, a native seed mixture will be applied to all temporary disturbance areas, followed by applications of mulch as required to provide additional erosion control.

1 INTRODUCTION

Rancho Viejo Solar, LLC (Rancho Viejo), is proposing to build the Rancho Viejo Solar Project (Project). The Project will be approximately 3 miles south of Santa Fe city limits and approximately 4.2 miles east of La Cienega (Figure 1.1). The Project will include a 680-acre solar facility, a 1-acre collector substation, a 2.3-acre BESS, a 2.3-mile generation tie-in line (gen- tie) and associated switchyard, a 2.1-mile access road, a aboveground water storage tanks, and a 1,400-square-foot by approximately 18-foot aboveground operations building, on private land in Santa Fe County, New Mexico (Figure 1.2). The Project will generate 96 MW and will include a 48-MW/192-MWh BESS, for storage and delivery of renewable solar energy to Public Service Company of New Mexico (PNM) customers in Santa Fe and New Mexico. The energy supplied by the solar facility is intended to replace part of the PNM fossil-based assets and would help fulfill New Mexico's renewable portfolio standard (RPS) of 50 percent renewable energy by 2030 and 100 percent carbon-free energy by 2045 for investor-owned utilities.

This environmental impact report (EIR) was prepared to support Rancho Viejo's application to Santa Fe County for compliance with Santa Fe County's Sustainable Land Development Code (SLDC), which was adopted in Ordinance 2016-9 on December 13, 2016. The 2016 SLDC governs land use and development throughout the unincorporated areas of the county. The 2016 SLDC contains the regulations that a property owner must follow when building or remodeling a structure. It also explains the process by which land use and development can occur. Section 6.3 of Ordinance 2016-9 outlines the requirements for an EIR, which "shall inform the County, the public and the applicant of the significant environmental effects or impacts and describe reasonable alternatives to the project."

Because the solar facility's capacity will be less than 300 MW, this Project is not subject to location approval from the New Mexico Public Regulation Commission (Commission). Location approval is required when a transmission line has a capacity of 230 or more kilovolts and is associated with a power plant that requires the Commission's location approval for new generation of 300 or more MW (6293.B New Mexico Statutes Annotated [NMSA] 1978). In addition, the right-of-way width for the generation tie line, once fully designed, will not exceed the 100-foot-wide threshold for transmission line oversight by the Commission.

1.1 Project Location

The Project will be located entirely on private land to be leased by Rancho Viejo and located in Sections 2–9, Township 15 North, Range 9 East (see Figure 1.2). Note that a portion of the proposed access road is an unplatted area not covered by the Public Land Survey System.

1.2 Decision to be Made

Rancho Viejo will apply to Santa Fe County for approval of the proposed Project as is required under the 2016 SLDC. This EIR will facilitate Santa Fe County Planning Commission's review of the application. Under the 2016 SLDC, the Santa Fe County Planning Commission shall approve application for the location of the proposed Project unless it finds the location will unduly impair important environmental values.

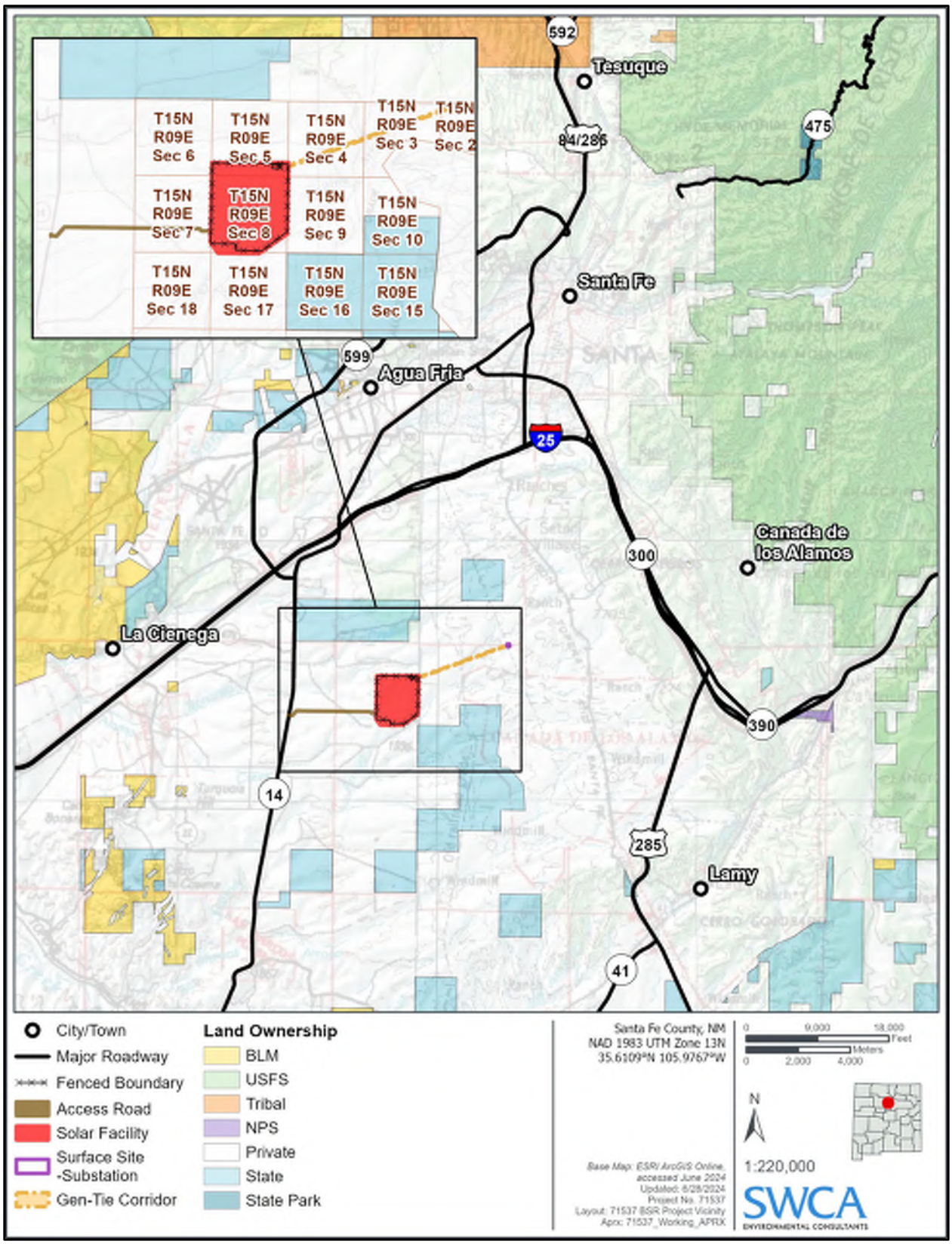


Figure 1.1. Vicinity map.

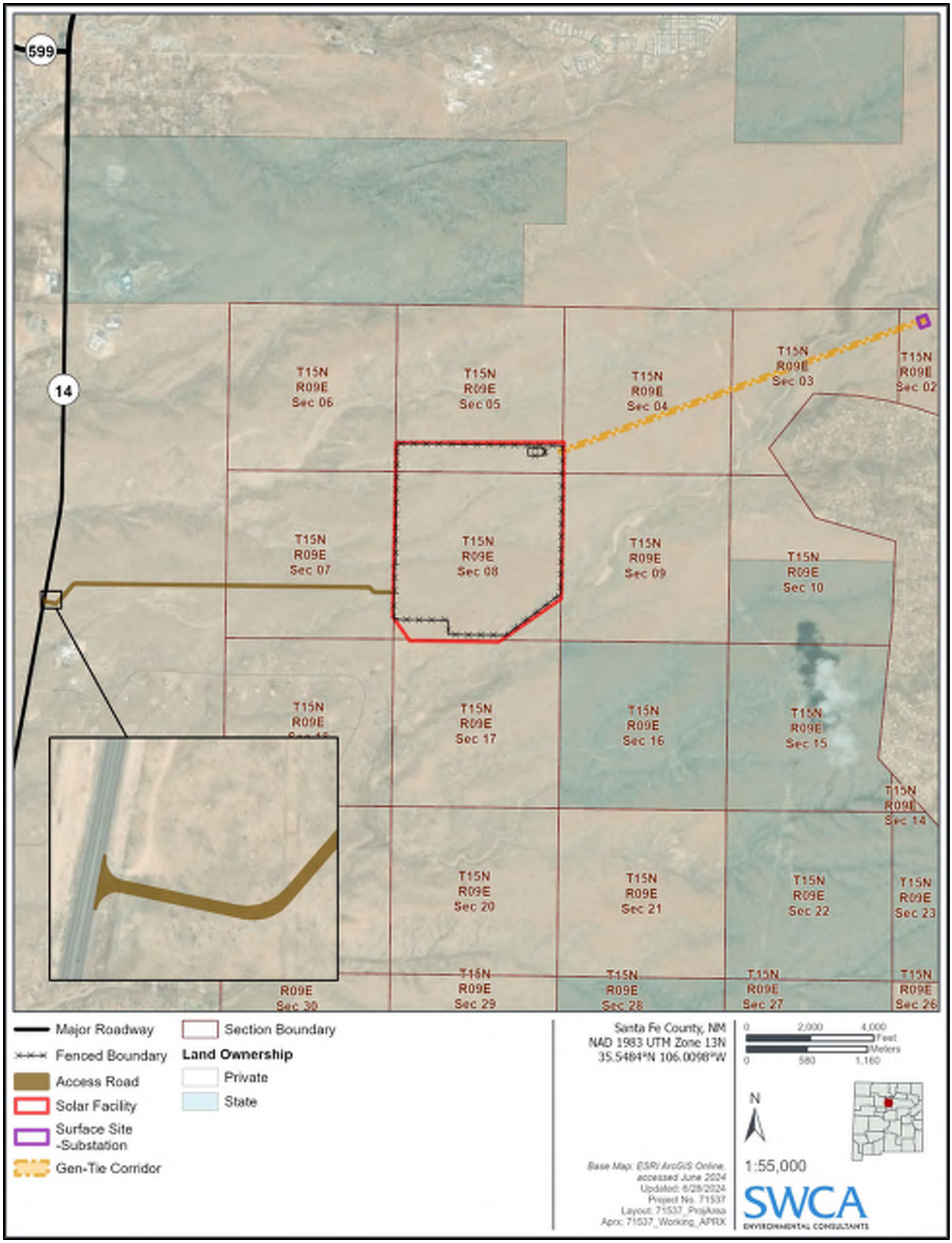


Figure 1.2. Project area.

2 PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

The proposed Project includes the construction of the 96-MW generation facility, 48-MW/192-MWh BESS, a Project collector substation, an operations building, water storage tanks, a generation-tie transmission line and associated switchyard, and an access road, for a total expected disturbance of 724 acres (Table 2.1; Figure 2.1). The final layout and locations of Project components were evaluated within a larger survey area and were designed to avoid sensitive environmental resources to the extent feasible (see Section 2.3 below) and minimize adverse impacts to resources via the implementation of EPMs. Thus, the Proposed Action is the environmentally preferred alternative.

Table 2.1. Facility Components

Component	Description
Generation facility	680 acres in size.
Battery energy storage system	Located in the northeast portion of the generation facility, the Project's battery energy storage system (BESS) will have a capacity of 48 MW on a 4-hour duration, with 192 MWh of storage capacity. The BESS system will consist of lithium-ion batteries, racked in engineered battery enclosures and controlled through a proprietary energy management system provided by a leading storage integration firm. The BESS will occupy approximately 2.3 acres of land area.
Collector substation	Located within the northeast part of the Project site. Approximately 1 acres in size, fenced facility with ground grid, gravel, concrete foundations, steel structures, transformers, breakers, metering, and other associated structures and equipment. Structures within the substation will generally have a height of less than 15 feet, with the exception of a lightening mast having an approximate height of 60 feet 4 inches. There may be an H-Frame structure within the collector substation having a maximum height of 50 feet or a monopole having a maximum height of 70 feet.
Gen-tie	Extends between the collector substation and the PNM-operated 115-kV transmission line that runs between Zia Substation and El Dorado Substation, approximately 2.5 miles northeast of the Project site. The gen-tie line will be 2.3 miles in length within a right-of-way less than 100-foot-wide. Up to 28.8 acres of disturbance, inclusive of the area under the conductors. The transmission structures are modeled as a single-circuit and will consist of one of these two options: • Option 1: H-Frames structures up to 50 feet in height with structure spans ranging from 250 feet to 350 feet, • Option 2: Monopole structures up to 70 feet in height with structure spans ranging from 250 feet to 450 feet.
Access road	Extends east from State Route 14 to the Project site for a length of 2.1 miles. Internal access roads will traverse the perimeter and internal solar panel layout.
Operations Building	Located south of the collector substation. The operations building will be approximately 1,400 square feet and will support compliance with 2021 International Fire Code (IFC) Chapter 12, Energy Systems, Section 1207.1.6.1, Fire mitigation personnel. A 5,000-gallon potable water tank and septic tank will be included to meet water and wastewater needs.
Additional Infrastructure	Water storage tank: Located west of the BESS. The water storage tank will hold approximately 30,000 gallons of water and will be 26.3 feet in diameter and 7.2 feet above ground. The water storage tank will meet the requirements of 2021 IFC Chapter 5, Fire Service Features, Section 507, Water Supply. Stormwater management: Located west of the BESS and water storage tank. PNM's switchyard: Located at the eastern terminus of the gen-tie corridor where the line will connect to the existing PNM line.
Laydown yard	Two laydown yard areas are proposed. One laydown yard is located at the eastern boundary, directly south of the proposed operations building, and the second is located in the southwest corner of the solar facility. The laydown yards would be used for storing materials and would provide central locations for construction personnel.

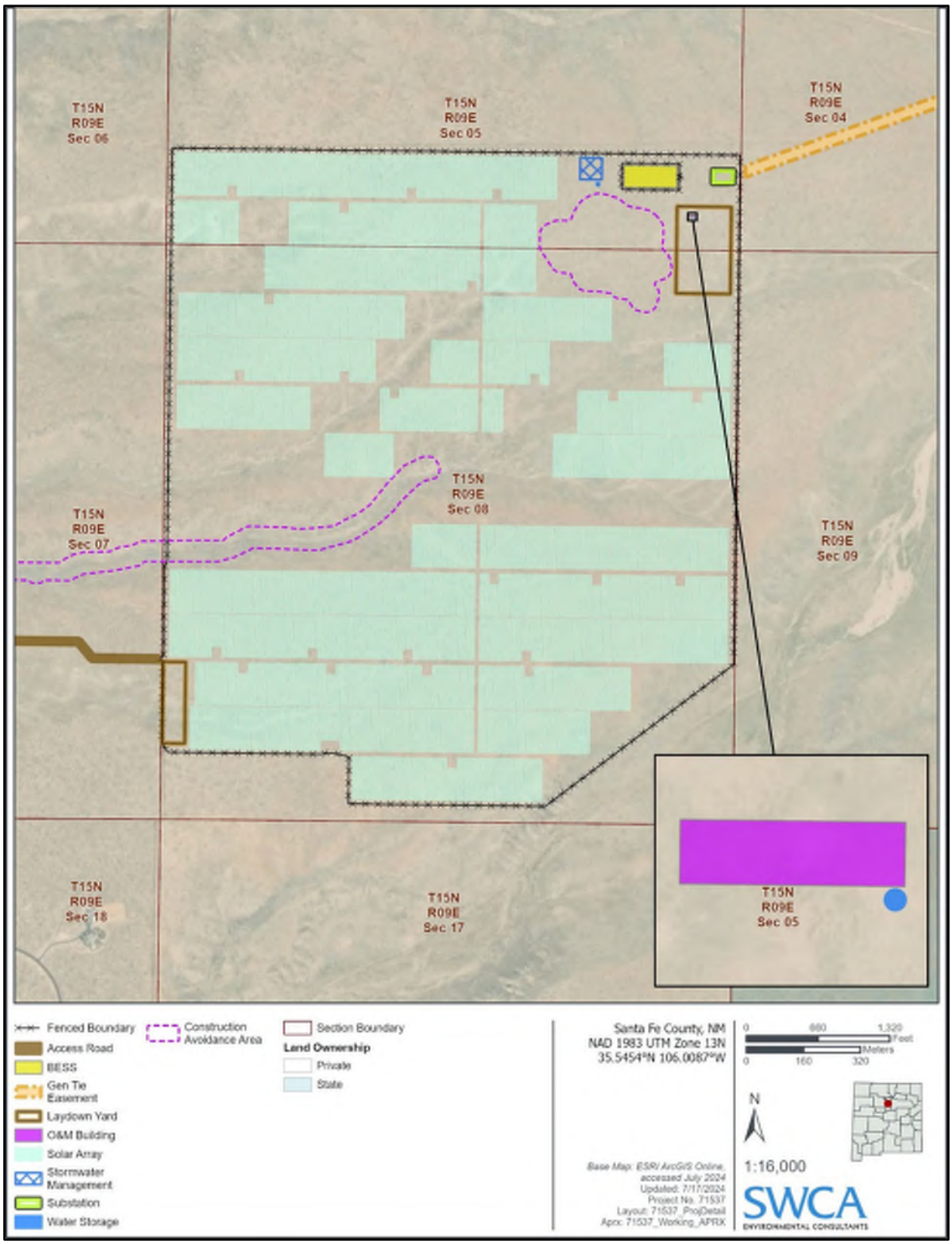


Figure 2.1. Detailed Project area map.

2.1.1 Facilities

2.1.1.1 SOLAR FACILITY

The Project is a 96-MW solar project with 48-MW/192-MWh BESS. The Project will utilize high-quality (Tier 1) bifacial monocrystalline modules from an industry-trusted and time-tested brand to absorb sunlight and produce electricity. The Project will consist of 1) solar photovoltaic (PV) modules mounted on single--axis tracking steel structures; 2) a medium voltage electrical collection system that will aggregate the output from the PV modules and convert the electricity from direct current (DC) to alternating current (AC); 3) an on-site collector substation where all of the facility's medium voltage output will be combined and transformed to 115-kilovolts (kV) ; 4) a 115-kV gen-tie line that will transmit the electrical power generated from the Project to PNM's existing Zia–Valencia 115 kV transmission line and the rest of the electrical grid; 5) communications infrastructure including fiber-optic cable; and 6) civil infrastructure including driveways, drainage management, and fencing.

The perimeter of the solar PV facility will be enclosed by an agricultural style fence, which is wildlife friendly, and posts will be a minimum of 8 feet and maximum of 12 feet tall. The on-site collector substation and BESS may be enclosed by a chain-link fence. The access points from the access driveway to the site will be controlled access (authorized personnel only) by employing swinging or rolling chain-link gates. Interior roads were designed in consultation with the Santa Fe County Fire Department and select roads will include an all-weather fire access surface for on-site access and circulation. All nonpaved temporary or permanent on-site roads and staging areas shall be improved pursuant to Santa Fe County standards or specifications.

The racking system has a range of tilt equal to +/- 52 degrees. At their highest point, the top edges of the PV panels will be up to 8 feet above ground level depending on spot topography based on current design. There will be 1,000-foot setbacks from the solar facility to surrounding property boundaries. Additional setbacks for the solar panels, if needed, will be determined by Santa Fe County, in conjunction with the applicant, and shall be based on an analysis of the Project's externalities together with the nature of the surrounding uses. The solar field will be laid out in a common PV block design to allow adequate clearance and adequate access for maintenance.

2.1.1.2 BATTERY ENERGY STORAGE SYSTEM

The Project battery energy storage system (BESS) will have a nameplate capacity up to 48 MW (192 MWh) and be connected to the 115-kV collector substation. The BESS will consist of tier-one lithium-ion batteries that can both absorb and discharge electricity directly onto the power grid. The storage facility design will consist of 1) batteries installed in external-access modular containers; 2) power conversion systems (inverters), which can bi-directionally convert the electricity between DC and AC; 3) electrical collection and fiber-optic communications lines; 4) heating ventilation and air conditioning (HVAC) and chiller systems; 5) fire detection and management systems; and 6) civil infrastructure including driveways and fencing.

During operation of the solar facility, the BESS will be used to store energy (charge the batteries) and to bridge intermittency gaps by discharging the stored electricity from the batteries into the grid to maintain steady output, or to shift Project output to when electricity demand is most high, often in the evenings after the sun has set or solar generation has waned. This helps to maintain grid balance, lower energy prices, and meet regional electricity demand. The BESS allows the solar facility to store energy generated during the day for use later when solar is not available or when demand for electricity is higher, providing exceptional value to PNM as a versatile grid stabilizing resource.

The BESS will be constructed and operated in accordance with all appliable guidelines, including the National Fire Protection Association (NFPA) guidelines NFPA 1 Fire Code and NFPA 70 National Electrical Code, NFPA 855, UL9540, and UL9540A.

2.1.1.3 COLLECTOR SUBSTATION

The Project collector substation will be located on the northeast portion of the Project site. The substation equipment transforms the medium-voltage distribution power from the inverters to high-voltage transmission for efficient transfer from the Project to the 115-kV grid.

2.1.1.4 GEN-TIE LINE

A 115-kV gen-tie will transmit electricity from the Project's on-site collector substation to the PNM-operated 115-kV transmission line that runs between Zia Substation and Valencia Substation, approximately 2.5 miles northeast of the Project site. The transmission structures will be single-circuit and will consist of one of these two options:

- Option 1: H-Frames structures up to 50 feet in height with structure spans ranging from 250 feet to 350 feet,
- Option 2: Monopole structures up to 70 feet in height with structure spans ranging from 250 feet to 450 feet.

The gen-tie will also provide communication paths via optical ground-wire fiber-optic cable and all-dielectric self-supporting fiber-optic cable.

2.1.1.5 ACCESS ROAD

Construction and operations will require access by service vehicles, construction equipment, cranes, and trucks carrying equipment, components, and other construction materials. A 20-foot-wide gravel surfaced or compacted native soil access road with a minimum inside turning radius of 28 feet will be constructed from New Mexico State Road 14 to the Project site. Internal access roads will traverse the perimeter and internal solar panel layout and will also be 20 feet wide with minimum turning radius of 28 feet in conformance with 2021 IFC Section 503 and 2021 IFC Appendix D, Fire Apparatus Roads.

2.1.1.6 OPERATIONS BUILDING

The operations building will be located south of the collector substation and will be approximately 1,400 square feet. The operations building will include two offices, a breakroom, conference room, bathroom, control room, and storage area. A 5,000-gallon potable water tank and septic tank will be included to meet water and wastewater needs. It is anticipated that approximately four qualified personnel will work out of the operations building during general business hours, and will support compliance with 2021 IFC Chapter 12, Energy Systems, Section 1207.1.6.1, Fire mitigation personnel.

2.1.1.7 ADDITIONAL INFRASTRUCTURE

Water storage tank: The water storage tank will be located west of the BESS. It will hold approximately 30,000 gallons of water and will be 26.3 feet in diameter and 7.2 feet above ground. The water storage tank will meet the requirements of 2021 IFC Chapter 5, Fire Service Features, Section 507, Water Supply.

Stormwater management: The stormwater management area will be a 200 × 200–foot area designed for stormwater retention.

PNM switchyard: The PNM switchyard will interconnect the Project into the existing 115-kV transmission line at Seton Village. The switchyard will consist of a fenced facility with ground grid, gravel, concrete foundations, steel structures, breakers, metering, and other associated structures and equipment.

2.1.1.8 LAYDOWN YARDS

Equipment and materials would be stored in laydown areas and moved into the construction area as needed. These areas would be reclaimed following construction.

2.1.2 Construction

2.1.2.1 PRECONSTRUCTION SURVEYS

SWCA Environmental Consultants (SWCA) has completed preconstruction biological, cultural, and water resource surveys of the analysis area. Additional engineering, surveying, and site assessments will occur prior to construction as the design process evolves.

Geotechnical investigations have been conducted to determine subsurface conditions, soil properties, and thermal and electric resistivity, to inform appropriate Project design (Appendix D).

2.1.2.2 CONSTRUCTION SCHEDULE AND WORKFORCE

Rancho Viejo is in the process of evaluating and selecting engineering, procurement, and construction (EPC) partners for the Project. The final EPC contractor selections will be made in the months following execution of a power purchase agreement (PPA) with PNM. The construction process typically requires 12 months from start to finish. Project construction will require approximately 200 workers over the construction period. It is anticipated that the majority of the Project workforce will be derived from Santa Fe, Sandoval, and Bernalillo Counties. In observance of New Mexico Statues 62-13-16, the Project has committed to employing apprentices from apprentice programs registered pursuant to the Apprenticeship Assistance Act at a level of at least 10% of the construction workforce.

2.1.2.3 TRANSPORTATION AND EQUIPMENT

The Project will require approximately 10 trips per day for materials and equipment over the construction period. Contractors commuting to the Project will generate approximately 115 to 190 trips per day for the duration of the construction period, for a total of 29,900 to 49,400 trips. Most Project-related trips will originate outside of the immediate vicinity of the analysis area. Equipment and materials will use paved roads to access the Project vicinity. Worker commute trips will primarily use paved roads.

Once in the vicinity of the Project, the Project site will be accessed via State Route 14 (paved). Equipment and materials will be stored within the laydown yard areas and moved into the construction area as needed. Equipment used during construction (Table 2.2) will include heavy civil equipment to prepare and clear the access road and to level and compact the switchyard area.

Table 2.2. Construction Workforce and Equipment

Activity	Staffing	Equipment
Site preparation, clearing, access roads	1 to 10 laborers/equipment operators	1 motor grader, 6 pickup trucks, 1 bulldozer, 1 backhoe, 1 bobcat, 2 roll off trucks, 1 dump truck, 2 water trucks, 1 paddle scraper if required, 1 water pull if required, 1 roller, 1 front-end loader
Materials hauling	2 to 15 laborers/equipment operators	10 tractor trailers for deliveries, 1 tractor-mounted crane, 2 pickup trucks, 4 flatbed trucks,4 box trucks, 4 telehandler forklifts, 4 offroad forklift
Vegetation clearing	1 to 10 laborers/equipment operators	1 bulldozer, 1 skidder, 1 chopper, 1 chipper, 1 mower, 1 tractor with harrow/disk
Foundation excavation and installation	4 to 20 laborers/equipment operators	1 mounted drill rig or auger truck, 1 backhoe, 1 excavator, 6 pickup trucks, 1 air compressor, 3 to 5 concrete trucks, case/bobcat with auger, 8 pile drivers
Component assembly	4 to 30 laborers/equipment operators and 1 crane operator, 3 forklift operator	1 to 3 hydraulic cranes, 6 pickup trucks, 2 flatbed trucks, 1 compressor, 3 telehandler forklifts
Component placement	4 to 30 laborers/equipment operators and 1 crane operator	1 crane (50- to 300-ton capacity), 6 pickup trucks, 1 telehandler forklift
Cleanup	1 to 15 laborers	1 bulldozer with ripper, 1 grader, 1 front-end loader, 1 tractor with harrow/disk/mower, 3 pickup trucks

2.1.2.4 WATER USE

Water use during construction will be approximately 100 to 150 acre-feet over a 12-month construction period and will be delivered to the Project site by water trucks. Water may be acquired from the following off-site sources, or a combination thereof: Santa Fe County bulk water station commercial pipe water; Ranchland Utility Company Class A reclaimed water; Santa Fe County reclaimed water; or any other legally permitted commercial water sales. Construction water will be used for equipment washing and dust abatement and to support general construction activities (concrete foundations, etc.).

2.1.2.5 SITE PREPARATION

The existing vegetation in the analysis area will be protected to the greatest extent possible; however, certain areas will be cleared and graded for movement of vehicles, assembly of components, and necessary crane maneuvers. Grading will be required for the construction of access roads, laydown areas, solar arrays, inverters, and transformer skids, and for the BESS and substation area. Trackers with relatively high slope tolerance will be selected for the Project and arrays will be sited to avoid the most prominent topographic features. Light grading may be needed along the access roads to remove any localized impediments to construction vehicles and equipment.

2.1.2.6 CONSTRUCTION SEQUENCING

Generally, construction will occur in the following steps, but portions of the Project may be constructed concurrently or sequentially. It is anticipated that the duration of construction will be approximately 12 months. Typical construction work schedules are expected to be from 7:00 a.m. to 7:00 p.m., Monday through Friday, with the potential for work to occur from 7:00 a.m. to 7:00 p.m. on Saturday. Work on the gen-tie may occur at night to minimize outages. In addition, certain activities, such as concrete pours, may occur outside of the specified hours when heat conditions are conducive to the activity.

Clearing, Grubbing, and Grading

Although the Project will be constructed at existing grade to the greatest extent possible, minor grading and/or grubbing may occur throughout the portions of the solar facility, BESS and substation area, foundation pads, and equipment storage and staging areas. Grading will conform to accepted slope stability requirements. Minor grading will include cuts and fills that are not expected to exceed 24 inches. Water or a dust palliative may be needed for dust control.

Equipment Installation

Installation of fencing and posts, assembly of the solar PV module tables, and construction of the arrays may occur concurrently. Multiple temporary staging and laydown areas will be located throughout the Project site to support assembly and installation. Rancho Viejo will procure crushed rock and cement from outside vendors during construction.

As construction progresses across the site, equipment will be removed from each temporary staging and laydown area, and solar arrays will be installed. Multiple arrays are combined into a circuit, and then multiple circuits are connected to the electrical collection system. Improved (earthen or gravel) roads will allow access within the arrays.

Construction of the BESS may occur concurrently with construction of the solar PV facility, or it may occur at a later time. Construction will be confined to a small footprint within or adjacent to the on-site collector substation. External-access modular containers will be utilized to house the storage technology. Associated conduit and support infrastructure will also be installed. The BESS will be constructed and operated in accordance with all applicable guidelines, including the National Fire Protection Association (NFPA) guidelines NFPA 1 Fire Code and NFPA 70 National Electrical Code.

Construction of the new poles for the 115-kV gen-tie and stringing lines on the poles may occur concurrently with construction of the solar PV facility. New poles will range between 50 feet and 70 feet in height and will have span lengths ranging between 250 feet and 450 feet, depending on if H-Frame or monopole structures are installed. Conductor stringing will occur by stationing stringing equipment at stringing sites along the gen-tie route, with bucket trucks, cranes, line/assist trucks with air compressors, truck- or trailer-mounted tensioner and puller, and various pickup and flatbed trucks stationed along the gen-tie route as the conductor is installed. Helicopters may be utilized to support conductor stringing. Stringing will take place within the existing gen-tie right-of-way.

Construction Waste Management

Construction sites, material storage yards, and access roads will be kept in an orderly condition throughout the construction period. During construction, the primary waste generated will be solid non-hazardous waste, such as packing materials (paper, wood, plastics) and vegetation. Solid waste generated during construction will be transported for disposal at a licensed waste management facility.

Most of the hazardous waste generated during construction will consist of liquid waste, such as flushing and cleaning fluids, and solvents. Other potential hazardous waste sources include paints, thinners, sealants, fuels, oils, and lubricants. Some hazardous solid waste, such as welding materials, may also be generated during construction. The quantities and concentrations of these hazardous substances are not expected to reach regulated levels. Hazardous waste would be managed in accordance with federal, state, and local regulations. No construction equipment oil or fuel will be drained on the ground. Oils or chemicals will be hauled to an approved site for disposal. Spill cleanup kits will be available on equipment so that spills or leaks of vehicle fluids could be quickly cleaned up for proper disposal.

2.1.2.7 INTERIM RECLAMATION

Postconstruction, areas in the analysis area not required for long-term operations and maintenance will be reclaimed. Reclamation techniques will follow those outlined in the Project's stormwater pollution prevention plan (SWPPP). Reclamation will include light grading, application of a native seed mixture (in areas with pre-existing vegetation), and application of mulch as required to provide additional erosion control.

2.1.3 Operations and Maintenance

Operations and maintenance of the Project will be performed by qualified personnel, including approximately four technicians who will work out of the on-site operations building during general business hours. The solar facility will be operational generally in daylight hours. Maintenance of the solar facility may include periodic washing of solar panels, general equipment maintenance, and vegetation trimming. The annual water consumption for operation of the facility will be expected to be approximately 2 to 3 acre-feet. This includes the water required for washing the PV panels as many as four times per year using a manual cleaning system. Water will be trucked to the Project site. Water may be acquired from the following off-site sources, or a combination thereof: Santa Fe County bulk water station commercial pipe water; Ranchland Utility Company Class A reclaimed water; Santa Fe County reclaimed water; or any other legally permitted commercial water sales.

During operation of the solar facility, the BESS system will be used to store energy to bridge intermittency gaps by discharging the stored electricity into the grid when solar generation dips or when electricity demand is high. This helps to maintain grid balance to meet electricity demand. The BESS storage system allows the solar facility to store energy generated during the day for use later when solar is not available or when demand for electricity is higher.

It is anticipated that batteries will be added and/or replaced as needed to maintain the BESS capacity at 48 MW/192 MWh of capacity. Old batteries will be recycled or disposed of in accordance with relevant federal, state, and local guidelines.

2.1.4 Decommissioning

Decommissioning of the Project will be completed within 12 months of the end of electricity generation and will include disassembling the permanent facilities described above. Concrete foundations will be removed to 3 feet below grade. Materials will be salvaged and/or recycled for future use, as applicable and economically feasible. Unsalvageable materials will be disposed of at authorized locations. Demolition or removal of equipment and facilities will meet applicable environmental and health regulations.

Following the removal of Project facilities, the site will undergo final cleanup and reclamation. Areas disturbed during removal of Project features will be restored and rehabilitated as near as possible to their original condition and will be available for the same uses that existed prior to construction of the Project. For more details, please see the Rancho Viejo Decommissioning Plan (Appendix E).

2.2 No Action Alternative

Under the No Action Alternative, the proposed facility and associated infrastructure will not be constructed. This alternative serves as a baseline, allowing decision-makers to compare the magnitude of environmental effects of the Proposed Action. The analysis area is primarily located within the Rural

Fringe (RUR-F) zoning district (SLDC Section 8.6.3), which designates areas suitable for a combination of estate-type residential development, agricultural uses and other compatible uses. The RUR-F designation provides an intermediate step in development density between typical open space and agricultural/ranching lands and primarily residential (low density) parcels. This zone also serves to protect agricultural and environmental areas that are inappropriate for more intense development due to their sensitivity. The RUR-F zone accommodates primarily large lot residential, eco-tourism, equestrian uses and renewable resource-based activities, seeking a balance between conservation, environmental protection and reasonable opportunity for development. Density transfers and clustered development shall be allowed in order to support continued farming and/or ranching activities, conserve open space or protect scenic features and environmentally sensitive areas. Therefore, depending on the type of development that may occur, the No Action Alternative could result in impacts to resources that would be similar and potentially greater in magnitude than the Proposed Action. Further, as Santa Fe County and the state of New Mexico both have goals related to renewable energy production, this Project would not contribute to those goals under the No Action Alternative.

2.3 Alternatives Considered but Eliminated from Further Analysis

Alternative locations for the solar array were explored within the larger parcel. Specifically, partially siting the Project in Sections 5 and 6 was examined but dismissed due to biological resources constraints along the southern branch of Bonanza Creek and the north-facing slopes. Siting the Project in Sections 5 and 6 was also dismissed based on public feedback related to concerns of potential visual resources effects to residential areas located to the south. Locating the Project closer to State Road 14 was also considered but this potential location was eliminated because it is part of the Turquoise Trail National Scenic Byway. Access road locations were modified to avoid documented cultural resources. Alternative locations for the Project BESS and gen-tie were not considered; however, the gen-tie route was largely dictated by topography and represents the shortest distance possible between the Project and the PNM line (resulting in the least surface disturbance). The gen-tie design was also altered to span a potential jurisdictional wetland (described below in Section 3.14.2).

3 ENVIRONMENTAL SETTING AND ENVIRONMENTAL EFFECTS

3.1 Scope of Analysis

The scope of analysis addressed in this EIR includes the environmental setting (existing conditions), the significant environmental effects (impacts) of the proposed Project, impact minimization and environmental protection measures (EPMs), and reasonable alternatives to the Project (SLDC Section 6.3.1). The 1,143-acre analysis area encompasses the combined footprints of the 680-acre solar facility, the 1-acre substation, the 2.3-acre BESS, the 2.3-mile generation tie-in line (gen-tie), 2.1-mile access road, the water storage tank, and the operations building, plus the survey area buffer, as depicted in Figure 3.1.

Based on the issues identified in the studies described in the Executive Summary above and in accordance with Santa Fe County's 2016 SLDC, the resources addressed in this EIR include air resources; biological resources; cultural, historic, archaeological, and religious resources; geological, paleontological, and soil resources; geographic resources; health and safety; land use; minerals and mining resources; noise resources; socioeconomic resources; roads; water resources; and visual resources. This analysis evaluates direct and indirect impacts to resources associated with the entire 1,143-acre analysis area. Impacts to resources may be either adverse (negative) or beneficial (positive); however, where adverse or beneficial is not specifically noted, the reader should assume the impact is adverse. With regard to duration, impacts are described as long-term, short-term, or temporary. Temporary impacts are those that end as soon as the activity ceases. Short-term impacts are those that extend beyond the implementation phase, potentially lasting for several months, but not for several years or longer. Long-term impacts are those that last for a long period of time (e.g., decades or longer, including impacts beyond the life of the project). Irretrievable commitments of resources are also evaluated.

This EIR also evaluates cumulative effects within a cumulative impacts analysis area (CIAA). Cumulative effects are most likely to arise when a relationship exists between a proposed project and other actions that have occurred or are reasonably expected to occur in a similar location or time period, or that involve similar actions (see Section 3.2 below). Projects in close proximity to the Proposed Action would be expected to have more potential for cumulative effects than those more geographically separated. The CIAA for all resources evaluated in this EIR (except for socioeconomic resources) includes the area within a 5-mile buffer of the proposed Project. The CIAA for socioeconomic resources is the geographic area of the city of Santa Fe and Santa Fe County.

Impact significance is assessed in this EIR for each of the resources listed above. An impact would be considered significant if there were a regional or population-level impact and/or the affected resource would not fully recover, even after the impacting agent is gone and remedial or mitigating action is taken. An impact would be less than significant if 1) there would be no impact or no measurable impact; 2) impacts are small and measurable and if adverse, the affected resource would recover completely without remedial or mitigating action; or 3) impacts are notable and measurable and if adverse, the affected resource would recover completely when remedial or mitigating action is taken.

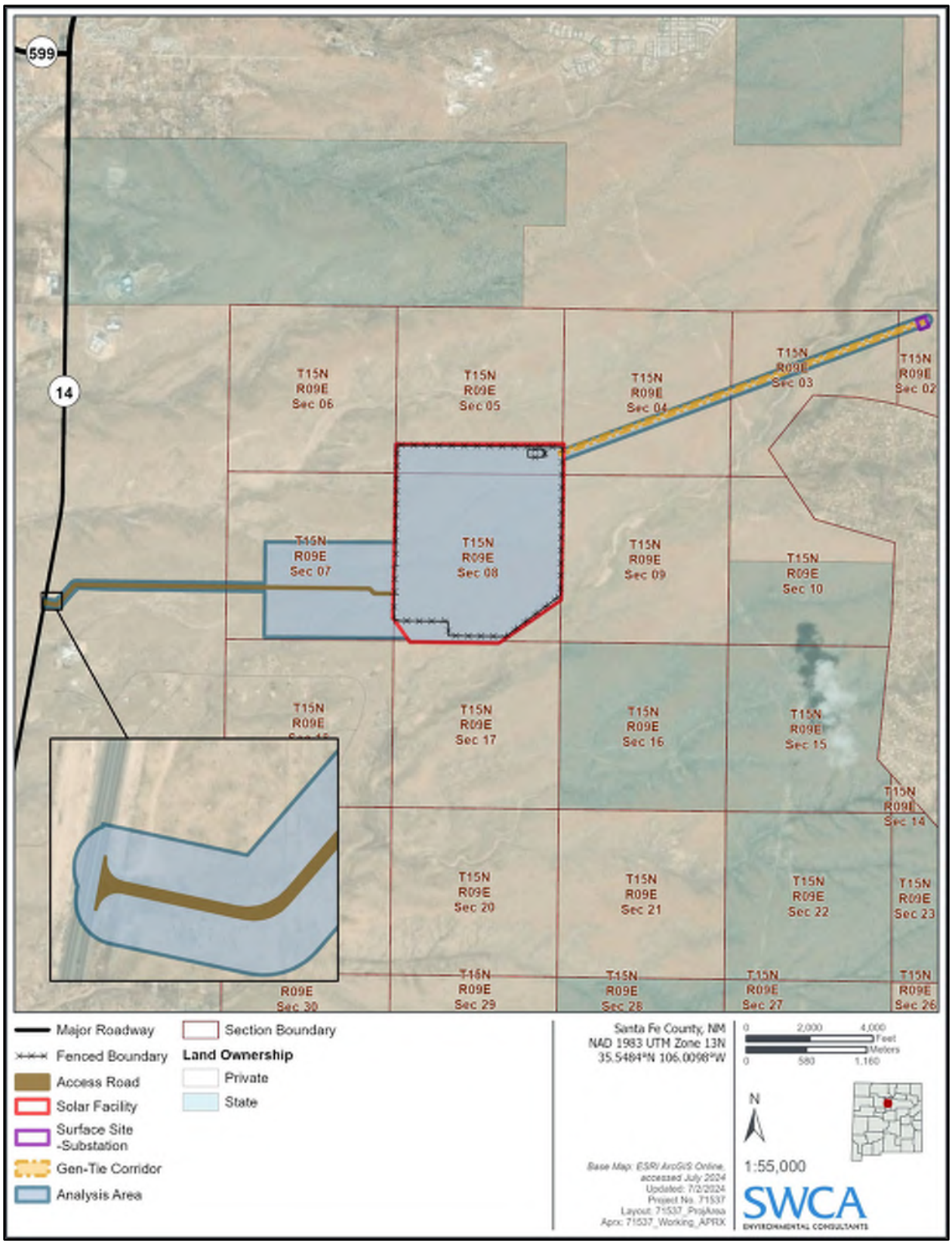


Figure 3.1. Analysis area.

3.2 Past, Present, and Probable Future Development Projects

The CIAA and general vicinity have historically been and are presently used as livestock rangeland. Surrounding areas have been experiencing increasing urbanization and development. According to Santa Fe County's Sustainable Growth Management Plan (SGMP), between 1990 and 2010, Santa Fe County as a whole grew by over 42.58 percent (2.13 percent per year). The diminished anticipated future growth from 2010 to 2030 is projected to increase only 14.35 percent over the forecast period (0.72 percent per year) and population growth within Santa Fe County is anticipated to slow overall (Santa Fe County 2015).

Currently, a charter school and housing subdivision are located just south of the proposed access corridor. The proposed gen-tie corridor abuts another large subdivision to the south. The Santa Fe Studios form a large building complex near the northwest corner of the analysis area. Slightly farther north on State Road 14 are a state penitentiary, armory, and county correction facility, and a Santa Fe County Fire Department facility. The Eldorado Fire and Rescue Station is located on the west side of Eldorado. Several existing transmission lines are in the vicinity of the Project area including a 115-kV AC transmission line intersecting the proposed gen-tie corridor, four additional 115-kV lines, and one 345-kV AC transmission lines.

The gen-tie connection point to the 115-kV transmission line is located in an undeveloped parcel within Santa Fe Community College District (CCD). The CCD is a planned zoning development district intended to promote compact mixed-used development in a village land use pattern. It is a major employment, education, and cultural center serving the city of Santa Fe, the County, and other regional areas and is expected to be the first of a number of new communities to be developed outside the Santa Fe urban area over the next 20 years (Santa Fe County 2016). Other upcoming projects within Santa Fe County include road improvements, expansion of the Santa Fe Regional Airport, and the Chupadero Water System improvement project. Past and present land use and mineral development within Santa Fe County are detailed in Sections 3.9 and 3.10 below.

3.3 Air Resources and Climate Change

Data sources reviewed to assess air quality conditions include the following:

- U.S. Environmental Protection Agency (EPA)
- New Mexico Environment Department (NMED) Air Quality Bureau

3.3.1 Environmental Setting

Air quality in the analysis area is generally classified as good to moderate. The primary sources of human-caused air pollution in Santa Fe County are dust from blowing wind on disturbed or exposed soil, exhaust emissions from fuel combustion and motorized equipment, and industrial sources (EPA 2017).

Air quality is determined by the ambient concentrations of pollutants that are known to have detrimental effects. The EPA has classified National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: carbon monoxide, nitrogen dioxide, particulate matter with diameter of 10 microns or less (PM_{10}), particulate matter with diameter of 2.5 microns or less ($PM_{2.5}$), ozone, sulfur dioxide, and lead. Areas with air quality that do not meet the standards are designated "non-attainment areas" by the EPA. In May 2020, the EPA published new design values for NAAQS for various counties throughout the United States (EPA 2021a). The EPA has delegated the responsibility of regulation and enforcement of

the NAAQS to the state level and has approved the New Mexico State Implementation Plan (SIP), which allows the State to enforce both the New Mexico Ambient Air Quality Standards (NMAAQS) and the NAAQS. Santa Fe County, where the Project is located, is in attainment/unclassifiable for all criteria pollutants, meaning that the air quality meets the NAAQS and Santa Fe County is also in compliance with the more stringent NMAAQS (EPA 2021a).

Air quality in a given region can also be measured by its air quality index (AQI) value (EPA 2021b). The AQI is used to report daily air quality information in an easy-to-understand way by explaining how local air quality relates to human health. The AQI summary report (EPA 2021c) provides annual summary information, including maximum AQI values and count of days in each AQI category. Part of Santa Fe County is located within the NMED Four Corners Interstate Air Quality Control Region, which includes the adjacent counties of Sandoval and San Juan. Recent AQI monitoring data are not available for Santa Fe County, but data are available for Sandoval and San Juan Counties and are likely comparable in terms of overall air quality. The air quality in this region is generally classified as good to moderate in terms of AQI values (EPA 2021c).

Along with criteria pollutant concentrations as measured by air monitors, the EPA provides data on criteria pollutant and hazardous air pollutant (HAP) emissions. The EPA's National Air Toxics Assessment (NATA) is the EPA's ongoing review of air toxics in the United States and is intended to be a screening tool for state, local, and tribal air agencies to help determine which pollutants, emission sources, or places may need further study to better understand risks to public health from air toxics. NATA results are published every 4 years and provide estimates of long-term cancer risks and non-cancer health effects of air pollution (EPA 2018). Based on the most recent NATA results, Santa Fe County's cancer risk and health risks due to air toxics are lower than the state and national average risks.

Greenhouse gas (GHG) emissions, such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), contribute to climate change. Santa Fe County is committed to reaching net-zero GHG emissions by 2050 and adopted a GHG Reduction Plan (Santa Fe County 2022). Increasing renewable energy use is a primary goal of Santa Fe County's GHG Reduction Plan. Development of the Project would support the primary goal of Santa Fe County's GHG Reduction Plan. The Project site is currently undeveloped and does not directly generate GHG emissions.

3.3.2 Environmental Effects

3.3.2.1 PROPOSED ACTION

Project emissions will be greatest during the construction period, which is estimated to be approximately 12 months. Project construction will consist of the activities and mobile equipment roster shown in Table 2.1. Equipment use and ground disturbance associated with the facilities will result in a low level of localized emissions of regulated air pollutants during the construction period. During construction, emissions from on-road and non-road equipment exhaust will include carbon monoxide, nitrogen oxides, PM_{10}, $PM_{2.5}$, volatile organic compounds, and HAPs. The Project will also cause emissions of PM_{10} and $PM_{2.5}$ from ground disturbance activities and vehicle traffic over paved and unpaved roads associated with construction.

While an air quality permit is not required for the Project, construction activities are governed by the applicable rules and regulations of the NMED Air Quality Bureau rules for fugitive dust emissions from construction activities and clearing of land. These include reasonable precautions to prevent dust from becoming airborne, including 1) using water or chemicals to control dust where possible, 2) covering open-bodied trucks at all times while transporting materials likely to produce airborne dusts, 3) establishing vehicle speed controls, 4) installing wind fences, and 5) promptly removing earth or

material from paved streets. In addition to the dust management strategies listed above, Rancho Viejo will implement protection measures to reduce emissions from construction vehicles and equipment by decreasing idling time and maintaining equipment properly.

Only minimal, short-term emissions of air pollutants will be expected from equipment use and fugitive dust from access road travel during the operations and maintenance phase, which will include approximately four technicians who will work out of the on-site operations building during general business hours and will provide visual inspections and routine maintenance actions. Decommissioning emissions will be similar to those emitted during initial construction in character and will be temporary.

Construction activities will result in a short-term increase in GHG emissions through the equipment uses described above. Operational-period emissions will be produced through vehicle travel for panel cleaning, maintenance, irrigation and water trucks, and security. However, during its operational life, the proposed Project will offset its operational GHG emissions. The offset effect of solar power results from the displacement of electrical power production that would otherwise occur at fossil-fueled power plants. Therefore, the proposed Project will contribute to a reduction in regional GHG emissions during operations, and GHG impacts are considered beneficial. By providing a new source of renewable energy, the proposed Project will reduce GHG emissions generated by the burning of fossil fuels, and thus, will be consistent with the objectives in Santa Fe County's GHG Emissions Reduction Plan.

3.3.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to air quality or climate change within the analysis area or surrounding areas because the Proposed Action will not be implemented. However, because the analysis area is privately owned and primarily located within the (RUR-F) zoning district (see Section 2.2), several types of potential development projects could occur under the No Action Alternative and could result in its own set of impacts to air quality and climate change. Furthermore, under the No Action Alternative, the Project will not contribute to meeting the goals and objectives of the Santa Fe County Greenhouse Gas Emissions Reduction Plan.

3.3.3 Environmental Protection Measures

The EPMs related to air resources that will be implemented to avoid and minimize impacts as part of the Project include the following:

- All fossil fuel–fired construction equipment will be maintained in accordance with manufacturer recommendations to minimize construction-related combustion emissions.
- The idling time of fossil fuel–fired construction equipment will be limited, unless idling must be maintained for proper operation (e.g., drilling, hoisting, and trenching).
- The speed of vehicles within construction sites will be limited during construction to help reduce the amount of fugitive dust generated.
- Water trucks or other dust suppression measures as required by the NMED Air Quality Bureau will be used to help reduce fugitive dust from construction activities.

3.3.4 Cumulative Impacts

Other existing and potential development projects in the CIAA include residential developments, road maintenance and utility projects. With implementation of EPMs, the Proposed Action, in conjunction with other existing and reasonably foreseeable development projects is not anticipated to have an adverse

cumulative effect on air quality or climate change. Due to a long-term reduction in GHGs, the Project would result in a cumulative beneficial impact on climate change.

3.3.5 Conclusion

Santa Fe County is in attainment for state and federal ambient air quality requirements and is generally classified as good to moderate with low health and cancer risks from air toxics. The short-term and localized Project construction and operations emissions are not expected to cause an exceedance of the NAAQS or NMAAQS or contribute to a degradation of ambient air quality. No direct long-term impacts to air quality will occur from the Project. Temporary impacts from fugitive dust and construction equipment will be negligible in scale and will be short-term. The EPMs listed above will be implemented to reduce fugitive dust from the construction phase and therefore, these impacts will be less than significant. The Project would not lead to an increase in AQI values for the area; therefore, the Project is not expected to unduly impair important environmental values regarding air quality and no irretrievable commitments of resources are anticipated.

3.4 Biological Resources

SWCA completed a biological survey of the analysis area April 4 through 11, 2022, and October 2, 2023, to assess habitat suitability for U.S. Fish and Wildlife Service (USFWS) and state classified threatened and endangered plant and animal species (SWCA 2022a). Additional data sources reviewed include the following:

- U.S. Geological Survey (USGS) topographic maps and Natural Resources Conservation Service (NRCS) soil maps (NRCS 2022a)
- New Mexico Crucial Habitat Assessment Tool data (New Mexico Crucial Habitat Data Set 2013)
- USFWS Information for Planning and Consultation (IPaC) system data (USFWS 2022a) and the USFWS Critical Habitat Portal (USFWS 2022b)
- NRCS PLANTS Database (NRCS 2022b)
- New Mexico Department of Game and Fish Biota Information System of New Mexico (BISON-M) data (BISON-M 2022), the New Mexico Rare Plants website (New Mexico Rare Plants Technical Council 1999), and the New Mexico Energy, Minerals and Natural Resources Department (EMNRD) state endangered plant species list (EMNRD 2022a).
- SWCA's Biological Resources Inventory Report (SWCA 2022a)

3.4.1 Environmental Setting

The biological resources in the analysis area, including vegetation, wildlife species, and habitat, are typical of the grassland/pinyon-juniper savanna dominated ecoregion that is common throughout northern New Mexico. The analysis area and surrounding landscape have been previously disturbed by two-track roads, cattle grazing, State Route 14, and transmission lines. No unique vegetation, wildlife, or habitat features were identified during the biological surveys (April 4–11, 2022, and October 2, 2023) of the analysis area (SWCA 2022a).

The analysis area is located in the North-Central New Mexico Valleys and Mesas ecoregion, which encompasses central New Mexico. The elevation in the analysis area is approximately 6,420 feet above mean sea level (amsl). The climate for this area, based on the climatic records for the Santa Fe 2 station in Santa Fe County, New Mexico (COOP Station No. 298085), has an average annual maximum

temperature of 64.9 degrees Fahrenheit (°F) and an average annual minimum temperature of 36.0°F. The average annual precipitation is 13.68 inches, with the majority occurring between May and October, while the average annual total snowfall is 21.0 inches, which largely occurs between November and March (Western Regional Climate Center 2022). Weather during the biological survey was approximately 41°F to 71°F, sunny to cloudy with western, northwestern, and eastern winds of approximately 0 to 35 miles per hour.

3.4.1.1 VEGETATION

The analysis area is located within the Arizona/New Mexico Plateau: North-Central New Mexico Valleys and Mesas Level IV ecoregion, which encompasses 887,860 acres in central New Mexico (Griffith et al. 2006). During the biological survey, SWCA biologists identified two distinct habitat types within the analysis area: grasslands (habitat 1) and pinyon-juniper savanna (habitat 2). Habitat 1 was observed along the access road and western portion of the solar facility and is dominated by blue grama (*Bouteloua gracilis*), prickly Russian thistle (*Salsola tragus*), and rubber rabbitbrush (*Ericameria nauseosa*). This habitat features approximately 61% vegetative cover composed of approximately 0% tree cover, 1% shrub cover, 60% herb/grass cover, and approximately 39% bare ground. Habitat 2 was observed in the eastern portion of the solar facility and along the gen-tie corridor and is dominated by blue grama, twoneedle pinyon (*Pinus edulis*), oneseed juniper (*Juniperus monosperma*), and rubber rabbitbrush. This habitat features approximately 21% vegetative cover composed of approximately 15% tree cover, 20% shrub cover, 40% herb/grass cover, and 25% bare ground. These habitats are typical of vegetative communities of the North-Central New Mexico Valleys and Mesas ecoregion. Plant species recorded during the biological survey are listed in Table 3.1.

During the biological survey, no U.S. Department of Agriculture (USDA)-listed noxious weed species or New Mexico Department of Agriculture (NMDA)-listed invasive or nonnative plant species were observed within or around the analysis area (NMDA 2020; USDA 2010). Prickly Russian thistle was observed during the biological survey. Prickly Russian thistle is not a designated noxious weed but is a nonnative species found throughout New Mexico (NRCS 2022b). Protection measures, such as noxious weed washing stations, can be utilized to reduce the introduction of noxious, invasive, and nonnative plants. A revegetation and weed management plan for this Project has been prepared by Rancho Viejo according to Santa Fe County's recommendations (Appendix F).

Table 3.1. Plant Species Observed during Biological Survey

Common Name	Scientific Name	Habitat 1 (grasslands)	Habitat 2 (pinyon-juniper savanna)
Bigelow sage	*Artemisia bigelovii*	x	x
Blue grama	*Bouteloua gracilis*	x*	x*
Broom snakeweed	*Gutierrezia sarothrae*	x	x
Club cholla	*Grusonia clavata*	x	–
Curly dock	*Rumex crispus*	x	–
Hairy crinklemat	*Tiquilia hispidissima*	x	–
Hairy grama	*Bouteloua hirsuta*	–	x
Jimsonweed	*Datura* sp.	x	–
Kingcup cactus	*Echinocereus triglochidiatus*	x	–
Mock vervain	*Glandularia* sp.	x	–
Narrowleaf yucca	*Yucca angustissima*	x	x

Common Name	Scientific Name	Habitat 1 (grasslands)	Habitat 2 (pinyon-juniper savanna)
Oneseed juniper	*Juniperus monosperma*	x	x*
Plains pricklypear	*Opuntia polyacantha*	x	–
Prickly Russian thistle	*Salsola tragus*	x*	–
Pricklypear	*Opuntia* sp.	–	x
Rubber rabbitbrush	*Ericameria nauseosa*	x*	x*
Spinystar	*Escobaria vivipara*	x	–
Springparsley	*Cymopterus* sp.	x	–
Tree cholla	*Cylindropuntia imbricata*	x	x
Twoneedle pinyon	*Pinus edulis*	x	x*

Note: Nomenclature follows the PLANTS Database (NRCS 2022b).

* Refers to dominant species

Wildlife

The Arizona/New Mexico Plateau: North-Central New Mexico Valleys and Mesas ecoregion provides habitat for a variety of wildlife species. The most common animals found in this ecoregion include black-tailed jackrabbit (*Lepus californicus*), cottontail rabbit (*Sylvilagus* sp.), mule deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), badger (*Meles meles*), coyote (*Canis latrans*), and skunk (*Mephitis mephitis*). Also typical to the area are vole (*Microtus* sp.), woodrat (*Neotoma* sp.), various species of mice (*Muridae* spp.), porcupine (*Erethizon dorsatum*), and squirrel (*Sciuridae* sp.). There are a variety of birds, including raptors, woodpeckers, various species of songbirds, ravens (*Corvus* sp.), doves (*Columbidae* spp.), and quail (*Coturnix* sp.). Numerous lizards and snakes are also found in this ecoregion, such as horned lizards (*Phrynosom*a sp.) and the western diamond-backed snake (*Crotalus atrox*) (Griffith et al. 2006).

SWCA biologists detected 15 bird and six mammal species during the April 2022 biological survey (Table 3.2). One of the mammal species detected is domestic. In addition, a Gunnison's prairie dog (*Cynomys gunnisoni*) colony was detected. Prairie dog colonies provide habitat for burrowing owls, which were also observed during the April 2022 biological survey. Both burrowing owls and Gunnison's prairie dog are special-status species.

Table 3.2. Wildlife Detected during Biological Survey

Common Name	Scientific Name
Birds	
American kestrel	*Falco sparverius*
Black-throated sparrow	*Amphispiza bilineata*
Burrowing owl	*Athene cunicularia*
Bushtit	*Psaltriparus minimus*
Common raven	*Corvus corax*
Curve-bill thrasher	*Toxostoma curvirostre*
Eastern meadowlark	*Sturnella magna*
Horned lark	*Eremophila alpestris*
House finch	*Haemorhous mexicanus*

Common Name	Scientific Name
Pinyon jay	*Gymnorhinus cyanocephalus*
Red-tailed hawk	*Buteo jamaicensis*
Say's phoebe	*Sayornis saya*
Scaled quail	*Callipepla squamata*
Turkey vulture	*Cathartes aura*
Western meadowlark	*Sturnella neglecta*
Mammals	
Black-tailed jackrabbit	*Lepus californicus*
Coyote (scat)	*Canis latrans*
Domestic cattle (scat)	*Bos taurus*
Gunnison's prairie dog (colony, scat)	*Cynomys gunnisoni*
Northern grasshopper mouse (dead)	*Onychomys leucogaster*
Pronghorn	*Antilocapra americana*

Individuals of each species were observed unless otherwise noted.

Migratory Birds

Most bird species are protected by the Migratory Bird Treaty Act (MBTA). The MBTA implements various treaties and conventions between the United States and other countries for the protection of migratory birds. Under the MBTA, unless permitted by regulations, it is unlawful to 1) pursue, hunt, take, capture, or kill; 2) attempt to take, capture, or kill; and 3) possess, offer to sell, barter, purchase, deliver, or cause to be shipped, exported, imported, transported, carried, or received any migratory bird, part, nest, egg, or product, manufactured or not. USFWS regulations broadly define "take" under the MBTA to mean "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." Under the MBTA, take does not include habitat loss or alteration. The Project is expected to comply with the MBTA.

Suitable nesting habitat for migratory birds, such as oneseed juniper and twoneedle pinyon, is present throughout the analysis area for species that nest in pinyon-juniper savanna. In addition, the biologist also observed one active curve-billed thrasher (*Toxostoma curvirostre*) nest, 14 inactive passerine nests in fair to poor condition, and two undetectable activity passerine nests during the biological survey. Various species of songbirds, including sparrows and thrushes, as well as dove and quail, are common to the area and could utilize this habitat for nesting. Other species like raptors and ravens are common to the area but are unlikely to utilize the analysis area for nesting due to the lack of tall vegetation, such as trees, and suitable perching structures. During the biological survey, 15 bird species were detected (see Table 3.2).

Bald and Golden Eagles

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the MBTA and the Bald and Golden Eagle Protection Act. Bald eagles are found typically in association with water, and nest and breed from October to July throughout the state of New Mexico. Golden eagles nest primarily on rock ledges or cliffs and occasionally in large trees at elevations ranging from 4,000 to 10,000 feet amsl. Golden eagles are typically found in mountainous regions of open country, prairies, arctic and alpine tundra, open wooded areas, and barren areas.

Both bald and golden eagles are carnivores. Bald eagles prey on fish but also on mammals, especially prairie dogs (*Cynomys* sp.). Golden eagles feed mainly on small mammals, as well as invertebrates, carrion, and other wildlife (BISON-M 2022; Stahlecker and Walker 2010).

No bald or golden eagle individuals were observed during the biological survey of the analysis area. The habitat in and surrounding the analysis area is not ideal foraging habitat for golden eagles because of the lack of available perching locations and lack of nearby mountains and is not ideal foraging habitat for bald eagles because of the lack of riparian habitat. It is unlikely that bald or golden eagles inhabit the analysis area. However, Gunnison's prairie dog, a potential prey species for golden eagles, are present within the analysis area (see below). Non-nesting golden eagles may forage wherever prey animals are encountered, and golden eagles are not uncommon in the Project vicinity (eBird 2023). Therefore, while nesting habitat for golden eagles is absent, opportunistic foraging or dispersal could occur.

Special-Status Species

The special-status species evaluated in this report consist of 1) federally protected (endangered and threatened) species (USFWS 2022a); 2) additional species listed by the USFWS as candidate and proposed species, and species under review (USFWS 2022a); and 3) state-listed endangered and threatened species (BISON-M 2022; EMNRD 2022a). The potential for local species occurrence was based on 1) existing information on distribution and 2) qualitative comparisons of the habitat requirements of each species with vegetation communities, landscape features, and/or water quality conditions in the analysis area. The potential for occurrence of a species was identified using the following categories:

- *Known to occur*: The species was documented in the analysis area either during or prior to the biological survey by a reliable observer.
- *May occur*: The analysis area is within the species' currently known range, and vegetation communities, soils, and water quality conditions, among other factors, resemble those known to be used by the species.
- *Unlikely to occur*: The analysis area is within the species' currently known range, but vegetation communities, soils, and water quality conditions, among other factors, do not resemble those known to be used by the species, or the analysis area is clearly outside the species' currently known range.

One USFWS candidate species—monarch butterfly (*Danaus plexippus plexippus*)—has the potential to occur within the analysis area during the migratory period (April–October). However, neither this species nor larval host plants were observed during the biological survey. In addition, SWCA observed burrowing owls, which are protected by the MBTA, and Gunnison's prairie dog colonies, which could provide habitat for this species, within the analysis area. The remaining special-status species are unlikely to occur in the analysis area due to lack of suitable habitat for each species and the Project being outside of some of the species' known range. Table 3.3 describes the special-status species with the potential to occur in Santa Fe County, New Mexico, their habitat, and their potential to occur in the analysis area. No USFWS-designated critical habitat is located in or around the analysis area, with the closest critical habitat (Mexican spotted owl [*Strix occidentalis*]) located approximately 12.1 miles northeast of the analysis area.

Table 3.3. Special-Status Species Listed for Santa Fe County, New Mexico

Common Name (scientific name)	Status*	Range or Habitat Requirements	Potential for Occurrence in Analysis Area
Plants			
Holy Ghost ipomopsis (*Ipomopsis sancti-spiritus*)	USFWS E NM E	This species grows on relatively dry, steep, west- to southwest-facing slopes in open ponderosa pine or mixed-conifer forest at 2,400 to 2,500 meters (m) (7,678–8,220 feet) amsl in San Miguel County and is found only in one canyon in the upper Pecos River drainage of the southern Sangre de Cristo Mountains. The geologic substrate is partly weathered Tererro limestone. This plant appears to grow best in bare mineral soils and is highest in density on disturbed sites such as road cuts. Flowers from July to September.	Unlikely to occur within the analysis area, as the only known population is restricted to one canyon in the Sangre de Cristo Mountains.
Santa Fe cholla (*Cylindropuntia viridiflora*)	NM E	The Santa Fe cholla is known from only three areas between Santa Fe and Chimayo and occurs in gravelly rolling hills in pinyon-juniper woodland at 1,770 to 2,200 m (5,800–7,200 feet) amsl. Flowers in July.	Unlikely to occur within the analysis area, as the closest known population is approximately 6 miles north of the analysis area (Natural Heritage New Mexico 2022).
Wood lily (*Lilium philadelphicum* var. *andinum*)	NM E	This species occurs in moist woodlands and meadows in mixed-conifer forests and canyon bottoms between 7,550 and 10,000 feet in Sandoval, Otero, Santa Fe, San Miguel, Los Alamos, and Colfax Counties. The plant is widespread in Canada and the United States. Flowers late spring through summer (late May–August).	Unlikely to occur within the analysis area because of the lack of mixed-conifer forests and canyon bottoms there. The analysis area is also below the elevation range of the species.
Great Plains lady's tresses (*Spiranthes magnicamporum*)	NM E	This species is widely distributed in the Great Plains and Great Lakes regions north to Ontario, Canada, and is rare in New Mexico. The plant occurs in wetlands, ciénegas, and stream sides in New Mexico from 4,560 to 6,500 feet amsl. Flowers from mid-July to August.	Unlikely to occur within the analysis area because of the lack of wetlands, ciénegas, and streams.
Arthropods			
Monarch butterfly (*Danaus plexippus plexippus)*	USFWS C	In New Mexico, this species' migration peaks in April and subsides by mid-May. Breeding occurs within the state, and a new generation matures in New Mexico by each July. In-state population numbers peak in August and September. The southward migration back to Mexico begins in late August and September. During the breeding season in New Mexico, young monarch butterfly caterpillars require milkweed species (*Asclepias* sp.) as a food source (Cary and DeLay 2016). Overall, monarch butterflies seem to be most abundant in southeastern New Mexico. There is currently no evidence that monarchs overwinter in New Mexico.	May occur within the analysis area for foraging if the area contains herbaceous flowering plants, including milkweed species, during breeding periods. Neither this species nor milkweed vegetation was observed during the April 2022 biological survey.
Mollusks			
Lilljeborg peaclam (*Pisidium lilljeborgi*)	NM T	In New Mexico, this species occurs in cold, alpine Nambe Lake, which is surrounded by rocky talus, stands of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), and grass-sedge-forb communities at approximately 11,350 m amsl.	Unlikely to occur in analysis area because of the lack of wetlands and the species restriction to Nambe Lake, which is approximately 17 miles northeast of the Project area.
Fish			
Rio Grande cutthroat trout (*Oncorhynchus clarkii virginalis*)	USFWS C	This subspecies of cutthroat trout is endemic to the Rio Grande, Pecos, and possibly the Canadian River Basins in New Mexico and Colorado. The species' historical range included Colorado, New Mexico, and Texas.	Unlikely to occur in the analysis area because of the lack of major rivers.

Common Name (scientific name)	Status*	Range or Habitat Requirements	Potential for Occurrence in Analysis Area
Birds			
Baird's sparrow (*Ammodramus bairdii*)	NM T	A winter resident in New Mexico, this species has been found on Otero Mesa and in the Animas Valley and may occur in other areas of suitable winter habitat, particularly in the southern portion of state. Generally, this species prefers dense, extensive grasslands with few shrubs and avoids heavily grazed areas.	Not known to occur in this area, although marginally suitable grassland habitat is present. The species is known to occur only in the southern portion of New Mexico.
Bald eagle (*Haliaeetus leucocephalus*)	NM T	This species occurs in New Mexico year-round. Bald eagle breeding is restricted to a few areas mainly in the northern part of the state or near lakes. During migration and winter months, the species is found chiefly along or near rivers and streams and in grasslands associated with large prairie dog (*Cynomys* sp.) colonies. Bald eagles typically perch in trees.	This species is unlikely to occur in the analysis area because of lack suitable habitat and water features. In addition, no suitable perching trees were observed during the biological survey.
Boreal owl (*Aegolius funereus*)	NM T	This species is found predominantly in spruce-fir forests. Populations are thought to be unviable in New Mexico because the state lacks adequate spruce-fir habitat in isolated mountain ranges, but small populations have been found in in spruce-fir and similar habitats in the San Juan, Sangre de Cristo, and Jemez Mountains (Stahlecker and Duncan 1996).	Unlikely to occur within the analysis area because of the lack of spruce-fir forests. The Project area is approximately 9 miles southwest of the closest known population.
Gray vireo (*Vireo vicinior*)	NM T	This species is strongly associated with pinyon-juniper (*Pinus* and *Juniperus* spp.) and scrub oak (*Quercus* spp.) habitats and is distributed mainly across the western two-thirds of the state. The gray vireo prefers gently sloped canyons, rock outcrops, ridgetops, and moderate scrub cover.	Unlikely to occur within the analysis area because of lack of canyon habitat and exposed rock outcropping.
Least tern (*Sterna antillarum*)	NM E	This migratory species occurs in North America during the breeding season and is associated with water (e.g., lakes, reservoirs, and rivers). In New Mexico, the species' breeding is restricted to the Pecos River Basin, primarily at Bitter Lake National Wildlife Refuge in Chaves County. The least tern may occur in the Bureau of Land Management Farmington Field Office planning area during migration but has not been recorded there. Suitable least tern habitat along rivers consists of bare sandy shorelines and salt flats.	Unlikely to occur in the analysis area because of the lack of perennial river bodies. The Project area is also more than 150 miles north of the species' known breeding range within the state.
Mexican spotted owl (*Strix occidentalis lucida*)	USFWS T	This species occupies mountainous areas and deep canyons incised within flat plateaus. The owl's habitat consists typically of mixed-conifer, ponderosa pine, and ponderosa pine–Gambel oak forest. The species prefers shaded mesic environments such as canyon bottoms and mountainous riparian areas.	Unlikely to occur within the analysis area because of the lack of mountainous habitat, old-growth mixed-conifer forest, and deep canyons preferred by the species.
Peregrine falcon (*Falco peregrinus*)	NM T	This species occurs in New Mexico year-round. All peregrine falcon nests in New Mexico are found on cliffs. During migration and winter, New Mexico's peregrine falcons are typically associated with water and large wetlands.	Unlikely to occur in the analysis area because of the lack of water, dense riparian habitat, large wetlands, and cliff roosting habitat.

Common Name (scientific name)	Status*	Range or Habitat Requirements	Potential for Occurrence in Analysis Area
Southwestern willow flycatcher (*Empidonax traillii extimus*)	USFWS E NM E	This species breeds and migrates through relatively dense riparian tree and shrub communities associated with rivers, swamps, and other wetlands, including lakes and reservoirs. The southwestern willow flycatcher historically nested in native vegetation such as willow (*Salix* spp.), seepwillow (*Baccharis salicifolia*), boxelder (*Acer negundo*), buttonbush (*Cephalanthus* spp.), and cottonwood (*Populus* spp.). This subspecies nests in native vegetation but also uses thickets dominated by nonnative tamarisk (*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolia*) and mixed native and nonnative stands of vegetation. In New Mexico, the southwestern willow flycatcher is known to breed along the Gila River and the Rio Grande.	Unlikely to occur in the analysis area due to the lack of dense riparian habitat.
Violet-crowned hummingbird (*Leucolia violiceps*)	NM T	In New Mexico, this species is found primarily in riparian woodlands at low to moderate elevations (Baltosser 1986) and seeks only well-developed riparian areas of Guadalupe Canyon in the summer (New Mexico Department of Game and Fish 1994).	Unlikely to occur in the analysis area due to a lack of riparian woodlands. In addition, the analysis area is not near the Guadalupe Canyon.
White-tailed ptarmigan (*Lagopus leucura*)	NM E	This species inhabits alpine tundra and timberline habitat in New Mexico above about 10,500 feet (Hubbard and Eley 1985). Associated with sedges (*Carex*) and grass-like plants (*Heleocharis*, *Scirpus*) above the treeline.	Unlikely to occur in the analysis area due to a lack of suitable tundra habitat and elevation.
Yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	USFWS T	Only the western population of this species beyond the Pecos River drainage has been listed as threatened under the Endangered Species Act. The yellow-billed cuckoo breeds and migrates through riparian habitat and associated drainages; springs, developed wells, and earthen ponds supporting mesic vegetation; and deciduous woodlands with cottonwoods and willows. Dense understory foliage is important for nest site selection. The species nests in willow, mesquite (*Prosopis* spp.), cottonwood, and hackberry (*Celtis occidentalis*); forages in similar riparian woodlands; and requires patches of at least 25 acres for breeding and nesting.	Unlikely to occur. The analysis area lacks riparian and deciduous woodland habitat.
Mammals			
Spotted bat (*Euderma maculatum*)	NM T	This species is found in open habitats, ponderosa pine forests, and marshlands. Distribution is limited to areas within flying distance of cliffs and stony outcrops, which provide suitable roosting sites. Spotted bats have been documented at numerous localities throughout the western two-thirds of New Mexico, and in 2014 through 2016, the species was detected by its distinct audible calls at multiple sites along the Gila River in Grant County.	Unlikely to occur because the analysis area lacks suitable roosting habitat, such as cliffs and limestone outcroppings, dense forests, and marshes.
Pacific marten (*Martes caurina*)	NM T	This species has been observed in the San Juan and Sangre de Cristo Mountains. The Pacific marten prefers late successional stands of conifer-dominated mesic forest of spruce (*Picea* spp.), fir (*Abies* spp.), Douglas fir (*Pseudotsuga menziesii*), and associated trees. Optimal habitat likely consists of mature old-growth spruce-fir communities with more than 30% canopy cover, a well-established understory of fallen logs and stumps, and lush shrub and forb vegetation. The species avoids large openings.	Unlikely to occur in the analysis area due to the lack of mature conifer habitat of spruce, fir, or Douglas fir.

Common Name (scientific name)	Status*	Range or Habitat Requirements	Potential for Occurrence in Analysis Area
Meadow jumping mouse (*Zapus luteus luteus*)	NM E	In New Mexico, this species is primarily associated with riparian habitats with short vegetation, high herbaceous vegetation cover, and species including common three-square (*Schoenoplectus pungens*), coyote willow (*Salix exigua*), dogbane (*Apocynum cannabinum*), foxtail barley (*Hordeum jubatum*), and Japanese brome (*Bromus japonicus*).	Unlikely to occur in the analysis area due to lack of associated species and lack of riparian habitat.

Sources: Except where otherwise noted, range or habitat information for wildlife species comes from the BISON-M (2022) website, IPaC (USFWS 2022a), EMNRD (2022a), and NatureServe (2022).

* Federal (USFWS) status: E = Endangered, T = Threatened, C = Candidate

State of New Mexico status: NM E = Endangered, NM T = Threatened.

Monarch Butterfly

The monarch butterfly (*Danaus plexippus plexippus*) is designated as a USFWS candidate species (USFWS 2024). In addition, this species is under review by USFWS and a proposed rule to list the species is likely to occur in 2024 (*Federal Register* 88:41560). This species is a candidate for listing due to the decline in populations across North America resulting from habitat reduction and fragmentation. Candidate species receive no statutory protection under the Endangered Species Act.

Monarch butterflies are important ecologically for plant population stability as it is an opportunistic pollinator. This species is known to occur throughout New Mexico during seasonal migration and the breeding season during the warmer months of April to October but is not known to overwinter within the state (Cary and DeLay 2016). The species is especially tied to the presence of milkweed (*Asclepias* spp.) during the breeding season since milkweed species are the sole source of food for monarch caterpillars (BISON-M 2022). Primary threats to the species include habitat destruction and fragmentation throughout the flyway, especially in overwintering and breeding sites; habitat loss through urbanization; use of toxic agrochemicals; and a reduction of milkweed populations (Commission for Environmental Cooperation 2008).

The species was not observed during the April 2022 biological survey of the analysis area. Adult butterflies may occur based on the annual migratory path. The analysis area provides suitable foraging habitat for this species due to the presence of flowering plants. At the time of the April 2022 survey, no suitable milkweed habitat was observed; however, revisiting the Project area during their flowering period (June–August) would confirm whether the Project area provides suitable milkweed habitat required for breeding.

Burrowing Owl

The burrowing owl is protected under the MBTA and State of New Mexico Statute 17-2-14. Populations of burrowing owls are declining across much of North America, particularly in the northern portion of the continent, chiefly because of prairie grassland habitat loss and fragmentation, human-caused mortality on wintering grounds and during migration, and the loss of colonial sciurids such as prairie dogs (Desmond 2010). During the 2022 biological survey, SWCA observed one active burrowing owl burrow with two adults in addition to a prairie dog colony during the 2022 biological survey (Figure 3.2 and Figure 3.3).



Figure 3.2. Burrow complex suitable for burrowing owls; view facing north.

Gunnison's Prairie Dog

Gunnison's prairie dog is native only to North America, inhabiting montane shrublands and high mountain valleys and plateaus in the southern Rocky Mountains at 6,000 to 12,000 feet amsl east of the continental divide. As a fossorial mammal, this species inhabits burrow complexes within sagebrush shrubland and pinyon-juniper habitats (BISON-M 2022). This species lives in colonies that can contain thousands of individuals within a complex (Miller and Cully 2001). These colonies provide an important food source for many predators within grassland habitats, and their burrows provide suitable burrows for burrowing owls.

SWCA observed an extensive prairie dog colony during the 2022 biological survey (see Figure 3.3). Although Gunnison's prairie dog is not listed in Santa Fe County, burrows can be a concern in regard to construction safety, and their destruction can affect burrowing owl habitat. If construction begins during the burrowing owl nesting season (March 1–October 31), occupied nesting burrow surveys could be conducted to verify the presence/absence of prairie dogs prior to construction.

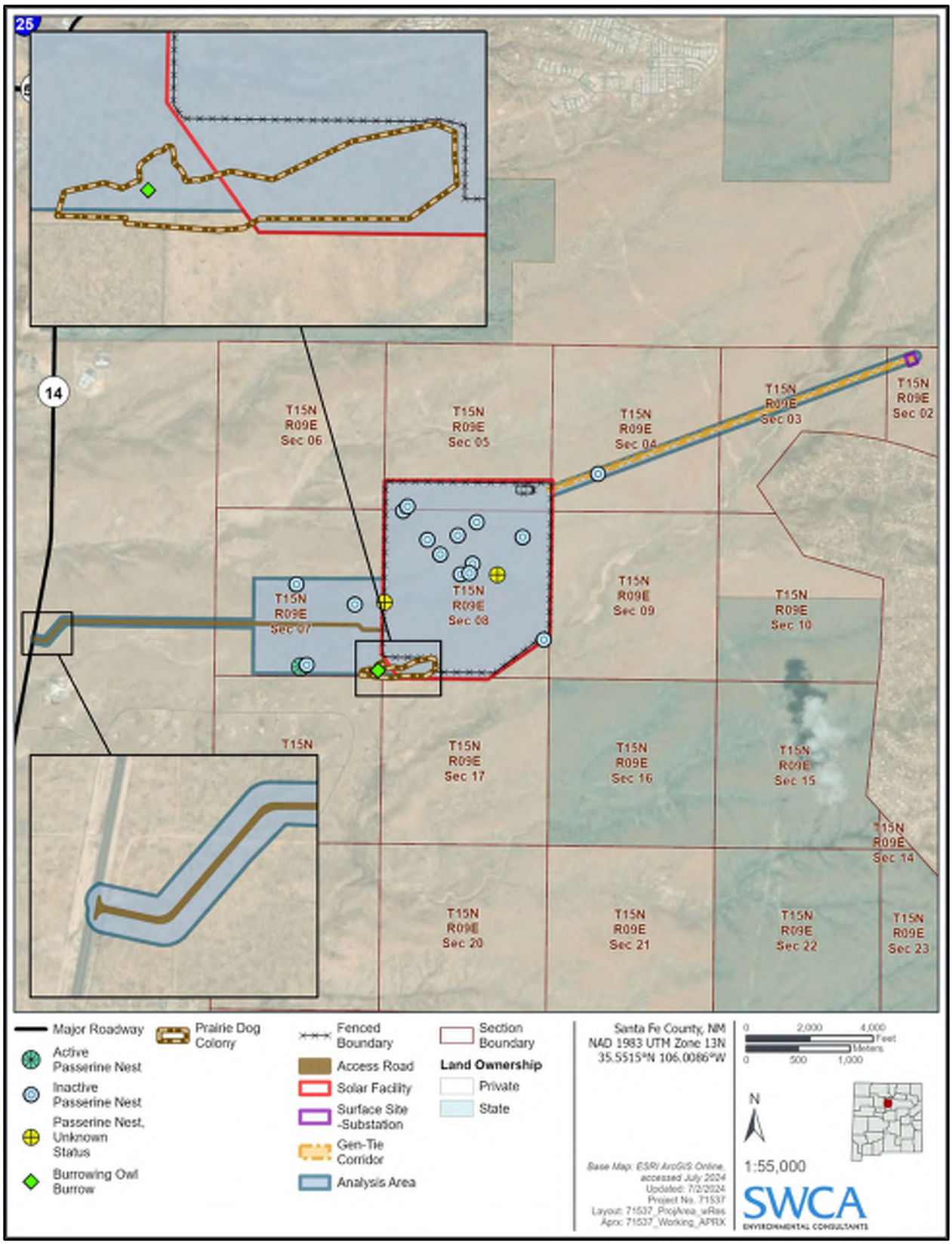


Figure 3.3. Biological resources within the analysis area.

3.4.2 Environmental Effects

3.4.2.1 PROPOSED ACTION

Impacts to wildlife and vegetation will result from actions that alter wildlife habitats, including changes to vegetation, surface disturbance, and the presence of humans and equipment during construction. Altering wildlife habitat in ways that would be considered adverse may occur directly (through habitat loss from surface disturbance) or indirectly (through the reduction in habitat quality caused by increased noise levels, increased human activity, and the presence of fugitive dust).

Vegetation

Certain areas within the analysis area will be cleared of vegetation during construction, where necessary. Further impacts to vegetation may occur as a result of deposition of fugitive dust generated during clearing and grading activities, the use of access roads, and from wind erosion of exposed soils; however, water trucks or other dust suppression measures as required by the NMED Air Quality Bureau will be used to help reduce fugitive dust from construction activities. This could reduce photosynthesis and productivity, increase water loss (Eveling and Bataille 1984), and result in injury to leaves in plants near the proposed analysis area. Localized fugitive dust could be generated from the areas of disturbed soil from blading associated with construction. Plant community composition could subsequently be altered resulting in habitat degradation. Localized impacts to plant populations and communities could occur if seed production in some plant species is reduced. Construction traffic and equipment brought to the site also represent a pathway for the introduction and spread of noxious weeds and invasive species. Rancho Viejo has prepared a weed management plan for the Project (Appendix F), which includes preventative and control measures to reduce the introduction of noxious, invasive, and nonnative plants, such as noxious weed washing stations. Rancho Viejo could coordinate with the Santa Fe – Pojoaque Soil and Water Conservation District to develop an invasive and noxious plant management plan; however, there are no land use ordinances requiring this coordination. Rancho Viejo's weed management plan will align with the control methods for the listed invasive and noxious plant species outlined within the New Mexico State's Troublesome Weeds of New Mexico booklet (Ashigh et al. 2010).

Postconstruction, interim reclamation will occur in areas not needed for long-term operations and maintenance. Impacts to vegetation from decommissioning activities would be similar to impacts from construction. Once decommissioning is complete, final reclamation of the Project area will aim to completely reestablish vegetation.

General Wildlife

Portions of the analysis area will be disturbed to facilitate construction of the Rancho Viejo Solar Project. Direct impacts to wildlife from construction would include the removal of existing vegetation, risk of direct mortality of species during construction, loss or degradation of native habitat, and displacement of wildlife species from habitat due to development. Additional potential indirect impacts may include disruption or displacement of species from nesting/birthing and foraging areas, changes in activity patterns due to construction, increased human activity, and noise disturbance. Noise disturbance from construction vehicles and equipment could impact wildlife by interfering with animals' abilities to detect important sounds or by posing an artificial threat to animals (Clinton and Barber 2013). While the biological survey of the analysis area showed a relatively high diversity of wildlife, the area has also been previously disturbed by cattle grazing, two-track roads, and transmission lines. Short-term disturbances associated with construction light and noise could cause individuals to move from the analysis area to similar suitable habitat within the surrounding landscape. However, these impacts would be temporary and would not result in population-level effects.

The Rancho Viejo Solar Project will be fenced, limiting the types of wildlife that may utilize the analysis area postconstruction to reptiles, birds, and small mammals. Operations activities will occasionally include noise disturbances that could temporarily displace wildlife in the analysis area and vicinity.

Impacts to wildlife species will be minimized through the implementation of protection measures such as allowing wildlife to leave the work area, checking trenches or excavation for wildlife, complying with speed limits, and following a worker environmental awareness training (see Section 3.4.3).

Impacts to wildlife from decommissioning activities will be similar to impacts from construction. Once decommissioning is complete, final reclamation of the analysis area will include the removal of Project fencing to promote the reintroduction of wildlife to the area.

Migratory Birds

No major or long-term effects on migratory birds are anticipated from the Rancho Viejo Project. The Project would implement measures to avoid construction-related impacts to active nests during the migratory breeding season (March 15–September 15), including training construction crews on actions to take in the event active nests are found in the analysis area, establishing nest buffers, and avoiding nests until birds have fledged (see Section 3.4.3). As burrowing owls are known to occur within the analysis area, preconstruction nest surveys will be conducted to determine whether active burrows are present. If burrowing owls are detected, Rancho Viejo will coordinate with the NMDGF, and the appropriate avoidance buffers will be implemented.

Incidental mortality or displacement of migratory bird species is possible on a local scale due to short-term construction activities and long-term ground disturbance. However, many birds occurring locally will likely move into adjacent habitat in response to disturbance. Adult migratory birds will not likely be directly harmed by the Rancho Viejo Solar Project because of their mobility and ability to avoid areas of human activity. Additionally, based on the abundance of similar habitat in the surrounding area, the impacts on bird populations that utilize this habitat type within the analysis area will be negligible.

Operation of the Rancho Viejo Solar Project, inclusive of transmission poles within the analysis area and PNM lines outside of the analysis area, could also present electrocution risk to avian wildlife; however, this risk is very low because the facilities are designed to discourage their use as perching or nesting substrates by birds, including designing aboveground transmission to follow established Avian Power Line Interaction Committee (APLIC) guidelines to minimize bird collisions and avoid electrocution of raptors (see Section 3.4.3). Some examples of commonly used protections include providing adequate separation between energized components, grounded components, and structural members. Rancho Viejo will determine appropriate measures once the final design of the Project is complete.

Bald and Golden Eagles

Construction activities and the long-term presence of the Project in the analysis area are not expected to directly impact bald or golden eagles. However, indirect impacts to golden eagles may occur due to the loss of suitable foraging habitat. Because the analysis area lacks suitable nesting habitat for both species and foraging habitat for bald eagles in and surrounding the analysis area, the Rancho Viejo Solar Project is not anticipated to cause take of individual bald or golden eagles, their nests, or their eggs. Adult eagles will not likely be directly harmed by the Rancho Viejo Solar Project because of their mobility and ability to avoid areas of human activity.

Special-Status Species

One federally listed candidate species, the monarch butterfly, has the potential to occur in the analysis area (see Table 3.3). Due to the early season biological survey in April 2022, the presence of milkweed species in the analysis area could not be confirmed. A lack of milkweed vegetation would confirm that the analysis area does not contain the plants required for egg laying, and therefore breeding efforts of the species would not likely be impacted by the proposed Project. Also, due to their ability to move out of areas of human activity, adult butterflies are not likely to be directly harmed if present during Project construction. Lastly, if construction occurs prior to milkweed emergence, eggs and larvae would likely not be directly harmed. Removal of vegetation within the Project footprint will reduce the availability of flowering plants and thus possibly impact the species' food sources. The proposed Project could impact individuals but is not likely to contribute to a trend toward federal listing or cause a loss of viability to the population or species.

Burrows of Gunnison's prairie dog were observed during the April 2022 biological survey within the analysis area. Burrowing owls, as well as burrowing owl signs, were also observed during the 2022 biological survey. Although Gunnison's prairie dog is not listed in Santa Fe County, burrows can be a concern in regard to construction safety, and their destruction can affect burrowing owl habitat. If construction begins during the burrowing owl nesting season (March 1–October 31), occupied nesting burrow surveys could be conducted to verify species presence/absence. The proposed Project will not directly impact the prairie dog colony and therefore will not directly impact burrowing owl nesting habitat (see Figure 3.3). Potential indirect impacts to burrowing owls could range from temporary habitat disturbance due to human presence/noise to loss of foraging habitat; however, the habitat within the analysis area is not unique to its surroundings; therefore, adult burrowing owls could relocate. Overall, the proposed Project may indirectly impact individuals or localized foraging habitat but is not likely contribute to a trend toward federal listing or cause a loss of population or species viability.

3.4.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to biological resources within the analysis area or surrounding areas because the Proposed Action will not be implemented. However, because the analysis area is privately owned and primarily located within the (RUR-F) zoning district (see Section 2.2), several types of potential development projects could occur under the No Action Alternative and could result in its own set of impacts to biological resources.

3.4.3 Environmental Protection Measures

EPMs that will be implemented to avoid and minimize impacts to biological resources include the following:

- Temporarily disturbed areas will be revegetated to the extent practicable in order to meet SWPPP requirements and performance standards for runoff and erosion control. Seed mixture and seeding rates will be developed through consultation with the local agency, experts, or landowner preference.
- Compacted soils will be restored as closely as possible to preconstruction conditions as required for ground stabilization and erosion control.
- Trash and food debris will be disposed of properly.
- The perimeter fence will be a wildlife-friendly agricultural woven-style fence with 10-foot poles.
- Wildlife that have entered the work area will be allowed to leave the area on their own.

- Environmental awareness training will be provided to all construction personnel working on the Project.
- Trenches, excavations, and uncapped pipe segments will be checked for wildlife entrapment (New Mexico Department of Game and Fish 2022).
- Personnel will comply with all posted and established Project speed limits.
- Vegetation will be cleared outside the nesting season (March 15–September 15) where feasible to discourage birds from establishing nests in Project work areas.
- The worker environmental awareness program will include training specific to avoidance of migratory birds and active migratory bird nests during the nesting season from March 15 to September 15. If active nests are found in the analysis area during construction, a biologist will be contacted to evaluate the activity status of the nest. The nest will be avoided until determined inactive by a biologist.
- To avoid impacts to nesting burrowing owls, preconstruction nesting surveys will be conducted up to 2 weeks beforehand to establish the occupancy status of any potentially suitable nesting burrows detected within the analysis area. Rancho Viejo will coordinate with NMDGF for the appropriate avoidance buffers and survey protocol.
- Facilities will be designed to discourage their use as perching or nesting substrates by birds, including designing aboveground transmission and facilities to follow established APLIC guidelines (APLIC 2006, 2012) to minimize bird collisions and avoid electrocution of raptors. APLIC guidelines will be considered at all stages of Project design and operation.
- Micrositing will be completed during engineering design to further minimize impacts to sensitive biological resources to the extent practicable.
- If present, milkweed vegetation removal will be minimized to the greatest extent possible.
- Rancho Viejo developed and will implement a vegetation and noxious weed management plan (Appendix F) for the control of noxious weeds and invasive species that could occur as a result of new surface disturbance activities at the site. Performance standards will be used to evaluate the success of the vegetation management plan.
- If required as part of the SWPPP, a native seed mixture will be applied to all temporary disturbance areas, followed by applications of mulch as required to provide additional erosion control.
- Construction activities will generally be limited to the least noise-sensitive times of day (i.e., daytime between 7 a.m. and 7 p.m.), unless necessary due to weather, safety, or schedule constraints. Construction equipment will be equipped with manufacturers' standard noise control devices or better (e.g., mufflers, engine enclosures).
- A worker environmental awareness program will be implemented to train facility personnel regarding their responsibilities to conserve protected resources that are located on-site and associated treatment measures.

3.4.4 Cumulative Impacts

The loss of approximately 724 acres of wildlife habitat under the Proposed Action will not cause undue degradation to general wildlife and vegetation within the CIAA as this habitat type is common in the CIAA and across the regional landscape and on land adjacent to the analysis area. There are no foreseeable actions near the Project area that would significantly affect biological resources. Therefore,

there is minimal potential for the Proposed Action, in conjunction with other identified existing and developments in the CIAA, to cause a significant cumulative effect to biological resources.

3.4.5 Conclusion

Potential impacts to vegetation and wildlife from the Proposed Action include the removal of existing vegetation, an increase in the potential for introduction of noxious weeds, increased risk of direct mortality of wildlife during construction, loss or degradation of native habitat, and displacement of wildlife species from habitat due to development. The Project would alter approximately 724 acres of potential habitat for wildlife; however, this would result in a less than 0.1% decrease in available habitat within the New Mexico/Arizona Plateau: North Central New Mexico Valleys and Mesas level IV ecoregion (Griffith et al. 2006). One federally listed candidate species, the monarch butterfly, has the potential to occur in the analysis area. Due to the early season biological survey, the presence of milkweed species in the analysis area could not be confirmed. However, the habitat within the analysis area is not unique to the surroundings, and due to their ability to move out of areas of human activity, adult butterflies are not likely to be directly harmed during construction or operation. Additional surveys could confirm the presence of milkweed vegetation and determine if this species should be included in the seed mixture for revegetation. The Rancho Viejo Solar Project could impact individuals if milkweed vegetation and larvae/eggs are present but is not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species. If milkweed vegetation is present, minimizing impacts to the monarch breeding habitat is recommended. With implementation of EPMs, no significant impacts to vegetation, wildlife, migratory birds, bald and golden eagles, or listed threatened and endangered species will occur from the Proposed Action, and no irretrievable commitments of resources are anticipated.

3.5 Cultural, Historic, Archaeological, and Religious Resources

Data sources reviewed to assess the cultural, historic, archaeological, and religious conditions within and surrounding the analysis area include:

- New Mexico Historic Preservation Division (HPD) Tribal County Consulting List (HPD 2022)
- New Mexico Cultural Resource Information System (NMCRIS) online database managed by the Archaeological Records Management Section (ARMS) of the New Mexico HPD (2022).
- State Register of Cultural Properties (SRCP) and National Register of Historic Places (NRHP) records found online through the NM HPD website (HPD 2022).
- Google Earth imagery for religious resources (Google Earth 2017).
- Historic aerial photographs (EarthExplorer 2022).
- USGS historical topographic maps (USGS 2022).
- National Park Service (NPS): El Camino Real de Tierra Adentro (NPS 2022).
- Atwell's Class I Cultural Resources Inventory for the Rancho Viejo Solar Project, Santa Fe County, New Mexico (Atwell 2020b).
    - Included review of the New Mexico HPD or State Historic Preservation Office (SHPO) ARMS database, New Mexico State Register of Cultural Resources (SRCP), NRHP, and Bureau of Land Management (BLM) GLO records.

3.5.1 Environmental Setting

3.5.1.1 CULTURAL AND HISTORIC ARCHAEOLOGICAL RESOURCES

Santa Fe County is rich in archaeological and cultural resources. The analysis area is located on private land, within Santa Fe County limits.

Tribal Coordination

Although the analysis area is not in the vicinity of any Tribal land, Rancho Viejo has reached out to several Native American Tribes for input concerning the Project, including Tribal representatives from Tesuque Pueblo, Pojoaque Pueblo, Cochiti Pueblo, San Ildefonso Pueblo, Santa Clara Pueblo. The New Mexico State Tribal Liaison, Santa Fe County Tribal Liaison, and New Mexico State Director of Cultural Affairs were also contacted.

Rancho Viejo hosted a site visit with Jerome Samuel from the Tesuque Pueblo. The leader of the San Ildefonso Pueblo indicated that he would like for a Tribal monitor to be on the Project site during construction. Emails to other representatives did not receive a response. Rancho Viejo has contracted with a Tribal consultant to engage with the eight Northern New Mexico Pueblos and the Tribal leaders, inform them of potential activity on the site, and collaborate with leaders during construction. Rancho Viejo hosted a meeting in March 2023 with state Pueblo leaders to discuss the details of the proposed Project, allowing them to ask questions, provide cultural insight, and identify who amongst the Pueblos would want to participate in site monitoring during the construction phase. Rancho Viejo's contracted Tribal consultant will continue to engage and consult with all Pueblo representatives.

Cultural Resource Survey and Results

The Class I Cultural Resource Inventory completed by Atwell, LLC in 2020 did not identify any previous cultural resource surveys within the analysis area. A brief review of the records by SWCA prior to survey identified one previous survey parallel to current NM 14 where access to the solar facility is proposed. SWCA research identified nine previous surveys within 500 m of the current survey area. One known archaeological site, LA 108488, is intersected by the proposed gen-tie line. LA 108488, a segment of the El Paso Rock Island Railroad Line was determined not eligible by SHPO in 2007 (HPD Log No. 82133). Review of the NRHP, SRCP, and SHPO records indicate that no listed cultural resources are within the analysis area (Atwell 2020). The review by Atwell, as well as SWCA, did identify a location identified by the National Park Service as a "speculative location" of a portion of one of the many routes of the El Camino Real de Tierra Adentro National Historic Trail (NPS 2022).

SWCA completed an intensive pedestrian cultural resource inventory survey of the analysis area, on April 4-7, 13-14, 18, and 25-29; May 3; and June 30, 2022 (NMCRIS No. 150271), in accordance with current SHPO guidance and NMAC 4.10.15 (Byers et al. 2022). SWCA's intensive cultural resources inventory of the analysis area found one previously recorded site and recorded 14 newly identified sites, as well as 74 isolated occurrences (IOs). Of the 15 sites recorded, 10 consist of prehistoric artifact scatters without features, three consist of historic artifact scatters with features, and two consist of historic artifact scatters without features. The portion of El Camino Real de Tierra Adentro National Historic Trail identified as a "speculative location" and plotted north-south through the existing dirt road proposed for access to the facility, was thoroughly examined. No evidence of the trail's presence was found. It is possible that the trail has been destroyed by erosion or was misplotted during the original identification of the trail by aerial imagery and historic maps. This portion of the trail has never been ground-truthed.

No evidence of El Camino Real de Tierra Adentro was identified within the analysis area; therefore, the trail was not recorded as a part of this survey. However, if at a later date this alignment is confirmed as part of El Camino Real de Tierra Adentro, impacts to the setting of the trail from the current project would need to be reevaluated. The previously recorded archaeological site had been determined not eligible in 2007. Thirteen sites are recommended not eligible for listing to the NRHP under any of the four criteria. Two sites, LA 200751 and LA 200755, have been recommended undetermined for listing to the NRHP by SHPO (HPD Log No. 118484). The 74 IOs do not qualify as sites and are not eligible for inclusion on the NRHP; no further management of these IOs is recommended.

3.5.1.2 RELIGIOUS RESOURCES

There are no churches or other religious resources within the analysis area. No NRHP-listed Native American religious sites or sacred areas are known to occur within the vicinity of the analysis area. The nearest religious resource is located approximately 2.5 miles north of the analysis area (Figure 3.4).

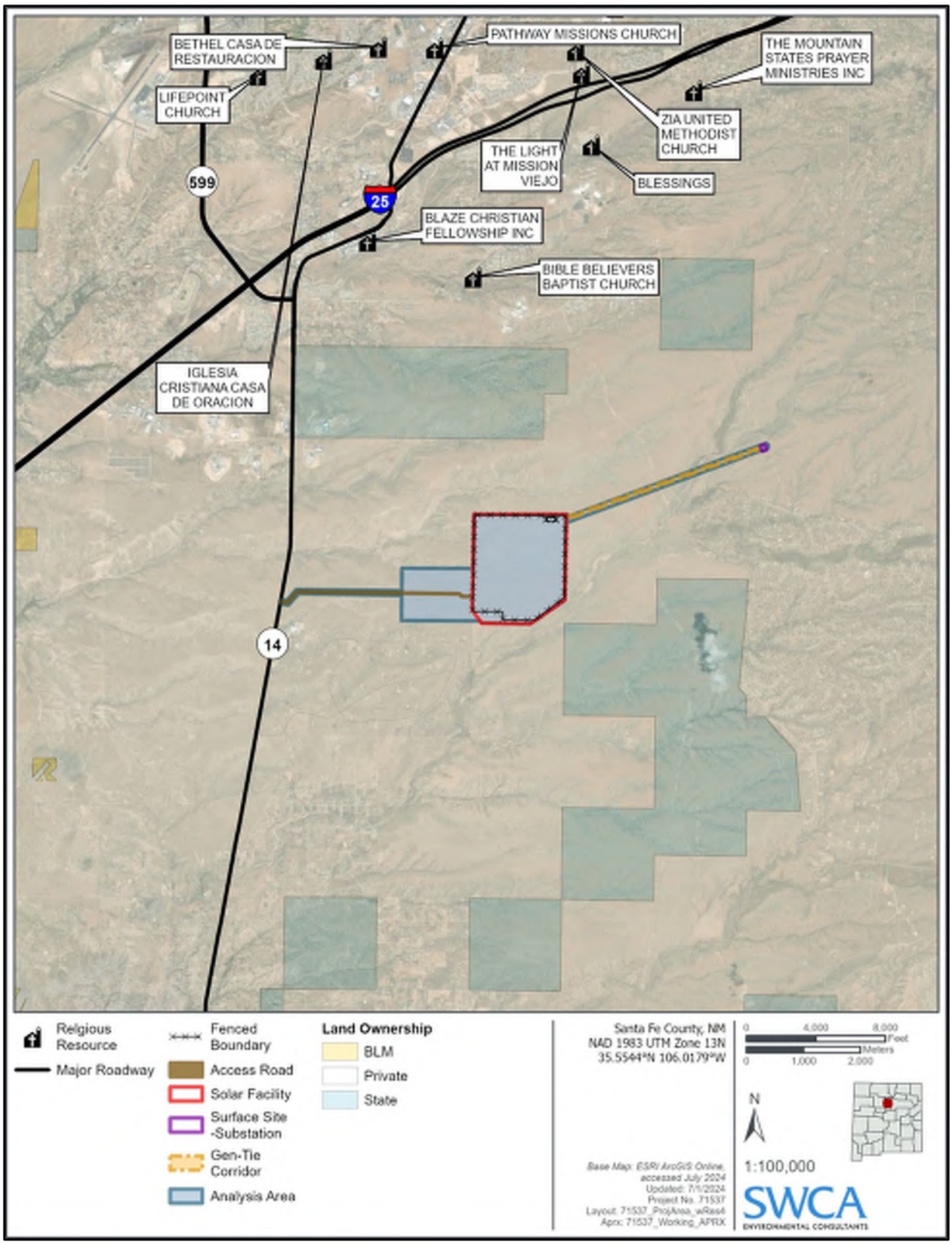


Figure 3.4. Religious resources within the vicinity of the analysis area.

3.5.2 Environmental Effects

3.5.2.1 PROPOSED ACTION

Cultural and Archaeological Resources

Fifteen archaeological sites were identified within the proposed analysis area during the cultural resources survey. Consultation with SHPO (HPD Log No.118484) after the cultural resource survey determined that 13 of these sites are not eligible to the NRHP and two (LA 200751 and LA 200755) are of undetermined eligibility. Sites of undetermined eligibility should be treated as eligible pending further testing and investigation. Rather than proceed with testing of these sites, Rancho Viejo has designed the Project to avoid these resources by at least 100 feet. In the initial letter from SHPO dated November 29, 2022 (HPD Log No. 118484), SHPO concurred with the initial findings and recommendations of SWCA's cultural resource survey with the exception of the eligibility for LA 200751 and LA 200755 (NMCRIS 150271). SHPO determined that these sites should have an undetermined status until further testing could be conducted. The site plan had already been designed to avoid LA 200751. To avoid LA 200755, adjustments were made to the access road and additional surveying was conducted. No cultural materials were identified during this survey. The report was submitted to SHPO and in a second letter, dated March 16, 2023 (HPD Log No. 119282), SHPO concurred with the report results. A third survey was conducted to accommodate another shift in the proposed Project access road. During the third and final survey of the area, an additional two archaeological sites were identified and recommended as not eligible.

In a third letter, dated April 4, 2024 (HPD Log No. 122238), SHPO concurred with the findings and recommendations in SWCA's cultural resource survey report. After the completion of all three surveys for this Project, a total of 17 sites were identified. Based on the avoidance of the two unevaluated sites (LA 200751 and LA 200755) and the remaining 15 sites being listed as not eligible, SHPO concluded that the Project will have no effect on historic properties.

The potential for subsurface cultural material within the analysis area is low; however, in the event that a previously undocumented burial site is discovered during Project construction, the appropriate authorities will be notified, which includes notifying HPD (SHPO) of an unanticipated discovery, ceasing work within the discovery footprint, and developing and following an Unanticipated Discoveries Plan. With the avoidance of the two undetermined resources, there will be *no effect* to any historic properties.

Religious Resources

There are no religious resources or churches in the vicinity of the analysis area and therefore there are no concerns of these types of resources being impacted.

No Action

Under the No Action Alternative, there will be no impacts to cultural or religious resources within the analysis area or surrounding areas because the Project will not be implemented. However, because the analysis area is privately owned and located primarily within the (RUR-F) zoning district (see Section 2.2), several types of potential development projects could occur under the No Action Alternative and may result in its own set of impacts to cultural resources.

3.5.3 Environmental Protection Measures

EPMs that will be implemented to protect undetermined or eligible cultural resources include the following:

- Avoidance of LA 200751 by at least 100 feet will occur as a result of a revised site plan by Rancho Viejo.
- Avoidance of LA 200751 will be achieved by constructing a new alignment of the access road to the Project. The site will be avoided by at least 100 feet.
- A Tribal monitor may be present during construction and Rancho Viejo will make the Project site available to the Tribal monitor during construction upon request. However, the Tribal monitor's presence is voluntary and not required for construction activities to proceed.

No further mitigations are recommended for the remaining 13 sites within the analysis area as they are listed not eligible for the NRHP (HPD Log No. 118484).

3.5.4 Cumulative Impacts

As no adverse impacts to cultural resources will occur, the Proposed Action will not contribute to cumulative impacts on cultural resources.

3.5.5 Conclusion

There were 15 not eligible and two unevaluated cultural resources identified within the analysis area during the cultural resources surveys. Consultation with SHPO on the eligibility and potential mitigation of the two undetermined resources has resulted in a revision to the site plan in order to achieve avoidance of both resources by at least 100 feet (see Figure 2.1). Therefore, there will be *no effect* to any historic properties and therefore no significant impairment to cultural resources. No irretrievable commitments of resources are anticipated.

If any unanticipated resources including subsurface burial sites are discovered, primarily during ground-disturbing construction activities all construction activities should cease, and a qualified archaeologist notified.

3.6 Geologic, Paleontological, and Soil Resources

Data sources reviewed to assess geologic and paleontological conditions, as well as existing soil resources, include the following:

- USGS topographic maps
- Digital 24K geologic map of the Turquoise Hill quadrangle (Koning and Hallett 2002)
- Digital 48K Geologic map of the southern Espanola Basin (Koning and Read 2010)
- BLM New Mexico's Potential Fossil Yield Classification GIS data (BLM 2022b)
- NRCS soil maps (NRCS 2022a)
- SWCA's biological survey report (SWCA 2022a)
- Preliminary Geotechnical Engineering Report (Appendix D)

3.6.1 Environmental Setting

Santa Fe County, New Mexico, contains abundant geologic and paleontological resources, including economically important minerals and scientifically important vertebrate fossils. Santa Fe County also contains sensitive soils that support the unique ecosystems of the greater Colorado Plateau high desert.

3.6.1.1 GEOLOGIC RESOURCES

The Rio Grande Rift dominates the geologic framework for this portion of New Mexico. The rift system's late Neogene crustal extensions formed a series of tilted half grabens and adjacent discontinuous mountain ranges resulting in the formation of multiple structural basins. The analysis area is located within the Española Basin, one of the northernmost basins of the rift zone. The west-dipping Española Basin is bounded to the east by the Santa Fe and Sangre de Cristo Mountains and the west by the Pajarito fault zone; and connected to the east-dipping San Luis and Santo Domingo basins to the north and south at the Embudo and La Bajada constrictions, respectively. The approximately 50 mile-long and 18- to 40-mile-wide basin is filled with over 10,000 feet of sedimentary deposits (Koning and Read 2010; Land 2016). The northwest–southeast-trending Embudo fault zone extends across the basin, which tectonically separated the main Española Basin to the south from the northern and northwestern parts of the basin. More recent faulting after deposition displaced or offset the basin-fill units. Multiple fault zones and igneous intrusions were active multiple times over the past several million years within the basin (Koning and Read 2010).

The geologic units of this area, including the analysis area, are characterized by Quaternary and Tertiary sedimentary deposits of the Santa Fe Group (Koning and Hallett 2002; Koning and Read 2010). A younger unit of the Santa Fe Group, the Ancha Formation, is the only formation of the group mapped within the analysis area. The Ancha Formation is composed mostly of granitic alluvium derived from the southeastern flank of the Sangre de Cristo Mountains. The Plains surface, a relatively flat but complex and diachronous physiographic surface, generally approximates the top of the Ancha Formation (Koning et al. 2002). This surface represents a former piedmont slope that has been subsequently incised by numerous streams draining the Sangre de Cristo Mountains. Soils of the Plains surface are typically modified by erosion and consist of calcic clay and siliceous carbonates. Exposures of the Ancha Formation are often limited to roadcuts and arroyos due to consistent thin covering of sheetwash or colluvium deposits. Depth to Miocene and older geologic units has not been determined within the analysis area, but from previous geologic studies and mapping, these units are estimated to be 10 to 76 m below the surface (Koning and Read 2010).

As described in Appendix D, geologic conditions at the Project site are consistent with the regional geology. The surficial geologic formations at or near the Project site are comprised of the following:

- Qay: Younger Alluvium. Comprised of a silty clayey sand to clay-silt interbedded with pebbly sand and sandy pebbles located in the bottom of valleys (Quaternary)
- QTaas: Ancho Formation. Comprised of silty sand with varying amounts of gravel. Some minor pebbles and cobbles (Quaternary)

3.6.1.2 PALEONTOLOGICAL RESOURCES

The Española Basin is rich in paleontological resources including diverse Pliocene and Pleistocene mammalian faunas; some of these fossils are in museum displays and many more are critical to historical and ongoing scientific studies (Lucas and Sullivan 2015; Tedford 1981; Tedford and Barghoorn 1993).

Although the analysis area is not on BLM land, the BLM's Potential Fossil Yield Classification (PFYC) System data values are used to analyze the potential impacts of the Project to paleontological resources. The PFYC system provides baseline guidance for predicting, assessing, and mitigating paleontological resources in areas of development. The PFYC is a ranking (1 [very low] to 5 [very high] or unknown [U]) of geologic units (formation, member, or other distinguishable units) based on the taxonomic diversity and abundance of previously recorded, scientifically important paleontological resources, including vertebrate, invertebrate, and plant fossils (BLM 2016). These values were previously assigned by the BLM to mapped geologic units throughout New Mexico regardless of surface ownership. For geologic units designated as PFYC U, sufficient information was not available to make an informed determination on paleontological potential, and these units are typically treated as units having higher or very high potential until more information is available.

The entire analysis area (1,143 acres) is mapped on the New Mexico state geologic map as the Santa Fe Group (Anderson 1997). While these units are ranked as having very high potential to contain important paleontological resources (PFYC 5) (BLM 2022b), more detailed geologic mapping indicates that the Project is immediately underlain by one of the youngest members of the Santa Fe Group, the Pliocene to late-Pleistocene Ancha Formation. The Ancha Formation is covered along the creeks in the analysis area by up to 5 m of Holocene alluvium valley fill, which has low potential (PFYC 2) to contain important paleontological resources (Koning and Hallett 2002). Sand and gravel of the Ancha Formation (Santa Fe Group) were deposited on pediments and contact the older Miocene-age Santa Fe Group Formations (e.g., Tesuque and Espinosa Formations) in the subsurface along an angular unconformity (Koning and Hallett 2002; Koning and Read 2010). While the Ancha Formation is part of the Santa Fe Group, the unit is not well known for containing abundant paleontological resources like some of the other formations within the group. The nearest known locality consists of a mammoth skull and tusk that was observed in similar gravel deposits resting on the pediment surface approximately 12 miles south of the analysis area, near Galisteo, New Mexico (Disbrow and Stoll 1957). Aerial image review indicates that the analysis area is vegetated, which obscures fresh exposures of the mapped Plio-Pleistocene geologic units.

A surface paleontological survey was not completed for the Project because the analysis area is vegetated and there are no surface exposures of the geological units with moderate to very high paleontological potential, and based on previous geologic mapping, Santa Fe Group Formations with very high potential to contain scientifically important fossils are between 10 to 76 m below the surface (Koning and Hallett 2002; Koning and Read 2010). If there are paleontological resources present in the analysis area, they are most likely buried below the younger mapped units.

3.6.1.3 SOIL RESOURCES

According to the NRCS (2022a), 12 soil map units are mapped within the approximately 1,143-acre analysis area (Table 3.4). These soils are considered well drained to excessively drained and non-hydric. None of the soils are considered prime farmland of statewide importance (NRCS 2022a). The soil complex parent material is predominantly alluvium derived from granite, gneiss, schist, loess, and volcanic ash. The soil is comprised mostly of loam, clay loam, and ranges from a clay loam, with smaller amounts of sandy loam and various other loam mixes. See Appendix D for additional information soil subsurface profile, thermal resistivity and soil chemistry, and soil corrosivity within the Project site.

Table 3.4. Soils in the Analysis Area

Soil Type Name	Soil Map Unit Symbol	Acres in Analysis Area	Percent of Analysis Area
Panky loam, 1 to 4 percent slopes	100	742.9	65.0
Zozobra-Jaconita complex, 5 to 25 percent slopes	101	47.8	4.2
Khapo sandy loam, 3 to 8 percent slopes	102	266.9	23.4
Zepol silt loam, 0 to 2 percent slopes, flooded	103	40.0	3.5
Arents-Urban land-Orthents complex, 1 to 60 percent slopes	116	0.5	<0.1
Predawn loam, 1 to 4 percent slopes	200	2.1	0.2
Tanoan-Encantado complex, 5 to 25 percent slopes	201	14.2	1.2
Alire loam, 2 to 6 percent slopes	202	7.5	0.7
Buckhorse-Altazano complex, 2 to 8 percent slopes, flooded	203	11.4	1.0
Levante-Riverwash complex, 1 to 3 percent slopes, flooded	213	0.9	0.1
Dondiego loam, 1 to 3 percent slopes	216	5.8	0.5
Ohke sandy loam, 1 to 3 percent slopes	217	2.9	0.3
Total		**1,142.9**	**100**

Source: NRCS (2022a).

3.6.2 Environmental Effects

3.6.2.1 PROPOSED ACTION

Construction activities are detailed within Section 2.1.2 and include installation of single-axis tracking steel structures and a wildlife-friendly perimeter fence. Grading and/or grubbing may occur throughout portions of the solar facility, BESS, foundation pads, operations building, and equipment storage and staging areas and include cuts and fill locations. Grading and/or grubbing ground disturbance is not expected to exceed 24 inches in depth. Additionally, a 20-foot-wide gravel surface or compacted native soil access road will be constructed between State Road 14 and the Project site, as well as internal access roads traversing the perimeter and internal solar panel layout. These roads will cause compaction of the native soil beneath.

Geologic Resources

Ground-disturbing activities, grading and boring, associated with the generation facility, substation, gen-tie line, and access roads will directly impact up to 724 acres of Holocene valley fill deposits and the Ancha Formation. The gen-tie structure foundations will be the deepest excavations within the analysis area, but even at a depth of up to 10 feet, they are unlikely to directly impact older geologic bedrock units such as the pre-Pliocene Tesuque and Espinaso Formations (Koning and Hallett 2002; Koning and Read 2010). Additional geotechnical investigation may be completed to determine the final design for the Project, including the exact depth of the transmission pole structures.

Paleontological Resources

Based on review of the geological, paleontological, and soil data sources, there is low potential for the Project to encounter any surface or subsurface paleontological resources due to lack of exposed geologic units at the surface within the analysis area and the depth (10 to 76 m) to a geologic unit with known high paleontological potential, and because subsurface disturbances of 2 m or more will likely be limited to

gen-tie pole foundation borings. If any paleontological resources are discovered during any phase of the proposed Project, these resources are considered property of the private landowner.

Need to verify if this is accurate

Soil Resources

The disturbance of up to 724 acres within the Project footprint during construction will directly impact the soils listed in Table 3.4. All construction occurring below the surface, including trench digging and structure foundation installation, as well as additional soil removal, will also directly impact these soils. Heavy equipment operations resulting in soil compaction and increased erosion from stormwater events from the loss of vegetative cover could cause the loss of soil structure and porosity. There is a potential for wind and water erosion due to the erosive nature of these soils. There is the potential for soil contamination due to spills or leaks from construction or maintenance equipment; however, the risk of soil contamination is low when protection measures are applied, such as preparing a spill prevention, control, and countermeasures (SPCC) plan. Soil contamination from spills or leaks can result in decreased soil fertility, less vegetative cover, and increased soil erosion.

Disruption of the soil crust can result in decreased soil organism diversity, soil nutrient levels, soil stability, and organic matter. These impacts are expected to be limited to the proposed analysis area. Although no sensitive soils, including biological soil crusts, were observed during the biological survey, the proposed Project could impact subsurface biological soil crusts if they are present. Indirect impacts to soil resources could include a change in soil productivity due to accidental mixing of topsoil with subsoil during construction. Protection measures are proposed to avoid and minimize these impacts, including minimizing surface disturbances and minimizing topsoil mixing through proper excavation techniques.

Decommissioning activities will have similar impacts to those described for construction as similar activities will occur.

3.6.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to geologic, paleontological, and soil resources within the analysis area or surrounding areas because the Project will not be implemented. However, because the analysis area is privately owned and located primarily within the (RUR-F) zoning district (see Section 2.2), several types of potential development projects could occur under the No Action Alternative and may result in its own set of impacts to geologic, paleontological, and soil resources.

3.6.3 Environmental Protection Measures

EPMs that will be implemented to avoid and minimize impacts to geologic, paleontological, and soil resources include the following:

- Construction will not be conducted during wet conditions when soils are saturated.
- To the extent possible, topsoil will be placed separately from subsoils/bedrock during excavation and not comingled and will be replaced in reverse order of excavation.
- Erosion will be reduced by applying and maintaining standard erosion and sediment control methods. These may include using certified weed-free straw wattles and bale barriers and silt fencing. Specific erosion and sediment control measures will be specified in a SWPPP. The SWPPP will include performance standards to evaluate the success of erosion control measures.
- A SPCC plan will be prepared by Rancho Viejo.
- Hazardous materials will not be drained onto the ground or into streams or drainage areas.

- Construction waste including trash, other solid waste, petroleum products, and other potentially hazardous materials will be removed to a disposal facility authorized to accept such materials.
- Contractors will implement a hazard communication program for any on-site hazardous materials to include training, labeling, and posting of Safety Data Sheets (SDSs). Fuels and petroleum-based products will be stored in approved containers and away from excavated areas. Waste motor oil, hydraulic fluid, and liquid gear lube will be stored in approved containers in isolated areas and removed to an authorized disposal facility monthly and in accordance with the regulations of NMED. All equipment using hydraulic hoses and cylinders will be inspected for leaks. Any equipment found to have petroleum leaks that cannot be repaired immediately will be removed from service and replaced.
- Contractors will have proper training, there will be spill kits on-site, and any leaking equipment will be repaired immediately. In the event contaminants are released, in addition to the requirements outlined in the environmental report, Rancho Viejo will adhere to the notification policies contained in 20.6.2.1203 NMAC.

3.6.4 Cumulative Impacts

The CIAA has a similar geological history, topography, and lack of surface exposures. Ground-disturbing activities associated with the Project and other existing and potential development projects in the CIAA are not likely to cumulatively impact geological or paleontological resources.

3.6.5 Conclusion

The proposed Project could directly impact soils and geologic units through grading for the generation facility, substation, and access roads, as well as grading and boring for the gen-tie pole installation. There is a low likelihood of the Project encountering paleontological resources during Project activities, thus limiting the potential for direct impacts. With implementation of EPMs to minimize impacts to soil resources, impacts to geologic, paleontological, and soils will be less than significant because there would be no expected impacts to paleontological or geologic resources. The Project is not expected to unduly impair important environmental values regarding geologic, paleontological, and soils resources and no irretrievable commitments of resources are anticipated.

3.7 Geographic Resources

Data sources reviewed to determine the nearest geographic resources include the following:

- NPS physiographic provinces (NPS 2021a)
- BLM special designations GIS data
- BLM areas of critical environmental concern (ACEC) list (BLM 2022a)
- USGS topographic maps
- Digital 24K geologic map of the Turquoise Hill quadrangle (Koning and Hallett 2002)
- Digital 48K Geologic map of the southern Espanola Basin (Koning and Read 2010)
- BLM New Mexico's Potential Fossil Yield Classification GIS data (BLM 2022b)
- NRCS soil maps (NRCS 2022a)
- SWCA's biological survey report (SWCA 2022a)

3.7.1 Environmental Setting

Geographic resources are rooted in cultural values and are typically places or earthly physical material that people treasure. Santa Fe County is situated at the base of the southern Rocky Mountains, nestled between the Sangre de Cristo Mountains to the east and the Jemez Mountains to the west. The county is in the Rio Grande Rift. The analysis area is located within the NPS's Basin and Range physiographic province (NPS 2021a). The analysis of impacts to geographic resources is limited to a 5-mile radius from the Project because, beyond this distance, direct impacts, including noise and visual disturbance associated with construction, operation and maintenance, and decommissioning activities will not occur.

Two BLM-managed ACECs, La Cienega ACEC and Galisteo Basin ACEC, are within approximately 4 miles of the analysis area. Information including their human value and use is listed in Table 3.5 and shown on Figure 3.5. Two speculative alignments of the El Camino Real de Tierra Adentro National Historic Trail (NHT) intersect the Project access road at the western terminus of the road. Neither of these alignments have been ground-truthed for positive identification. Additionally, other construction projects have successfully been completed along other intersections of speculative alignments. Definitive alignments of the trail are located approximately 4 miles west of the analysis area. Other geographic resources within 5 miles of the analysis area, such as preserves, national monuments, and NHTs, are also listed in Table 3.5.

Table 3.5. Local and Regional Geographic Resources

Geographic Resource	New Mexico County	Proximity to Analysis Area	Geographic Resource Use
El Camino Real de Tierra Adentro NHT	Santa Fe	0 miles to speculative alignments; 4 miles west to definitive alignments	This trail began in Mexico City and was important economically, socially, and politically. Exploration and trade expanded the route north, ending at Ohkay Owingeh Pueblo, New Mexico (NPS 2021b).
La Cienega ACEC	Santa Fe	4 miles west	This ACEC has cultural value, including pueblo ruins, and provides habitat for special-status species (BLM 2012).
Galisteo Basin ACEC	Santa Fe	4 miles south*	This ACEC is composed of multiple archaeological sites; the location for sites closest to the analysis area is provided here (BLM 2012).
Galisteo Basin Preserve	Santa Fe	5 miles south	A conservation-based community development with over 41 miles of publicly accessible trails and thousands of preserved acres (Galisteo Basin Preserve 2021).

*Due to confidentiality of the archaeological sites contained within this ACEC, the exact location is not disclosed.

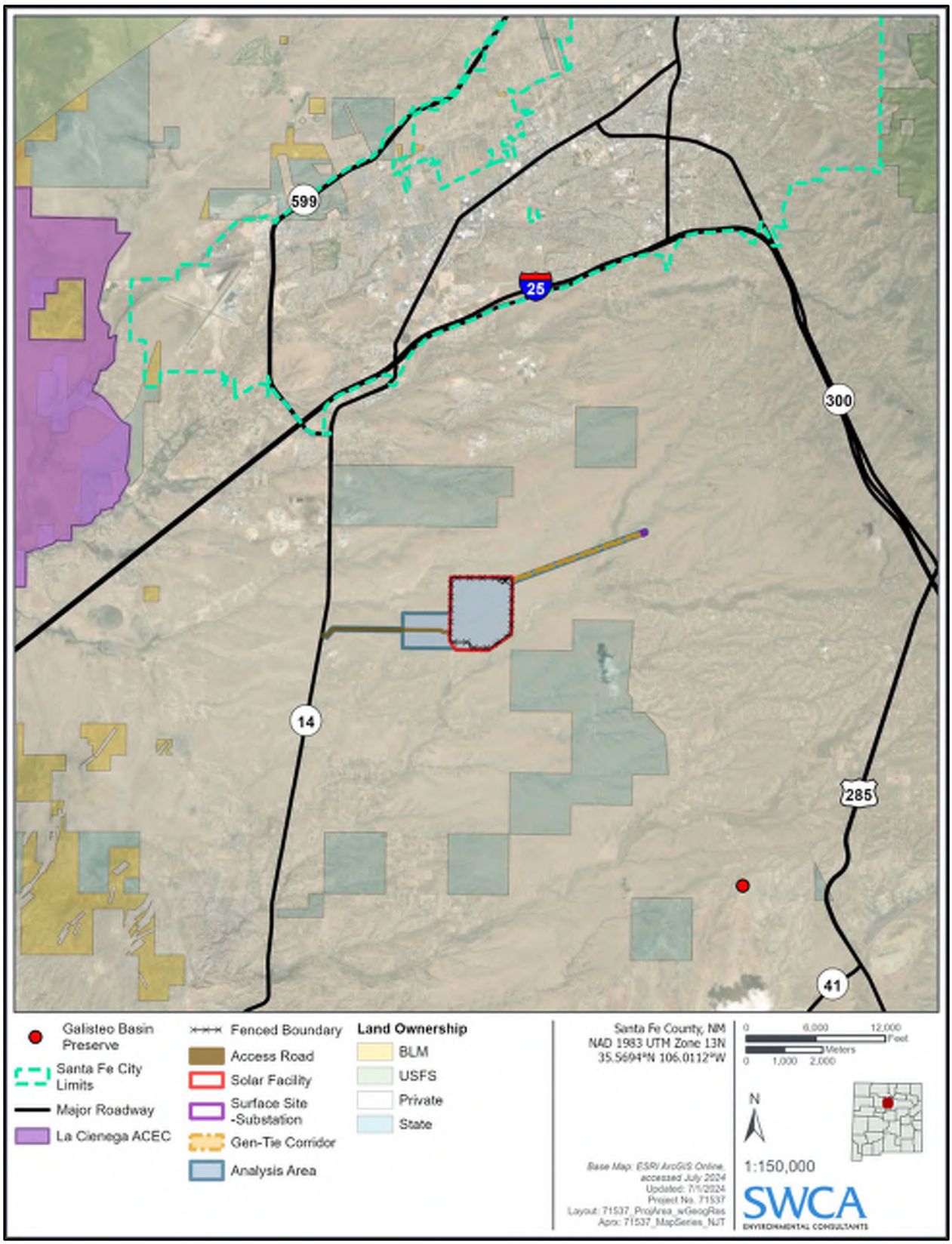


Figure 3.5. Geographic resources.

3.7.2 Environmental Effects

3.7.2.1 PROPOSED ACTION

Air resources impacts, including emissions from construction and decommissioning equipment and vehicles, are analyzed in Section 3.3. Emissions will be minor and will not impact the overall air quality of the region, including the geographic resources. EPMs will minimize effects to air resources as specified in Section 3.3 and below in Section 3.7.3.

Indirect impacts to the NHT, ACECs, and Galisteo Preserve could include impacts to visual resources, but viewers within the designated areas are not likely to notice the Project infrastructure. If the structures are noticed by a casual observer, the Project will appear to be similar in nature and lesser in intensity compared with the visual resource impacts resulting from the adjacent residential development, major roadways, existing transmission lines, and other scattered developments that occur in the vicinity of the analysis area. No indirect impacts to the Galisteo Basin Preserve are anticipated due to their distance from the analysis area (5 miles south). Visual impacts associated with the Project facilities are analyzed in Section 3.15. Section 3.13 analyzes impacts to traffic associated with construction vehicles in detail. The EPMs below were developed to minimize traffic safety risks to the public through obtaining required permits for access road improvements and implementing proper construction techniques and best management practices.

3.7.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to geographical resources within the analysis area or surrounding areas because the Proposed Action will not be implemented. However, because the analysis area is privately owned and located primarily within the (RUR-F) zoning district (see Section 2.2), several types of potential development projects could occur under the No Action Alternative and may result in its own set of impacts to geographic resources.

3.7.3 Environmental Protection Measures

EPMs that will be implemented to avoid and minimize impacts to geographical resources include the following:

- All fossil fuel–fired construction equipment will be maintained in accordance with manufacturer recommendations to minimize construction-related combustion emissions.
- The idling time of fossil fuel–fired construction equipment will be limited, unless idling must be maintained for proper operation (e.g., drilling, hoisting, and trenching).
- The speed of vehicles within construction sites during construction will be limited to help reduce the amount of fugitive dust generated.
- Water trucks or other dust suppression measures as required by the NMED Air Quality Bureau will be used to help reduce fugitive dust from construction activities.
- The applicable permits needed to transport equipment and materials will be obtained from Santa Fe County.
- Proper construction techniques and best management practices will be employed to minimize impacts to local roads.

- Visual impacts during construction will be reduced by minimizing areas of surface disturbance as practical, controlling erosion, using dust suppression techniques as practical, and, if applicable, restoring exposed soils as closely as possible to their original contour and vegetation.
- Construction activities will primarily be limited to daytime hours. If night work is required during construction, lighting will be the minimum necessary for safety, and lighting will not be left on when not in use.

3.7.4 Cumulative Impacts

The Project is located 4 to 5 miles from the following geographic resources within the CIAA: El Camino NHT, La Cienega ACEC, Galisteo ACEC, and Galisteo Basin Preserve. No direct impacts to these resources are expected; however, indirect temporary adverse impacts may occur, as described above. The Proposed Action, in conjunction with other reasonably foreseeable development projects in the CIAA has minimal potential to cumulatively affect geographical resources due to the fleeting nature of the impacts and implantation of EPMs.

3.7.5 Conclusion

Any visual or noise disturbance associated with the proposed Project will occur in the distance and/or will attenuate with distance. The air emissions associated with the construction and operations period will not contribute to a degradation of the regional ambient air quality standard, including the air quality within and surrounding the geographic resources. No direct long-term impacts to air quality will occur from the Project. Temporary impacts from fugitive dust will be negligible in scale, short term, and mitigated by the measures listed above. The indirect impacts associated with construction and decommissioning vehicle traffic to local area roads for travelers visiting the geographic resources will be short term, and the EPMs will alleviate the short-term impacts. Because the expected impacts would be minimal and short-term in nature, impacts from the Project will be less than significant. The Project is not expected to unduly impair important environmental values regarding geographic resources and no irretrievable commitments of resources are anticipated.

3.8 Health and Safety

Data sources reviewed include the following:

- Google Earth aerial imagery of the analysis area (Google Earth 2022)
- EPA's online environmental review databases (EPA 2021d)
- Pre-Incident Plan (Appendix B)
- First Responder Mitigation Guidelines (Appendix G)
- Preliminary Hazard Mitigation Analysis (HMA) (Appendix H)

3.8.1 Environmental Setting

Health and safety issues addressed in this document include an evaluation of environmental impairment, and safety hazards and risks to occupational workers and the public associated with construction and operation of the Rancho Viejo Solar Project. Risks to Project workers include those associated with construction techniques and equipment, including accidental release of hazardous materials, and electrical

and fire hazards. Similar risks to the public would occur if access to the Project area is gained during construction or operations.

The Project area and surrounding land are mostly vacant rangeland and housing developments. Developments in proximity to the Project area include the Turquoise Trail Charter School, the Penitentiary of New Mexico, the Santa Fe County Adult Correctional Facility, the Santa Fe County Fire Department facility, the Eldorado Fire and Rescue Station, and various housing developments. The nearest community is Santa Fe, approximately 3 miles north of the Project area. The Project area can be access accessed via State Road 14, a paved two-lane highway, to the proposed access road. State Road 14 is located west of the Project area.

Based on a review of the EPA's spills and cleanup data, there are no documented spills; contaminated sites; or dangerous waste treatment, storage, disposal, recycling, or used oil facilities within or near the analysis area (EPA 2021d).

The nearest fire response unit to the Project area is associated with Santa Fe County and is located less than 3 miles away. There are also several medical facilities, including hospitals, in Santa Fe, less than a 10-mile drive away from the Project area as outlined the First Responder Mitigation Guidelines (Appendix G).

3.8.2 Environmental Effects

3.8.2.1 PROPOSED ACTION

Clearing and grading of areas within the 680-acre solar facility, a 1-acre substation, a 2.3-acre BESS, a 2.3-mile gen-tie, and a 2.1-mile access road for the Rancho Viejo Solar Project will not impact any recognized health and safety environmental conditions or known radioactive wastes or radiation hazards because none are present in the Project area.

Construction and operation of the Project will occur in accordance with all applicable laws and regulations governing health and safety, including the Occupational Safety and Health Act of 1970 as administered by the Occupational Health and Safety Administration (OSHA). Solid and hazardous wastes that are generated by Project construction will be disposed of off-site at permitted landfill(s). EPMs will be implemented to minimize potential exposure to individuals from accidental releases of hazardous materials to soils and waters of the U.S. (WOTUS) during construction. Any accidental releases will be appropriately cleaned and discarded in accordance with the site SPCC plan. A safety and hazardous materials management plan will also be developed as part of the Rancho Viejo Solar Project.

Additional EPMs will be implemented to reduce fire risks, including banning smoking and non-construction flame sources outside of vehicles, establishing safety guidelines for construction flame and spark sources, and equipping vehicles with fire suppression tools and equipment. In addition, a Preliminary HMA has been developed to evaluate the conformance of the BESS site against the HMA requirements of the National Fire Protection Association (NFPA) 855, *Standard for the Installation of Energy Storage Systems* (2023 edition), and the *International Fire Code* (2021 edition). This evaluation assesses the anticipated overall effectiveness of the provided protective barriers to prevent and mitigate the consequences of a battery related failure (see Appendix H). A Final HMA will be performed as part of the detailed engineering process.

The nearest public access road to the Project area is State Road 14, located west of the Project area, connecting to the proposed access road. During construction, public access to the Project area will be restricted, thereby minimizing the potential for public exposure to construction-related risks.

The Rancho Viejo Solar Project's permanent facilities will be operated and maintained in accordance with industry standards for safety and site security and will be fully fenced facilities that will preclude public access. The Project has been designed to comply and conform with the New Mexico Fire Code (or other applicable fire code as established by NMAC 10.25.5.8), and the Santa Fe County Fire Code as outlined in the Preliminary HMA (Appendix H). Workers accessing the site for routine operations and maintenance will be trained in the proper maintenance of the facilities and will be familiar with the Pre-Incident Plan (Appendix B) and the First Responder Mitigation Guidelines (Appendix G). Additionally, the potential for accidental releases of hazardous materials from operations equipment is minimized by the small number of operations equipment operating on-site, and there are no radioactive wastes or radiation hazards associated with the operations of the facilities. Implementation of these practices will reduce the potential occupational health and safety risks of the Project.

Impacts to health and safety during Project decommissioning will be similar to those described for construction. Postconstruction, Project facilities will be removed from the analysis area and the area restored as described in Section 2.1.4. There will be no long-term health and safety impacts after decommissioning.

3.8.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to health and safety within the Project area or surrounding areas because the Proposed Action will not be implemented. However, because the analysis area is privately owned and located primarily within the (RUR-F) zoning district (see Section 2.2), several types of potential development projects could occur under the No Action Alternative and may result in its own set of impacts to health and safety.

3.8.3 Environmental Protection Measures

The following EPMs will be implemented to avoid and minimize impacts as part of the Rancho Viejo Solar Project:

- A SPCC plan will be prepared by Rancho Viejo.
- Rancho Viejo, or its contractors, will be responsible for fencing the site during construction to restrict access to the public for safety.
- Hazardous materials will not be drained onto the ground or into streams or drainage areas.
- Construction waste including trash, other solid waste, petroleum products, and other potentially hazardous materials will be removed to a disposal facility authorized to accept such materials.
- Contractors shall implement a hazard communication program for any on-site hazardous materials to include training, labeling, and posting of SDSs. Fuels and petroleum-based products will be stored in approved containers and away from excavated areas. Waste motor oil, hydraulic fluid, and liquid gear lube will be stored in approved containers in isolated areas and removed to an authorized disposal facility monthly and in accordance with regulations of NMED. All equipment using hydraulic hoses and cylinders will be inspected for leaks. Any equipment found to have petroleum leaks that cannot be repaired immediately will be removed from service and replaced.
- Contractors will have proper training, there will be spill kits on-site, and any leaking equipment will be repaired immediately. In the event contaminants are released, in addition to the requirements outlined in the environmental report, Rancho Viejo will adhere to the notification policies contained in 20.6.2.1203 NMAC.

- A Preliminary HMA has been prepared for the project (Appendix H). A Final HMA will be performed as part of the detailed engineering process. This HMA (Appendix H) will include site and product specific fire risk assessment and a First Responder Mitigation Guidelines (Appendix G). Local first responders will have access to these reports. Rancho Viejo will provide on-site and in-person training to the local responders prior to commercial operation of the system. There are no special materials required to respond to a fire event for the containerized BESS units. Only standard water application to the adjacent BESS containers is required and this is only in the case where all internal fire suppression systems may fail. All information required by the first responders will be included in the first responder plan part of the HMA.
- If a battery fire is initiated, the enclosures planned for this site will release fire suppressant in large concentrations directly into the initiating cell, removing heat and preventing thermal runaway throughout the enclosure. UL 9540 certification addresses safety and requires UL 9540a test results to be available for review. The UL 9540a tests of this system indicate adequate prevention of thermal runaway. The Rancho Viejo Energy Storage solution will achieve UL 9540 certification prior to site commercial operation.
- Wildland fire prevention measures will be used during construction, including limiting vehicle travel to and within construction areas to only essential vehicles, establishing parking guidelines in remote areas, banning smoking and non-construction flame sources outside of vehicles, and establishing safety guidelines for construction flame and spark sources.
- Rancho Viejo and its contractors, as appropriate, will initiate discussions with local fire districts and regional fire prevention staff prior to construction to discuss emergency procedures.
- As appropriate, vehicles will be equipped with fire suppression tools and equipment. Fire suppression equipment may include, but will not be limited to, shovels, buckets, and fire extinguishers.
- Smoking and equipment parking will be restricted to approved areas.
- Rancho Viejo and/or its contractors will fuel all highway-authorized vehicles off-site or in approved areas to minimize the risk of fire. Fueling of construction equipment that is transported to the site and is not highway authorized will be done in accordance with regulated construction practices and applicable federal, state, and local laws.
- Federal and state occupational health and safety standards will be established for the Project, such as OSHA's Occupational Health and Safety Standards. Additionally, a hazardous materials management plan will be developed for the management of hazardous materials, in coordination with those requirements under the Project's SPCC plan and SWPPP.
- A safety plan will be developed prior to construction for contractors working at the site. The plan will include items such as location of nearest medical emergency facilities, agency contacts and procedures, and inclement weather procedures.
- Construction is unlikely but could lead to the inadvertent excavation of pipes containing asbestos, or soils contaminated with asbestos fines/fragments. In the event such fragments/soils are excavated, Rancho Viejo shall analyze such fragments/soils, and if the fragments/soils exceed more than 1% asbestos, the asbestos waste will be disposed of by an approved commercial hauler in accordance with New Mexico Solid Waste Rules.

3.8.4 Cumulative Impacts

No foreseeable actions in the CIAA have been identified that would significantly affect health and safety. Therefore, there is minimal potential for the Project, in conjunction with other identified development projects in the CIAA, to cumulatively affect health and safety for occupational workers or the public.

3.8.5 Conclusion

There are no known recognized health or safety environmental conditions currently existing within the Project area and the immediate vicinity that could present a health and safety risk during development of the Rancho Viejo Solar Project. No direct impacts to health and safety will occur from the Project. The EPMs listed above will be implemented to avoid and minimize occupational and public health and safety risks during construction, operations and maintenance, or decommissioning. Therefore, any potential adverse impacts to health and safety will be less than significant and no irretrievable commitments of resources are anticipated.

3.9 Land Use

Data sources reviewed to determine the current land use conditions include the following:

- BLM Taos Field Office grazing allotment GIS spatial data
- Summary of the Mineral Resources of Bernalillo, Sandoval, and Santa Fe Counties, New Mexico (Elston 1967)
- Google Earth aerial imagery for land uses (Google Earth 2020)
- New Mexico Department of Transportation airport information (New Mexico Department of Transportation 2017)
- Federal Communications Commission information on communication sites and signals (Cavell Mertz & Associates 2022)
- Santa Fe County Sustainable Growth Management Plan (Santa Fe County 2015)
- Aeronautical Information Services Open Data Military Training Routes (Federal Aviation Administration 2022)

3.9.1 Environmental Setting

The region surrounding the Project contains lands managed by the BLM Taos Field Office, New Mexico State Land Office, the U.S. Forest Service, and privately managed lands (Figure 3.6). The lands within the Project area are privately managed. State Land Office–managed lands are located north (0.8 mile) and southeast (0.2 mile) (see Figure 3.6) of the Project area. The Project is located in a rural setting with predominantly undeveloped rangelands; however, regionally, there are several existing residential and commercial developments and industrial uses. The proposed Project will contain a transmission line approximately 2.3 miles in length that will connect to PNM's existing 115-kV transmission line to northeast of the generation facility. Although no other high-voltage transmission lines intersect or are within the immediate vicinity of the Project area, numerous other transmission lines are located in the region (see Figure 3.6).

Casual observers or sensitive viewers will include residents or other drivers passing by the Project using local roads, and users of adjacent land such as ranchers, hunters, or industry workers. The closest rural

residential parcel is located approximately 0.2 mile south of the Project's generation facility. The nearest community is Eldorado at Santa Fe, approximately 0.3 mile southeast of the Project's proposed transmission line and 1.3 miles east of the Project's generation facility. These dwellings are high-capacity single-family homes. The nearest major highway is State Road 14 (also known as Turquoise Trail) located approximately 2.1 miles west of the Project's generation facility. The proposed access for this Project connects to State Road 14.

Land use resources in the region of the analysis area include historic resources such as coal, sand, and gravel mining, as well as modern-day livestock grazing, residential development, and oil and gas and mining activities, including sand and gravel. While mining and oil and gas mineral extraction exists in the region, there are no mines or other subsurface mineral extraction projects, including oil and gas, in the immediate vicinity of the Project (see Figure 3.6). Past and present coal, sand, and gravel mining exploration within Santa Fe County is detailed in Section 3.10.

The city of Santa Fe, New Mexico, located approximately 3 miles north of the Project area, is a renowned center of southwest cultural and art. In 2005, Santa Fe was designated as a United Nations Educational, Scientific and Cultural Organization (UNESCO) as a creative city of crafts and folk arts (UNESCO 2005). Recreation uses center around tourism within and around Santa Fe from art and cultural museums to camping and hiking in the nearby National Forests and BLM lands. There are three NHTs in northern New Mexico. These NHT byways include the El Camino Real, Turquoise Trail, and Route 66 pre-1937 alignment (see Figure 3.6). The Route 66 pre-1937 alignment is approximately 5.7 miles northwest from the analysis area. The El Camino Real is located within the Interstate 25 corridor approximately 3.6 miles northwest of the proposed Project. The Turquoise Trail occurs on State Highway 14, which is adjacent to the access road for the proposed facility and is the closest NHT to the Project. Since the analysis area is located on private land, there are no other known official existing and established recreation uses within this area. However, the private landowner may have unestablished recreational activities.

According to the Santa Fe County SGMP, the analysis area is located in an unincorporated portion of the county (Santa Fe County 2015). There are approximately 4,948.3 acres of land in the unincorporated portions of Santa Fe County that are developed for public, institutional, and utilities uses. Land uses in this category consist mainly of federal, state, and county offices; community centers; schools; and places of worship. The largest developed sites in this category include the state prison and the National Guard Amory, both of which are also located along State Road 14. Other sites include the Glorieta Conference Center, the landfill managed by the Solid Waste Management Authority, and the Caja del Rio unit of Santa Fe National Forest. Other major public/institutional land uses in the unincorporated portions of the county include the Santa Fe Opera, the Santa Fe Community College campus, and the Institute of American Indian Arts (Santa Fe County 2015).

The County's existing zoning allows public, institutional, and utilities in a broad range of zoning districts, mainly designated as "community service facilities," so the adequacy of the supply of land for such uses is not a concern. The main challenges with the location of these uses are to encourage the location of schools, community centers, government offices, places of worship, and other institutional uses within communities; serve as a focal point for the community and afford easy access to residents; encourage development of joint agreements to provide access to school land and recreational facilities after hours; and ensure that potential land use compatibility and environmental conflicts are taken into consideration in the location of utility uses, such as landfills, solid waste transfer stations, wastewater treatment plants, power lines and substations, and solar or wind power generation sites.

Communication facilities located in the region of the Project include microwave towers and AM/FM radio towers (Cavell Mertz & Associates 2022). The closest tower to the Project area, a cellular communication microwave tower, is located approximately 3.4 miles north (Cavell Mertz & Associates 2022).

One airport, the Santa Fe Regional Airport, is located approximately 5.3 miles northwest of the Project area. There are several military aviation training routes in north-central New Mexico; however, all of these routes are separated by distances of 25 miles or greater from the Project generation facility and more than 23 miles from the transmission line, as shown on Figure 3.7 (FAA 2022a).

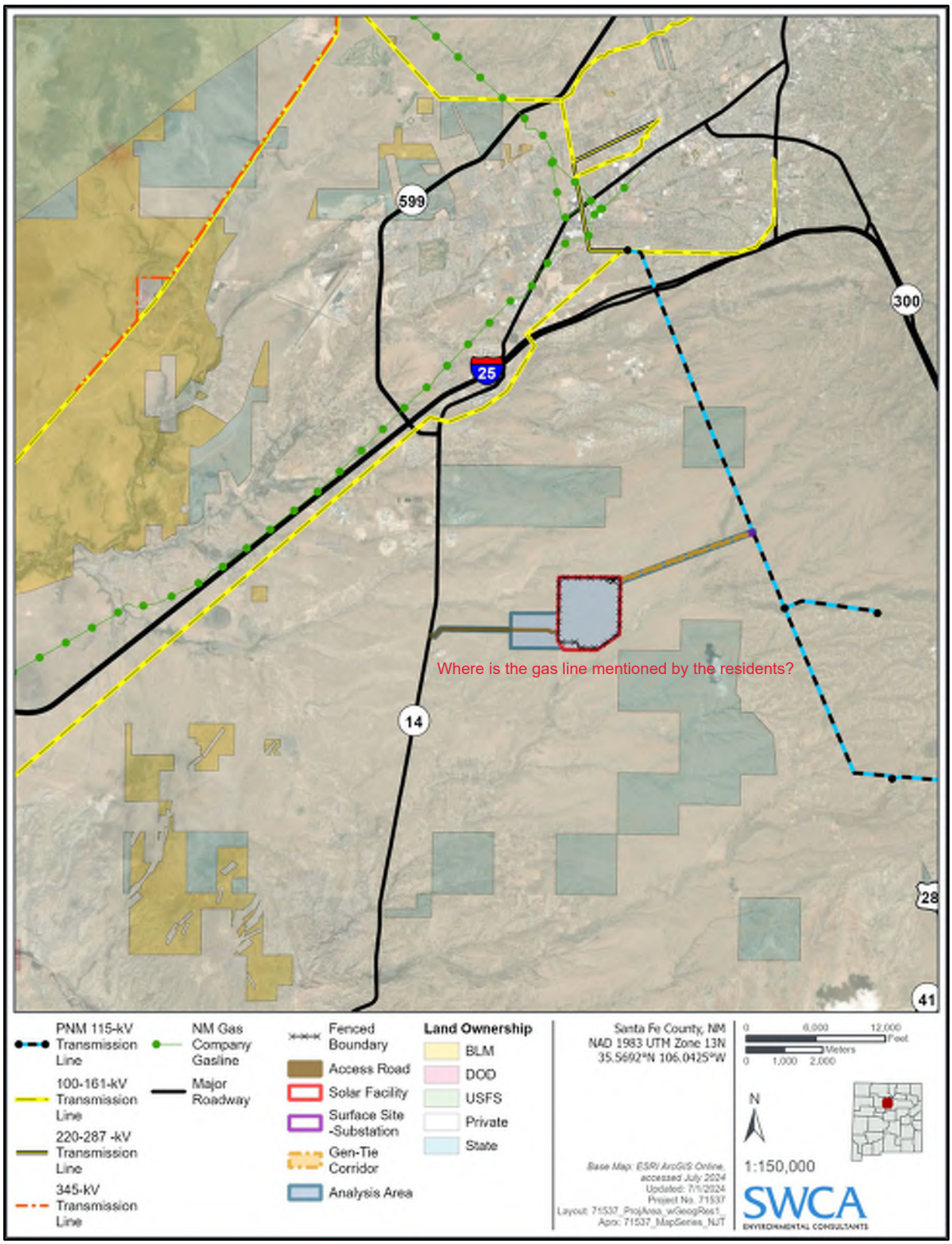


Figure 3.6. Analysis area and surrounding land uses.

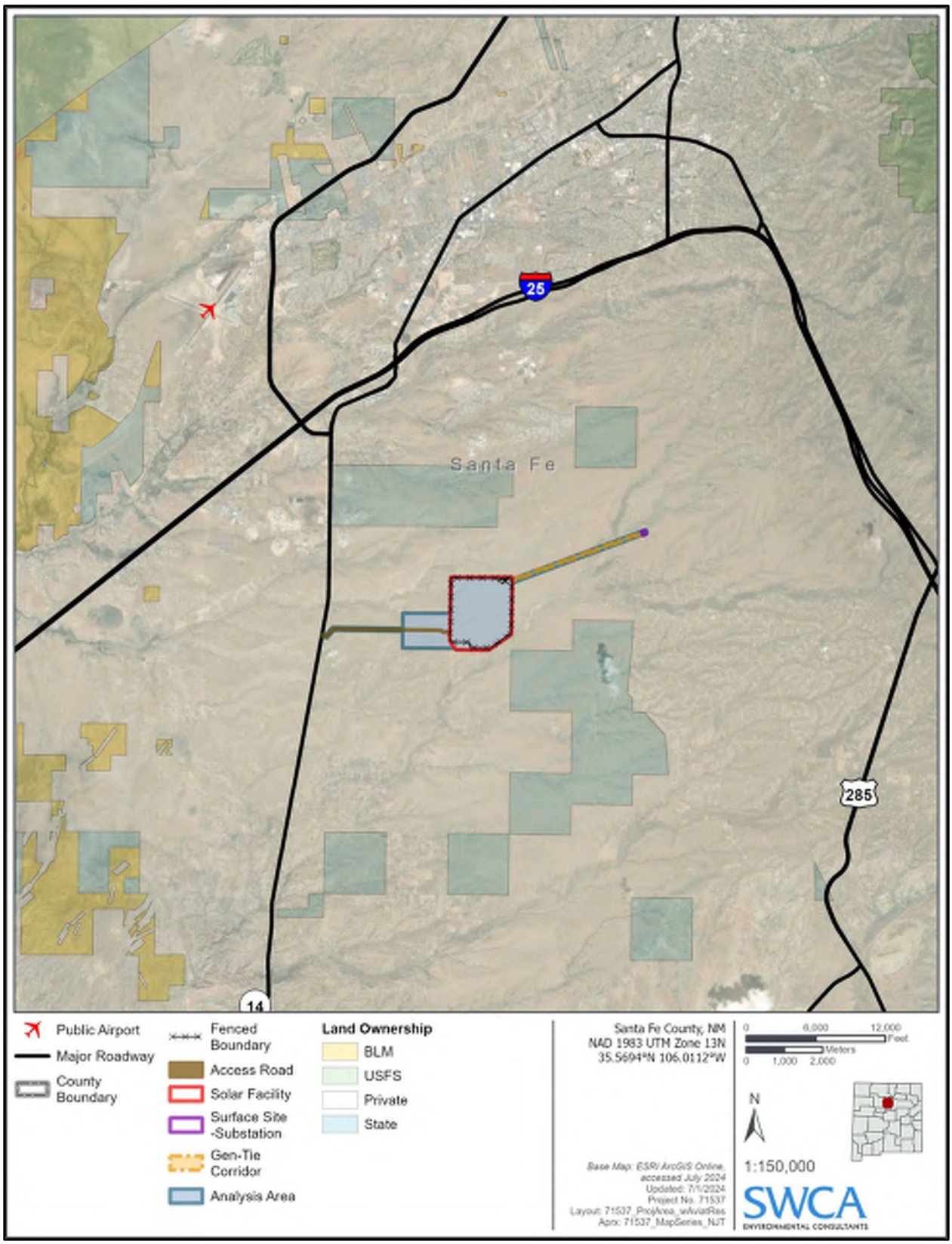


Figure 3.7. Analysis area and aviation resources.

3.9.2 Environmental Effects

3.9.2.1 PROPOSED ACTION

Impacts to mining and mineral extraction activities, including oil and gas development, are detailed in Section 3.10. PNM's existing 115-kV transmission line will facilitate energy transmission associated with the Project to connections at the Zia Substation and El Dorado Substation to PNM's customers. The Zia Substation and El Dorado Substations will facilitate the movement of solar power through the existing transmission line; thus, the Zia Substation and El Dorado Substations will support this current land use.

Direct impacts, including noise and visual disturbance associated with construction, operation and maintenance, and decommissioning activities, to people visiting the Old Spanish and Santa Fe NHTs, Santa Fe National Forest, Pecos National Historic Park, Cerillos Hills and Hyde Memorial State Parks, Santa Fe Ranch ACEC, and Bandelier and Kasha-Katuwe Tent Rocks National Monuments will not occur due to their distance from the analysis area (over 5 miles away). EPMs will minimize effects to air resources as specified in Section 3.3 and include the measures listed below in Section 3.9.3.

Specific visual effects for visitors traveling El Camino Real are analyzed in Sections 3.15. Two alignments of the El Camino Real de Tierra Adentro NHT intersect the Project access road. The alignments are located at the western terminus of the access road. Additionally, other construction projects have successfully been completed along other intersections of speculative alignments. Definitive alignments of the NHT are located approximately 4 miles west of the analysis area.

The analysis area is located off the Turquoise Trail National Scenic Byway (State Road 14). Travelers use this section of the byway to enjoy the scenery and to access Cerillos Hills State Park. Additionally, Interstate 25 is approximately 3 miles east and 4 miles west from the analysis area; this interstate will likely be used by visitors of the geographic resources described above. Indirect impacts to travelers, particularly those on the byway, will include temporary visibility of construction activities while passing the Project site. Indirect impacts will be the greatest during the 12-month construction period. Section 3.13 analyzes impacts to traffic associated with construction vehicles in detail. However, the EPMs below were developed to minimize traffic safety risks to the public through obtaining required permits for access road improvements and implementing proper construction techniques and best management practices.

The Project will be consistent with the Santa Fe County SGMP (Santa Fe County 2015). A conditional use permit is required from the County for the Project. Rancho Viejo has coordinated with the County regarding the proposed development.

The analysis area and general vicinity have historically been and are presently used as livestock rangeland. No impacts to public grazing allotments will occur as the analysis area is located approximately 3.1 miles west of the nearest allotment (BLM Allotment Number 00828) (Figure 3.8) (BLM 2012). The private grazing that currently occurs in the analysis area will terminate prior to construction of the transmission facilities; therefore, no impacts to the available foraging habitat for grazing are considered.

Additionally, the area is experiencing increasing urbanization and development, including a charter school and housing developments directly adjacent to the Project area. The loss of 724 acres of wildlife habitat will not cause undue degradation to general wildlife and vegetation as this habitat type is common across the regional landscape and is readily available on land adjacent to the analysis area.

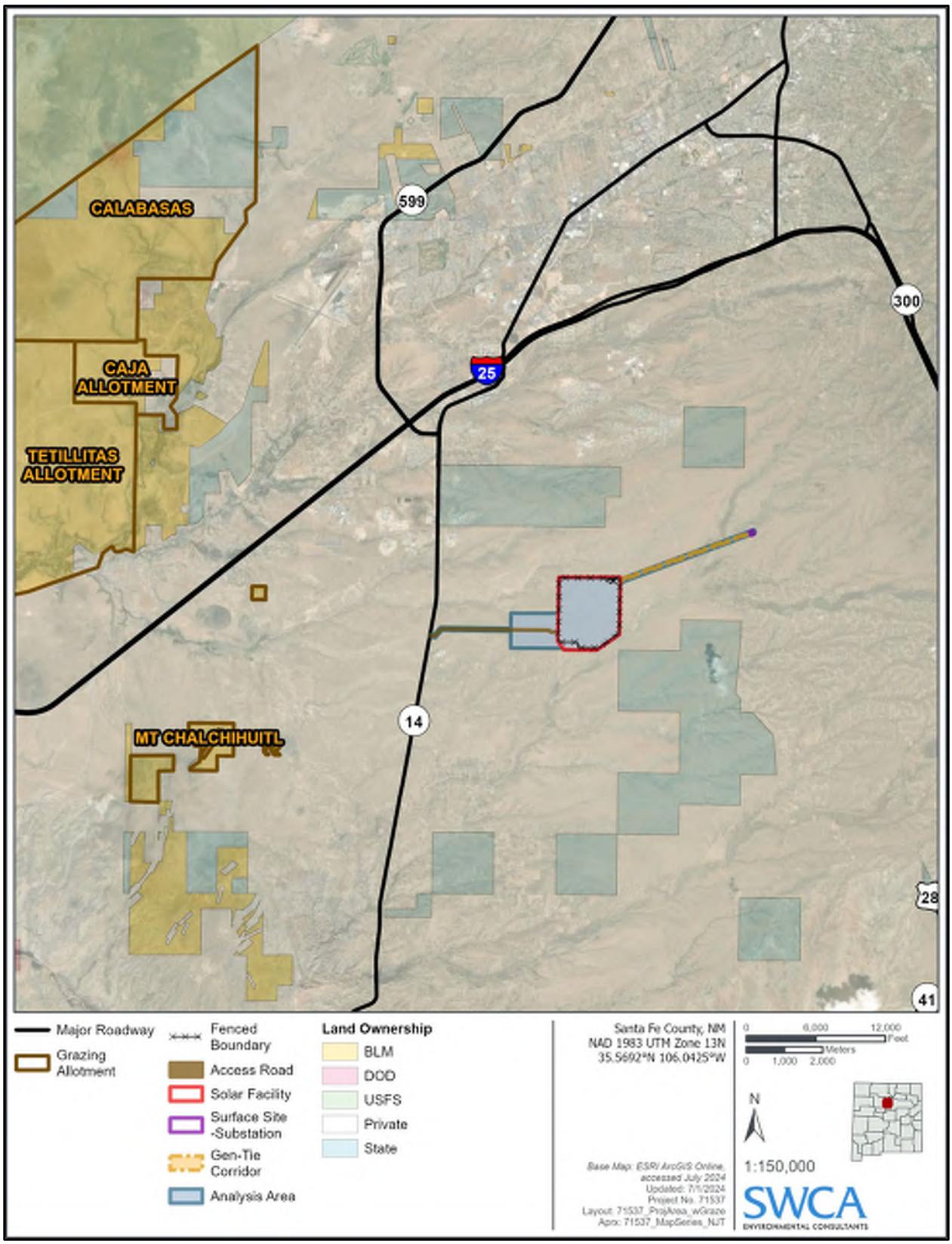


Figure 3.8. Analysis area and grazing allotments in the vicinity.

The portion of the Project footprint that is not needed for long-term operation and maintenance activities will be reclaimed following construction. According to the protection measures related to reclamation, a native seed mixture will be applied to all temporary disturbance areas. Additionally, Rancho Viejo will ensure the invasive and noxious plant management objectives within the land use plan are applied in the analysis area, including the implementation of control methods for the listed invasive and noxious plant species outlined within New Mexico State's Troublesome Weeds of New Mexico booklet (Ashigh et al 2010).

3.9.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to land use within the Project area or surrounding areas because the Proposed Action will not be implemented. However, because the analysis area is privately owned and primarily located within the (RUR-F) zoning district (see Section 2.2), several types of potential development projects could occur under the No Action Alternative and would result in its own set of impacts to land use.

3.9.3 Environmental Protection Measures

EPMs related to land use that will be implemented to avoid and minimize impacts to land use include:

- Compacted soils will be restored as closely as possible to preconstruction conditions as required for ground stabilization and erosion control.
- Rancho Viejo will develop and implement a noxious weed and control management plan for the control of noxious weeds and invasive species that could occur as a result of new surface-disturbing activities at the site.
- If required as part of the SWPPP, a native seed mixture will be applied to all temporary disturbance areas, followed by applications of mulch as required to provide additional erosion control.
- Rancho Viejo will coordinate with military bases and aviation facilities as needed.
- Construction activities will generally be limited to the least noise-sensitive times of day (i.e., daytime between 7 a.m. and 7 p.m.), unless necessary due to weather, safety, or schedule constraints. Construction equipment will be equipped with manufacturers' standard noise control devices or better (e.g., mufflers, engine enclosures).

3.9.4 Cumulative Impacts

The analysis area and general vicinity have historically been and are presently used as livestock rangeland; however, livestock grazing within the analysis area will be terminated as a result of the Project which will result in an incremental but nonsignificant loss of rangeland of livestock forage.
No foreseeable actions within the CIAA have been identified that would significantly affect land use. Therefore, there is minimal potential for the Proposed Action, in conjunction with other identified developments in the CIAA, to cumulatively affect land use for a long-term duration.

3.9.5 Conclusion

The surface disturbance associated with the Project could also influence the spread of noxious, nonnative, and invasive plant species, but these effects will be avoided or minimized by use of a noxious weed management plan. Livestock grazing on the available vegetation within the surrounding rangeland that remains or is reclaimed after construction of the Project, is anticipated, subject to landowner approval.

Implementation of EPMs will minimize impacts to vegetation used for foraging. There will be minimal impacts to recreation. The nearest recreation resources, El Camino Real de Tierra Adentro NHT and Turquoise Trail National Scenic Byway, are located directly west of the analysis area; however, neither will be impacted by the location of the Project as no disturbances are expected to occur on the El Camino Real de Tierra Adentro NHT and Turquoise Trail National Scenic Byway. Additionally, the Project is located near other existing infrastructure. The Project will not impact communication signals, transmission lines, or civilian or military aviation facilities. Therefore, the impacts from the Project on land use will be less than significant. The Project is not expected to unduly impair important environmental values regarding land use and no irretrievable commitments of resources will occur.

3.10 Minerals and Mining Resources

Data sources reviewed include the following:

- New Mexico Mining and Minerals Division Mine Registrations and Permits (EMNRD 2022b)
- New Mexico Mining and Minerals Divisions Registered Mines in New Mexico (EMNRD 2022c)
- Summary of the Mineral Resources of Bernalillo, Sandoval, and Santa Fe Counties, New Mexico (Elston 1967)
- New Mexico Bureau of Geology and Mineral Resources (2022).

3.10.1 Environmental Setting

Minerals and mining resources analyzed in this environmental document are surface and subsurface mineral resources, including aggregate, as well as gold, scoria, and pumice. Impacts to mineral resources may occur from surface and subsurface disturbance and the presence of permanent surface facilities in the analysis area.

The operations and maintenance of the Rancho Viejo Solar Project will not change or limit access to the existing mines within the region as they are all located over 10 miles from the analysis area (EMNRD 2022b) (Figure 3.9). The analysis area lies within the southern Española Basin. Historically, there have been economically important deposits of copper-gold-silver-tungsten, as well as iron veins, in the general area. Economically important industrial nonmetals in the general area have included pumice, scoria, gravel and sand, coal, aggregate, and turquoise. Regional mining activities and subsurface mineral extraction are more currently limited to aggregate, scoria, and pumice; however, there is no mineral extraction happening within an approximate 10-mile radius of the analysis area therefore the Project will not impact the ability to access surface and subsurface mineral deposits (such as aggregates or scoria) (EMNRD 2022c) (see Figure 3.9). There are no oil and gas activities that exist in the immediate Project vicinity. Mineral resources in the general area that are adjacent to the analysis area are owned by separate entities.

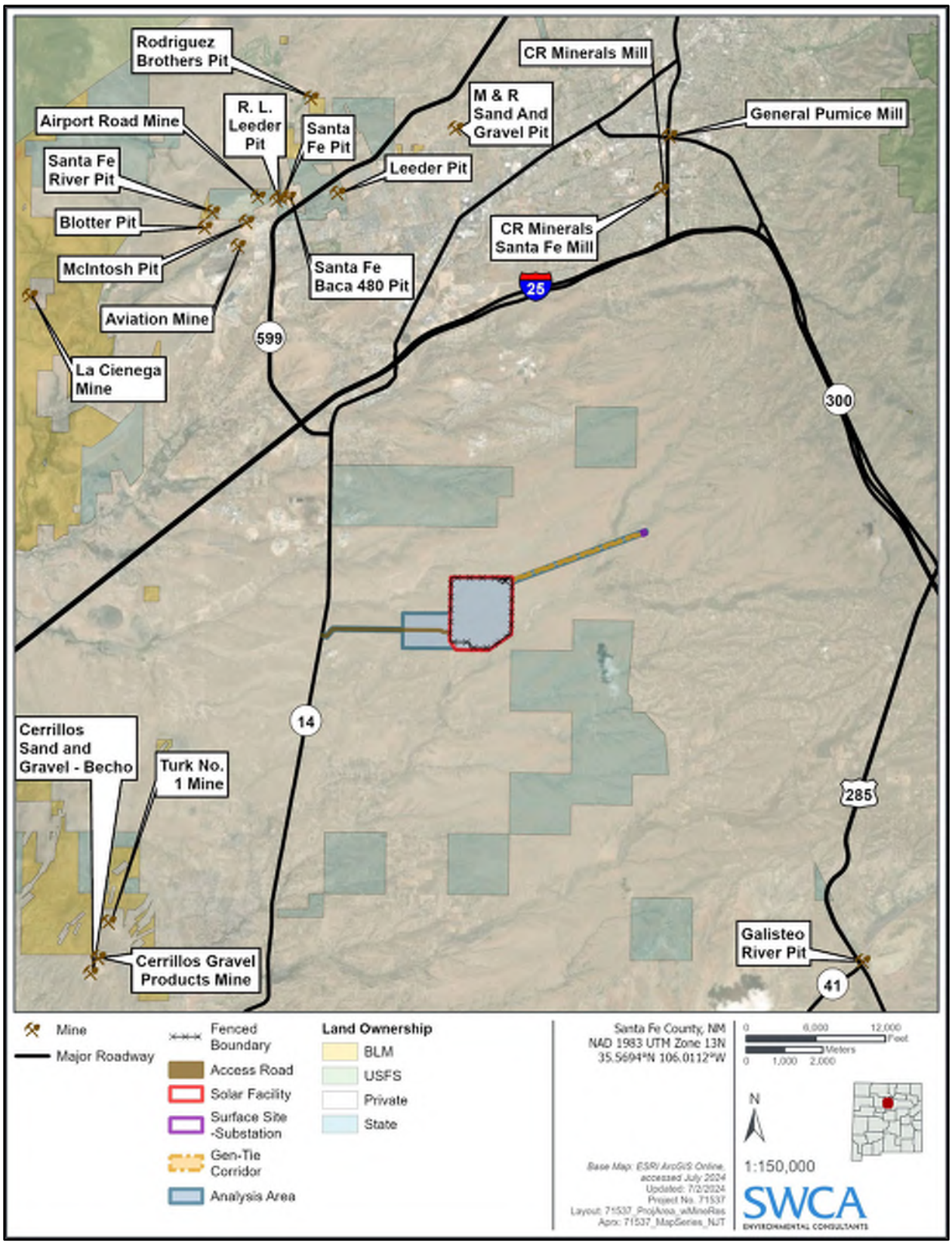


Figure 3.9. Mines in the Project area vicinity.

3.10.2 Environmental Effects

3.10.2.1 PROPOSED ACTION

Certain areas of the analysis area will be cleared and graded for movement of vehicles, assembly of components, and necessary crane maneuvers. Grading will conform to accepted slope stability requirements. Minor grading will include cuts and fills that are not expected to exceed 24 inches. Access roads will be constructed to facilitate access to the construction areas.

The operations and maintenance of the Rancho Viejo Solar Project will not change or limit access to the existing mines within the region as they are all located over 10 miles from the analysis area (EMNRD 2022c) (see Figure 3.9). The location of the Rancho Viejo Solar Project will impact the ability to access surface and subsurface mineral deposits (such as aggregates, and scoria) via open-pit mining techniques from within the area of permanent disturbance; however, there are no plans for aggregate or gypsum mining in the analysis area (EMNRD 2022b; New Mexico Bureau of Geology and Mineral Resources 2022). Impacts to subsurface oil and gas resources are not anticipated as there are no known existing subsurface oil and gas resources and there are no plans for oil and gas drilling within the analysis area.

Rancho Viejo will coordinate with any pertinent existing mineral and oil and gas rights holders regarding their resources. Once the Rancho Viejo Solar Project has been decommissioned, the area will be reclaimed, and mineral extraction could occur on this land.

3.10.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to minerals and mining resources within the Project area or surrounding areas because the Proposed Action will not be implemented. However, because the analysis area is privately owned and located primarily within the (RUR-F) zoning district (see Section 2.2), several types of potential development projects could occur under the No Action Alternative and may result in its own set of impacts to minerals and mining resources.

3.10.3 Environmental Protection Measures

No EPMs are proposed for this resource. Rancho Viejo will coordinate with any pertinent mineral and oil and gas rights holders, and there are no plans for mining in the analysis area.

3.10.4 Cumulative Impacts

There is no mineral extraction happening within the CIAA and therefore, the Project will not impact the ability to access surface and subsurface mineral deposits (such as aggregates or scoria) (EMNRD 2022c). There are no oil and gas activities that exist in the immediate Project vicinity. Currently, there are no known mines or planned mines for the CIAA; therefore, there is minimal potential for the Proposed Action, in conjunction with other identified developments in the CIAA, to cumulatively affect the important environmental values regarding mines and mineral resources.

3.10.5 Conclusion

While the location of the Rancho Viejo Solar Project will impact the ability to access surface and subsurface mineral deposits (such as aggregates, and scoria) via open-pit mining techniques from within the area of permanent disturbance, there are no plans for aggregate or gypsum mining in the analysis area. Prior to construction, Rancho Viejo will coordinate with any pertinent mineral and oil and gas rights

holders. Therefore, any impacts to mineral resources would be considered less than significant and no irretrievable commitments of resources are anticipated.

3.11 Noise Resources

Data sources reviewed include the following:

- Google Earth aerial imagery for evaluation of surrounding land uses (Google Earth 2022)
- U.S. Census Bureau data for population characteristics (Headwaters Economics 2022a)
- EPA's Protective Noise Levels, Condensed Version of EPA Levels Document (EPA 1979)
- SWCA's Noise Technical Report (SWCA 2024a)

3.11.1 Environmental Setting

Santa Fe County is a semi-rural, semi-urban county in central New Mexico. The acoustical setting in the Project area and its immediate vicinity generally has relatively low ambient noise levels due to the rural setting. Noise in the region typically ranges from very quiet with natural sounds such as birds and wind dominating, to noisy in localized areas near towns, cities, highway crossings, and oil and gas gathering activities. Small ranches and rural residences are spread throughout the area.

Noise is generally defined as loud, unpleasant, unexpected, or undesired sound that is typically associated with human activity and that interferes with or disrupts normal activities (EPA 1978). Prolonged exposure to high noise levels has been demonstrated to cause hearing loss (Center for Hearing and Communication 2020). The response of individuals to similar noise events is diverse and influenced by the type of noise; the perceived importance of the noise, and its appropriateness in the setting; the time of day and the type of activity during which the noise occurs; and the sensitivity of the individual.

Noise could also disrupt wildlife life-cycle activities of foraging, resting, migrating, and other patterns of behavior. Wildlife already existing in proximity to human development may be habituated to noise from land use and human disturbance; however, changes to these baseline activities may still result in wildlife disruption. Additionally, sensitivity to noise varies from species to species, making it difficult to identify how a noise source could affect all flora and fauna in an area.

Community sound levels are generally presented in terms of A-weighted decibels (dBA). The A-weighting network measures sound in a similar fashion to how a person perceives or hears sound, thus achieving a strong correlation with how people perceive acceptable and unacceptable sound levels. Table 3.6 presents A-weighted sound levels and the general subjective responses associated with common sources of noise in the physical environment.

The American National Standards Institute (ANSI) has published a standard (Acoustical Society of America S12.9-1993/Part 3) (ANSI 1993) with estimates of general ambient noise levels based on detailed descriptions of land use categories. The ANSI document organizes land use based on six categories. The analysis area and vicinity fits ANSI's Category 6 – very quiet, sparce suburban or rural areas with an ambient daytime noise level of approximately 43 dBA. Existing noise typically ranges from very quiet with natural sounds to occasional vehicles passing through analysis area or on rural roads directly adjacent to the analysis area.

Table 3.6. Typical Sound Levels Measured in the Environment and Industry

Noise Source at a Given Distance	Sound Level (dBA)	Qualitative Description
Carrier deck jet operation	140	–
Civil defense siren (100 feet)	130	Pain threshold
Jet takeoff (200 feet)	120	Deafening
Auto horn (3 feet) Pile driver (50 feet) Rock music concert environment	110	Maximum vocal effort
Jet takeoff (100 feet) Shout (0.5 foot) Ambulance siren (100 feet) Newspaper press (5 feet) Power lawnmower (3 feet)	100	–
Heavy truck (50 feet) Power mower Motorcycle (25 feet) Propeller plane flyover (1,000 feet)	90	Very loud/Annoying; Hearing damage (8-hour, continuous exposure)
Pneumatic drill (50 feet) Garbage disposal (3 feet) High urban environment	80	Very loud
Passenger car, 65 mph (25 feet) Living room stereo (15 feet) Vacuum cleaner (3 feet)	70	Loud/Intrusive (telephone use difficult)
Air conditioning unit (20 feet) Human voice (3 feet) Department store environment	60	–
Light auto traffic (50 feet) Residential air conditioner (50 feet) Private business office environment	50	Moderate/Quiet
Living room/Bedroom Bird calls (distant) Quiet office or library Quiet residential area (Ldn)	40	–
Estimated existing nighttime sound level for land use category 6: very quiet, sparse suburban or rural areas	37	–
Library soft whisper (5 feet) Quiet bedroom environment	30	Very quiet
Broadcasting/Recording studio	20	Faint
	10	Just audible
	0	Threshold of human audibility

Sources: Adapted from Table E, "Assessing and Mitigating Noise Impacts" (New York Department of Environmental Conservation 2001) and *Handbook of Environmental Acoustics* (Cowan 1993) and EPA (1978).

Sensitive noise receptors generally are defined as locations where people reside or where the presence of unwanted sound may adversely affect the existing land use. Typically, noise-sensitive land uses include residences, hospitals, places of worship, libraries, performance spaces, offices, and schools, as well as nature and wildlife preserves, recreational areas, and parks.

3.11.2 Environmental Effects

3.11.2.1 PROPOSED ACTION

The use of heavy equipment such as hoist cranes, excavators, dozers, and backhoes during construction will elevate ambient noise levels. The type of standard construction equipment proposed typically operate in range of 68 to 90 dBA above ambient noise levels at the source. In outdoor settings, the rate at which noise decreases is influenced by the distance separating noise sources and noise receptors, as well as local conditions such as traffic, topography, and weather. Generally, when noise is emitted from a point source, the noise is decreased an average of 6 dBA each time the separating distance is doubled (Berger et al. 2003; Radtke 2016). Noise impact calculations are determined by using the rate of noise attenuation and rule for reducing sound levels by dBA subtraction for heavy equipment operations based on maximum noise levels using a reference distance beginning 50 feet from the proposed conveyor's sound generation source (Thalheimer 2000). The solar facility Project area will be located a minimum of 1,000 feet from adjacent property.

Based on noise attenuation and these assumptions and estimated equipment noise levels (Federal Highway Administration 2006), noise generation from equipment operating in the ranges of 68 dBA (light trucks), 85 dBA (backhoe, excavator), and 90 dBA (heavy truck, concrete saw) at increasing distances is captured in Table 3.7. The majority of equipment will operate in the range of 80 dBA. Worker commutes and material delivery vehicles will cause noise that will be short term and have little effect on the hourly average noise level.

Table 3.7. Summary of Predicted Noise Generation from the Proposed Construction Equipment by Distance

Equipment Operating at 68 dBA		Equipment Operating at 85 dBA		Equipment Operating at 90 dBA	
Distance in Feet from the Source (miles [approximate])	Noise Level (dBA)	Distance in Feet from the Source (miles [approximate])	Noise Level (dBA)	Distance in Feet from the Source (miles [approximate])	Noise Level (dBA)
0	68	0	85	0	90
50 (0.01)	62	50 (0.01)	79	50 (0.01)	84
100 (0.02)	56	100 (0.02)	73	100 (0.02)	78
200 (0.04)	50	200 (0.04)	67	200 (0.04)	72
400 (0.08)	44	400 (0.08)	61	400 (0.08)	66
800 (0.15)	38	800 (0.15)	55	800 (0.15)	60
-	-	1,600 (0.30)	49	1,600 (0.30)	54
-	-	3,200 (0.60)	43	3,200 (0.60)	48
-	-	6,400 (1.20)	37	6,400 (1.20)	42

Based on noise attenuation, construction equipment noise levels will be expected to dissipate to below background levels (assumed to be 42 dBA) within approximately 0.15 mile to 1.2 miles of the Project area. The closest sensitive noise receptors, 16 residences located approximately 800 feet (0.15 mile) to 1,600 feet (0.3 mile) away (Figures 3.10 and 3.11), will experience a temporary increase in ambient outdoor noise levels during the 12-month construction period. Given the distance from the construction equipment, the increase in ambient noise levels at these sensitive noise receptors will attenuate to approximately 55 dBA, or the noise level of an air conditioning unit at 20 feet or normal human speech at

3 feet of distance. Sensitive noise receptors between 1,600 feet (0.3 mile) and 3,200 feet (0.6 mile) away consist of 114 residences and the Turquoise Trail Charter School (Figures 3.10 and 3.11) and will experience a temporary increase in ambient outdoor noise levels, which will attenuate to approximately 48 dBA, or the noise level of light automotive traffic or a quiet office environment. Sensitive noise receptors between 3,200 feet (0.6 mile) and 6,400 feet (1.2 miles) away consist of 262 residences and will experience a temporary increase in ambient outdoor noise levels, which will attenuate to low levels comparable to existing background noise levels.

During construction, protection measures will be implemented to minimize noise impacts, including limiting construction activities to the least noise-sensitive times of day (i.e., daytime between 7:00 a.m. and 7:00 p.m.) on weekdays, with the potential for work to occur from 7:00 a.m. to 7:00 p.m. on Saturday, and operating equipment manufacturers' standard noise control devices or better (e.g., mufflers, engine enclosures). Work on the gen-tie may occur at night to minimize outages. In addition, certain activities, such as concrete pours, may occur outside of the specified hours when heat conditions are conducive to the activity. Construction effects on wildlife are discussed in Section 3.4.2.

To determine the potential noise impact from these sources, detailed noise modeling was conducted. The noise levels at the property boundaries and at identified noise-sensitive areas in the vicinity of the Project from the operation of the Project have been predicted and compared with the relevant noise criteria, including the Sante Fe County Ordinance No. 2016-9 Chapter 7 – Sustainable Design Standards at property boundaries and the EPA's Ldn of 55 dBA at residential noise-sensitive areas.

Once the Project is constructed, noise associated with the Project will have a negligible increase in ambient noise levels beyond the immediate Project area and is not anticipated to impact the nearest sensitive receptor (Table 3.8) (SWCA 2024a).

Table 3.8. Equipment Sound Power Levels Expected During Operation

Description	Project Contribution (dBA)	Representative Background Noise Levels (dBA)	Total Calculated Noise Levels (dBA)	Estimated Noise Increase (dBA)
Loudest Property Line Modeled Noise Level	36.5	48.0	48.3	0.3
Santa Fe County Noise Limit (daytime)	-	-	55	-
Loudest Property Line Modeled Noise Level	36.5	42.0	43.5	1.5
City of Santa Fe Noise Limit (nighttime)	-	-	45.0	-

The human perception for change in sound level (i.e., potential increase above ambient) is estimated as 0.3 dBA during daytime hours and 1.5 dBA during nighttime hours. These noise increases would not be able to be perceived by a human observer. Therefore, the proposed operation would not result in a substantial permanent increase in ambient noise levels in the vicinity of the Project, as it is not expected the Project will produce noise that is audible to residents at these locations. For additional details, please review the Noise Technical Report for the Rancho Viejo Solar Project (Appendix C).

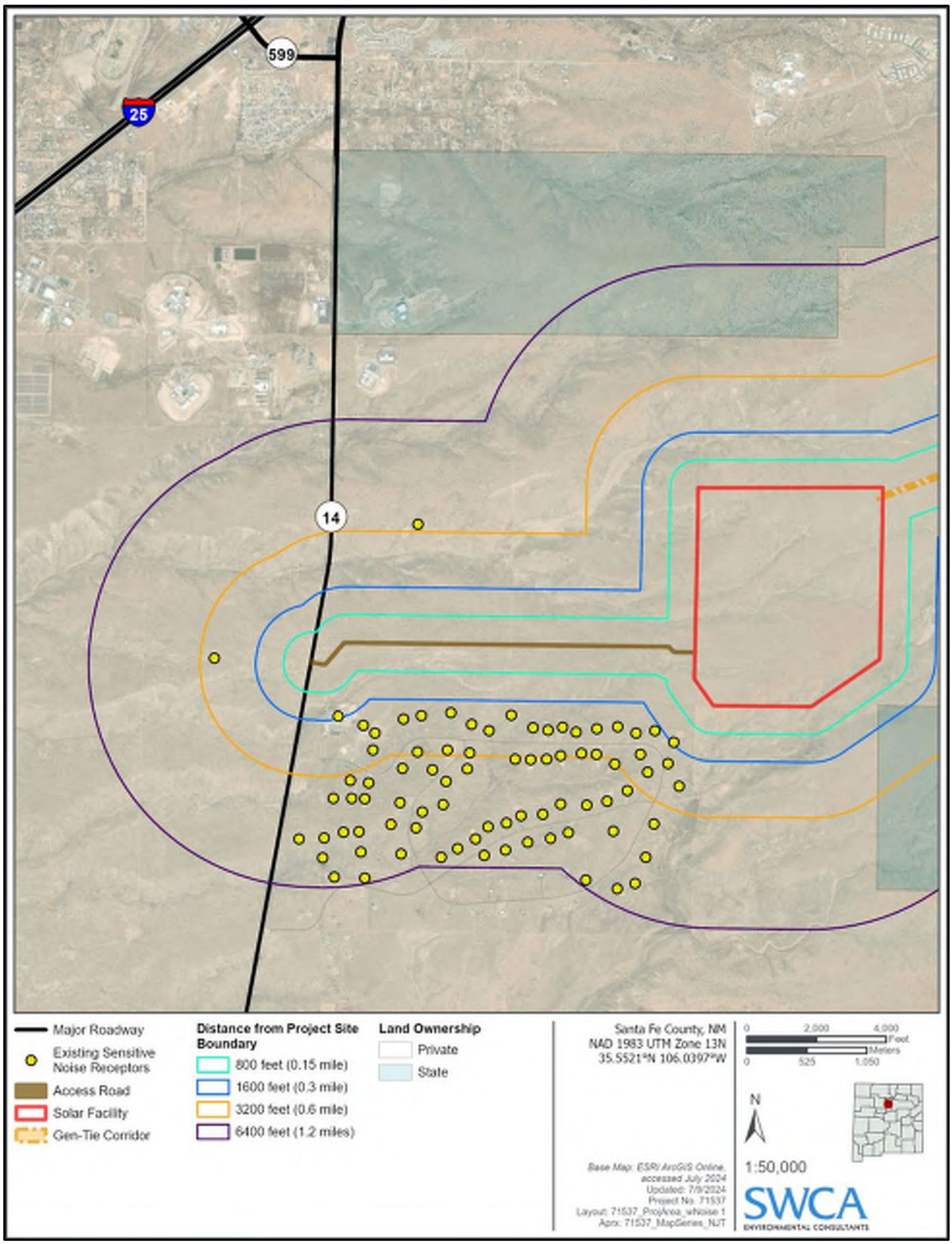


Figure 3.10. Analysis area and noise sensitive receptors, map 1.

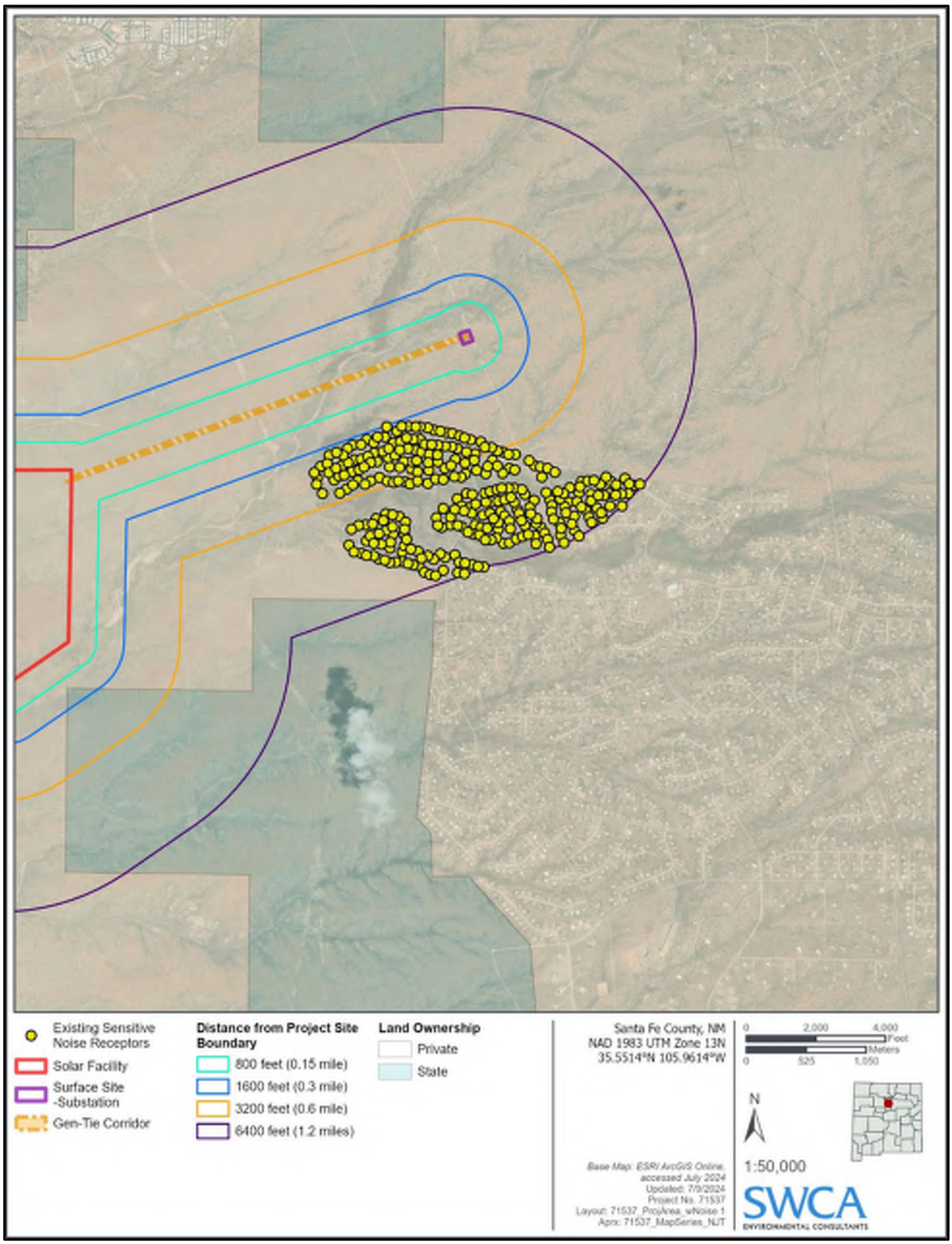


Figure 3.11. Analysis area and noise sensitive receptors, map 2.

3.11.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to noise resources within the Project area or surrounding areas because the Proposed Action will not be implemented. However, because the analysis area is privately owned and located primarily within the (RUR-F) zoning district (see Section 2.2), several types of potential development projects could occur under the No Action Alternative and may result in its own set of impacts to sensitive receptors.

3.11.3 Environmental Protection Measures

EPMs related to noise resources that will be implemented to avoid and minimize impacts as part of the Rancho Viejo Solar Project are described above and include:

- Construction activities will generally be limited to the least noise-sensitive times of day (i.e., daytime between 7:00 a.m. and 7:00 p.m.), unless necessary due to weather, safety, or schedule constraints.
- Construction equipment will be equipped with manufacturers' standard noise control devices or better (e.g., mufflers, engine enclosures).

3.11.4 Cumulative Impacts

No foreseeable actions in the CIAA have been identified that would significantly affect ambient noise levels. Therefore, there is minimal potential for the Proposed Action, in conjunction with other identified development projects in the CIAA, to cumulatively affect ambient noise levels and sensitive receptors.

3.11.5 Conclusion

The Rancho Viejo Solar Project is located in a semi-rural area with low existing noise levels.
The construction of the Rancho Viejo Solar Project will result in a temporary increase in ambient noise levels during the construction period as construction equipment noise levels will be expected to dissipate to below background levels within approximately 0.15 mile to 1.2 miles of the Project area. In addition, EPMs are proposed to minimize these impacts. Once in operation, the Project will have a negligible effect on ambient noise levels beyond the immediate vicinity of the Project area as the human perception for change in sound level (i.e., potential increase above ambient) is estimated as 0.3 dBA during daytime hours and 1.5 dBA during nighttime hours. These noise increases would not be able to be perceived by a human observer. Direct impacts to ambient noise will occur from the Proposed Action by increasing background noise levels from approximately 42 to 55 dBA for a short period of time (12 months). With implementation of EPMs and the noise increase not being discernable by the human observer, these impacts will be less than significant and no irretrievable commitments of resources are anticipated.

3.12 Socioeconomics

Socioeconomic data were obtained from:

- Headwaters Economics (2022a, 2022b, 2022c)

3.12.1 Environmental Setting

The socioeconomic factors relevant to the Rancho Viejo Solar Project potential socioeconomic impacts evaluated in this analysis include population, housing and occupancy, income, poverty, and industry

employment. Socioeconomic data are presented for the geographic area of the city of Santa Fe and Santa Fe County where the Project is located. The state of New Mexico is also presented as a reference population. Land uses and the existing setting of the Project area and vicinity are described above under Section 3.9.

The Project area is located in rural Santa Fe County, New Mexico, and the setting includes some areas of existing industrial developments. The total population of Santa Fe County was 150,319 in 2020 (Headwaters Economics 2022a). The population of Santa Fe County and New Mexico increased marginally from 2010 to 2020 (Table 3.9). In 2020, the total population of the city of Santa Fe was 84,418, which shows a significant growth from the 2010 population (Table 3.10).

Housing and occupancy characteristics for 2020 are shown in Table 3.9. There are approximately 6,046 vacant units in the city of Santa Fe and 10,344 vacant units in Santa Fe County. The median household income in Santa Fe County was $60,668 in 2020, with 9.0% of families below the poverty line. In New Mexico as a whole, the median household income was $51,243, with 14.2% of families below the poverty line (Headwaters Economics 2022a). Unemployment in 2020 was 8.3% in Santa Fe County and 8.4% in New Mexico (Headwaters Economics 2022b, 2022c). The top employment industries in in Santa Fe County are government, retail trade, healthcare, accommodation and food service, and professional and technical services (Table 3.11) (Headwaters Economics 2022b).

Table 3.9. Population (2010 to 2020)

Area	Population 2010	Population 2020	Percent Change 2010 to 2020
Santa Fe County	141,702	150,319	+6.1
City of Santa Fe	67,588	84,418	+24.9
New Mexico	2,013,122	2,097,021	+4.2

Source: Headwaters Economics (2022a)

Table 3.10. Housing and Occupancy (2020)

Area	Total Housing Units	Occupied Units	Vacant Units
Santa Fe County	73,496	63,152	10,344
City of Santa Fe	42,142	36,096	6,046
New Mexico	943,568	792,755	150,813

Source: Headwaters Economics (2022a)

Table 3.11. Santa Fe County Employment by Industry (2020)

Industry	Employment (Number of Jobs)
Non-services related	**7,875**
Farm	734
Forestry, fishing, and agricultural services	167
Mining (including fossil fuels)	578
Construction	5,323
Manufacturing	1,073

Industry	Employment (Number of Jobs)
Services related	**63,205**
Utilities	150
Wholesale trade	1,070
Retail trade	9,480
Transportation and warehousing	1,285
Information	1,406
Finance and insurance	3,132
Real estate and rental and leasing	4,553
Professional and technical services	7,551
Management of companies	407
Administrative and waste services	3,781
Educational services	2,404
Health care and social assistance	10,281
Arts, entertainment, and recreation	4,037
Accommodation and food services	7,704
Other services, except public administration	5,964
Government	**15,412**
Total Employment (Number of Jobs)	**86,492**

Source: Headwaters Economics (2022b)

3.12.2 Environmental Effects

3.12.2.1 PROPOSED ACTION

The Rancho Viejo Solar Project's construction, operations and maintenance, and decommissioning are unlikely to adversely impact social, economic, or population aspects of the area. The addition of the Rancho Viejo Solar Project will not alter the area's rural setting as the Project will be located near other existing developments.

The economic output associated with construction employment (approximately 200 workers) and economic multipliers from local spending (including sales tax revenue) during the 12-month construction period will have a minor beneficial, short-term economic impact to the local region. Construction workers are expected to be drawn from the local area, including Santa Fe, and from crews traveling with the contractor to various job sites. It is anticipated that construction workers who do not live in the nearby area will either stay in hotels or campsites in population centers and commute to the Project area daily. There are vacant housing units in Santa Fe and Santa Fe County that construction workers could use if desired; however, it is anticipated that most construction workers will commute from Santa Fe and the neighboring counties. Given the number of construction workers (approximately 200 workers) and the short duration of the construction period (12 months), any changes to the area's population or housing occupancy will be negligible relative to existing conditions.

Indirect spending associated with the presence of construction works in and around Santa Fe or other communities in Santa Fe County will be a short-term increase in revenue for these areas. Wages and labor during construction is estimated to total approximately $24 million dollars for the estimated 200 workers.

An estimated labor contribution for Santa Fe County during the construction phase is approximately $850,000 with total material purchases from Santa Fe County during construction to be approximately $4.1 million. More broadly, the Project is estimated to have approximately $6.1 million in applicable gross receipts taxes going to New Mexico. Estimates for property tax or payment in lieu of taxes are preliminary as appropriate contributions to enable Project competitiveness have not been initiated as they require conditional use permit approval from Santa Fe County prior to application. However, based on similar projects throughout New Mexico using prevailing mill rates and project capital costs, approximately $10 million is estimated to provide indirect benefits to the County, schools, and college districts over the operational lifetime.

Operation and maintenance of the Rancho Viejo Solar Project will be performed by approximately four technicians who will work out of the on-site operations building. This level of employment and any associated equipment and materials spending will have a negligible effect on socioeconomics over the operations phase. There will also be a minor increase in property taxes assessed on the Project area parcel as a result of the Rancho Viejo Solar Project improvements. Decommissioning impacts will be similar to those described for construction as similar methods are proposed.

3.12.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to socioeconomics within the Project area or surrounding areas because the Proposed Action will not be implemented. However, because the analysis area is privately owned and located primarily within the (RUR-F) zoning district (see Section 2.2), several types of potential development projects could occur under the No Action Alternative and would result in its own set of impacts to socioeconomics.

3.12.3 Environmental Protection Measures

The Rancho Viejo Solar Project socioeconomic impacts will be incremental and short term; therefore, no EPMs are proposed.

3.12.4 Cumulative Impacts

Foreseeable actions in Santa Fe County described in Section 3.2 may have a beneficial impact on socioeconomics in the county. Therefore, the Proposed Action, in conjunction with other foreseeable actions in the county, may contribute to beneficial short-term impacts on the socioeconomics of Santa Fe County.

3.12.5 Conclusion

The Rancho Viejo Solar Project could contribute to short-term revenue increases for the surrounding county and businesses therein from construction employment and local spending. No long-term changes to the area's population or housing characteristics are anticipated as the construction work force is anticipated to commute from larger population centers. The Project will result in an estimated $6.1 million in applicable gross receipts taxes and $10 million in indirect benefit to the County, schools, and college districts. Impacts during decommissioning will be similar to those described for construction. Short-term impacts would be potentially beneficial, and long-term impacts would be negligible; therefore, the impacts from the Project will be less than significant and no irretrievable commitments of resources are anticipated.

3.13 Traffic and Roads

The following data sources were reviewed for this analysis:

- New Mexico Department of Transportation (2017)

3.13.1 Environmental Setting

Roads in this analysis refers to the public and private roads that may be impacted by the vehicle and equipment trips generated during Project construction, operations, and decommissioning. The analysis area will be primarily accessed via New Mexico State Road 14 (Turquoise Trail). To access New Mexico Highway 14, Interstate 25 or Camino Los Abuelos will be used (Figure 3.12). The analysis area and surrounding land are residential and rural areas. The main transportation use in this area includes residential and cultural/recreation traffic.

Other regional road networks on which equipment, materials, or construction workers may travel to reach the analysis area include State Route 85, U.S. Route 285, Bonanza Creek Road, Camino Los Abuelos Road, and Interstate 25. Some trips may also include Interstate 25 from the Albuquerque area south of the analysis area. Transportation characteristics for these routes are provided in Table 3.12. The interstates, U.S. routes, and state routes are managed by the New Mexico Department of Transportation (District 5).

In general, traffic is greater in and around the population centers compared with rural areas. The most recent (2017) average annual daily traffic (AADT) count ranges available for U.S. and state routes are provided in Table 3.12 (New Mexico Department of Transportation 2017). Average annual traffic counts for Cam Los Abuelos and Bonanza Creek Road are also included.

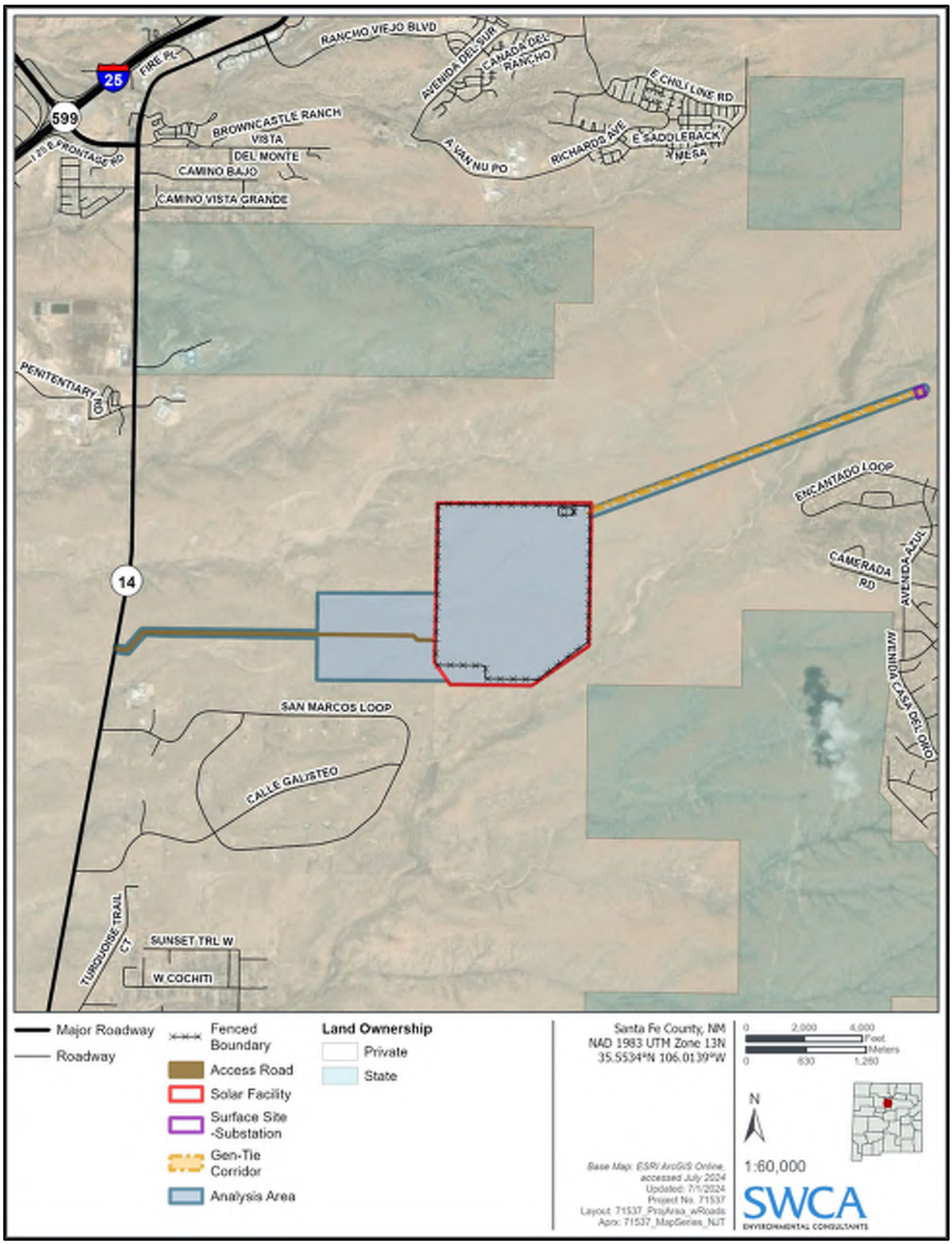


Figure 3.12. Regional road network and Project access routes.

Table 3.12. Transportation Route Characteristics

Road	Characteristic
Camino Los Abuelos	Management: Santa Fe County Road Segment: Access to New Mexico Highway 14 from Galisteo. Road Type: Paved, two lanes AADT Range: Unavailable
Bonanza Creek Road	Management: Santa Fe County Road Segment: Access to Interstate 25 from State Highway 599. Road Type: Paved, two lanes AADT Range: Unavailable
New Mexico State Road 14 (Turquoise Trail)	Management: New Mexico Department of Transportation (District 5) Road Segment: Access to the analysis area from Interstate 25, State Highway 599, U.S. Route 85, Camino Los Abuelos Road, and Bonanza Creek Road. Road Type: Paved, two lanes AADT Range: 151 to 2,000
State Highway 599	Management: New Mexico Department of Transportation (District 5) Road Segment: Access to New Mexico Highway 14 from Albuquerque or Santa Fe. Road Type: Paved with minimum of four lanes. AADT Range: 601 to 5,500
U.S. Route 85	Management: New Mexico Department of Transportation (District 5) Road Segment: Access to Interstate 25 from Galisteo. Road Type: Paved, two lanes AADT Range: 151 to 2,000
U.S. Route 285	Management: New Mexico Department of Transportation (District 5) Road Segment: Access to Interstate 25 from Galisteo. Road Type: Paved, two lanes AADT Range: 151 to 2,000
Interstate 25	Management: New Mexico Department of Transportation (District 5) Road Segment: In and around Albuquerque to State Road 14 in Santa Fe County. Road Type: Major interstate. Paved with minimum of four lanes. AADT Range: Major interstate, counts vary

3.13.2 Environmental Effects

3.13.2.1 PROPOSED ACTION

Project construction, operations, and decommissioning will increase traffic temporarily on local and regional transportation routes. Construction is anticipated to last approximately 12 months. The Project will require approximately 10 trips per day for materials and equipment over the construction period. Contractors commuting to the Project will generate approximately 115 to up to 190 trips per day for the duration of the construction period, for a total of 29,900 to 49,400 trips. Similar to the construction of solar facilities in other locations, the number of employees for the first two months and the last two months of construction will be lower with peak on-site employment occurring for the eight months in the middle of the Project schedule. Most Project-related trips will originate outside of the immediate vicinity of the analysis area. Worker commute trips will primarily use paved roads; however, depending on their origination point, some unpaved roads may be used. The number and type of vehicles planned to be involved during peak construction are described as follows:

- 10 heavy haul trucks (e.g., 18-wheeler deliveries, water trucks, garbage trucks) per day

- 75 to 150 work trucks (e.g., crew, foreman, superintendents) per day
- 40 work trucks specifically for the BESS install per day

An increase in daily construction traffic from material and equipment delivery and worker commutes will result in a short-term increase in traffic on the local routes around the analysis area. Construction traffic will be most notable on New Mexico Highway 14, closest to the analysis area. This route is estimated to have low existing traffic levels in the range of 151 to 2,000 AADT. A proposed access point for the Project currently has a gated entry on New Mexico Highway 14 just to the north of the existing Turquoise Trail Charter School. Rancho Viejo intends to improve and realign this access point to facilitate traffic for the construction of the solar facility, which will require a new permit from New Mexico Department of Transportation.

Depending on where construction trips originate, similar construction traffic increases may also occur on Interstate 25, U.S. Route 285, and State Highway 599. Local users may experience short-term delays as a result of the increased construction traffic on these routes. The daily increase in construction traffic will not impact the regional transportation routes farther from the analysis area with higher existing AADT counts.

Once operational, the site will be supported by approximately four technicians who will work out of the on-site operations building. The small increase in operations-related trips to the site will be imperceptible on the local and regional transportation routes.

Impacts of decommissioning on traffic will be similar to those described for construction because similar activities are proposed. There will be no traffic associated with Project post-decommissioning.

3.13.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to roads or traffic within the analysis area because the Project will not be implemented. However, because the analysis area is privately owned and located primarily within the (RUR-F) zoning district (see Section 2.2), several types of potential development projects could occur under the No Action Alternative and may result in its own set of impacts to traffic and roads.

3.13.3 Environmental Protection Measures

EPMs related to roads that will be implemented to avoid and minimize impacts as part of the Project are described above and include the following:

- The applicable permits needed to transport equipment and materials will be obtained from the County. All oversized loads will require a NMDOT permit.
- Construction speed limits will be established.
- Proper construction techniques and best management practices will be employed to minimize impacts to local roads.

3.13.4 Cumulative Impacts

No foreseeable actions in the CIAA have been identified that will significantly increase traffic levels. Foreseeable actions in the Santa Fe County described in Section 3.2 may result in short- or long- term impacts on traffic and roads in the CIAA depending on their location. Therefore, the Proposed Action,

in conjunction with other foreseeable actions in the CIAA, may contribute to short-term cumulative impacts on the traffic levels for the area.

3.13.5 Conclusion

The Project is located in an area with low existing traffic levels. The Project will result in a short-term increase in traffic on the local roads during the construction and decommissioning phases, with a negligible increase during operations and maintenance. Direct impacts to existing traffic levels will occur from the Proposed Action for a temporary period of approximately 12 months. EPMs are proposed during construction to minimize impacts to the routes that will be utilized. With implementation of EPMs and the short-term nature of the potential traffic increases and road closures, these impacts will be less than significant, and no irretrievable commitments of resources are anticipated.

3.14 Water Resources

SWCA completed a biological survey of the analysis area April 4 through 11, 2022, to identify and map the boundaries of any aquatic and wetland resources that have the potential to be WOTUS. SWCA also surveyed for sensitive habitats and plant communities that are supported by the aquatic resources in the region. Additional data sources reviewed include:

- USGS quadrangles
- National Wetlands Inventory (NWI) maps (USFWS 2022c), National Hydrology set (NHD) data (USGS 2016), and NRCS soils data (NRCS 2022a)
- Federal Emergency Management Agency (FEMA) maps (FEMA 2022)
- Aerial photographs of the analysis area, accessed using Google Earth (Google Earth 2022)
- SWCA's Aquatic Resources Inventory Report (SWCA 2022b)

3.14.1 Environmental Setting

The analysis area is located in the Rio Grande Groundwater Basin, which includes portions of southern Colorado and western Texas. The average elevation of the analysis area is approximately 6,420 feet amsl. The topography in the analysis area is relatively flat, gently sloping to the west. Approximately 88.2% of the analysis area occurs within the Santa Fe River watershed (Hydrologic Unit Code 1302020101), and approximately 11.8% occurs within the Outlet Galisteo Creek watershed (Hydrologic Unit Code 1302020104) (USGS 2016).

Existing water use in Santa Fe County was estimated at approximately 26,919 acre-feet of groundwater and 9,734 acre-feet of surface water (36,653 acre-feet total) in 2015 (New Mexico Office of the State Engineer 2015). The dominant water uses were for irrigated agriculture, public water supply, domestic (self-supplied), and commercial (self-supplied). There are 327 groundwater wells within Township 15 North, Range 9 East. The average depth of wells within the township and range of the Project area is 169 feet with depths ranging from 18 to 535 feet. Therefore, depths to groundwater within the analysis area indicate a shallow water table (New Mexico Office of the State Engineer 2010). There are no groundwater wells within the analysis area.

According to the NWI and NHD, there are four NWI-mapped riverine wetlands and one NHD-mapped surface water feature (Gallina Arroyo) within the analysis area; the NHD-mapped surface water feature and one of the NWI-mapped riverine features overlap and occur within the same drainage that intersects the permanent easement for the gen-tie (USFWS 2022c; USGS 2016). During the aquatic resources

delineation conducted by SWCA on April 8, 2022 (SWCA 2022b), it was determined that the NHD-mapped feature (Gallina Arroyo) contained an ordinary high-water mark (OHWM) but did not meet the criteria (hydrology, hydrophytic vegetation, hydric soils) necessary to be classified as a wetland (Table 3.13; Figure 3.13). One erosional feature (EF01) was recorded along an NWI-mapped riverine feature within the solar facility. In addition, approximately 0.5 acre of the proposed gen-tie overlaps a Zone A floodplain. Zone A floodplains are defined as areas with a 1% annual chance flood event (FEMA 2022).

Table 3.13. SWCA-Mapped Surface Water Features within the Proposed Project Area

Feature ID	Corresponding NHD/NWI	Jurisdictional Determination	Average OHWM Width (feet)	Length (feet)	Potentially Jurisdictional Waters within the Proposed Project Area (acres)
Gallina Arroyo (DR01)	Ephemeral drainage	Potentially jurisdictional	43.0	38.4	0.05

Source: USGS (2016)

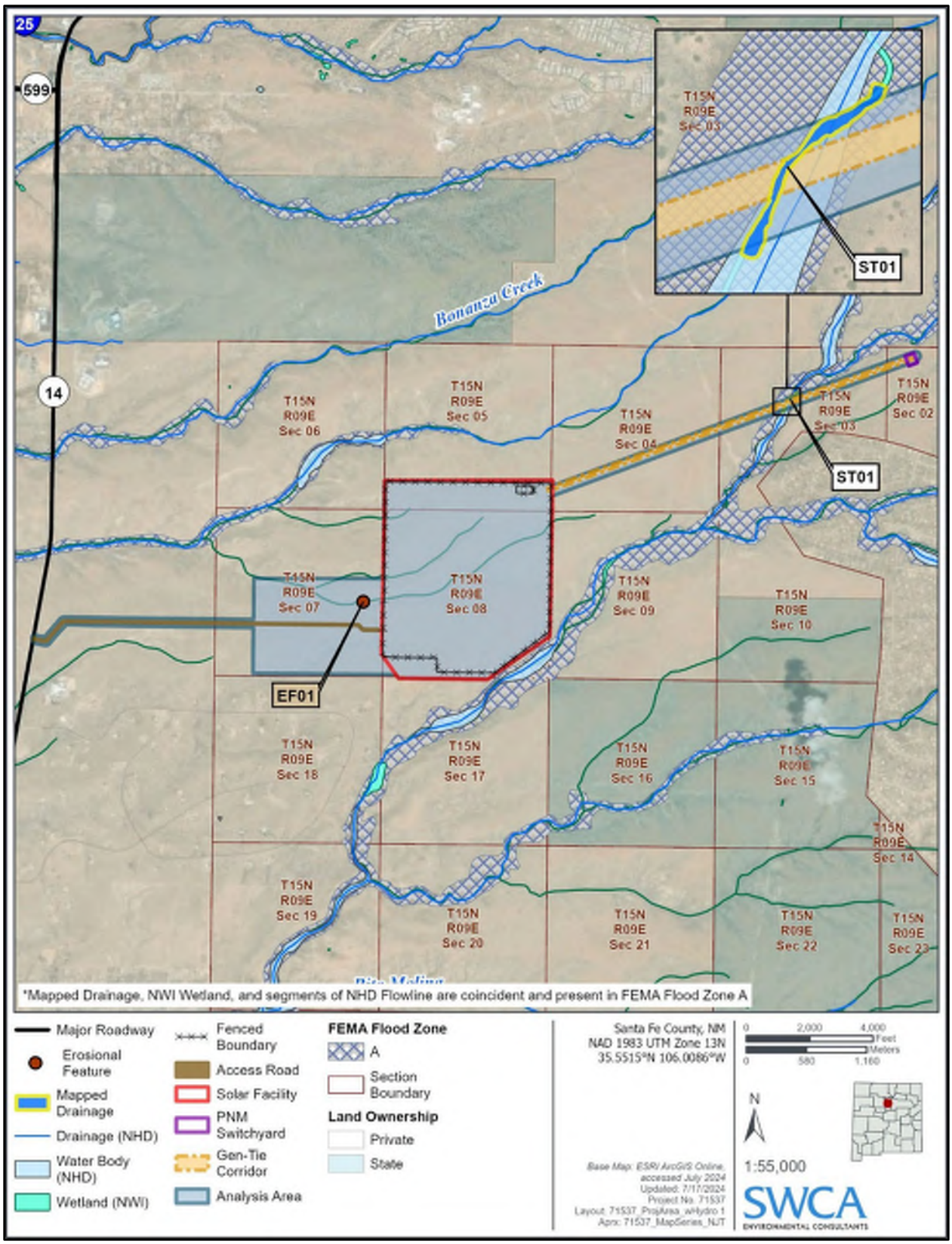


Figure 3.13. Aquatic resources in the analysis area vicinity.

3.14.2 Environmental Effects

3.14.2.1 PROPOSED ACTION

One ephemeral drainage (Gallina Arroyo) containing an OHWM was observed during the April 2022 aquatic delineation survey within the gen-tie corridor. Rancho Viejo will span this drainage and no structures will be placed within it; therefore, impacts to this drainage are estimated to be less than 0.1 acre for gen-tie access. If permanent impacts to any WOTUS are determined to be less than 0.5 acre per individual crossing, the Project will likely qualify for coverage under Nationwide Permit (NWP) 57 (Electric Utility Line and Telecommunications Activities) and NWP 14 (Linear Transportation Projects) per Section 404 of the Clean Water Act. Both NWP 57 and NWP 14 have a 0.5-acre permanent impact threshold per individual crossing. If permanent impacts to any surface water feature are greater than the 0.1-acre threshold, the applicant will need to notify the U.S. Army Corps of Engineers (USACE) through submittal of a preconstruction notification. Additional notification triggers, including but not limited to effects to biological or cultural resources, would also apply. If impacts to WOTUS are greater than 0.5 acre at each individual crossing, the Project will require an individual permit with a USACE-compliant alternatives analysis and associated prescribed mitigation.

The potential to impact water resources primarily lies with the indirect impacts that could occur due to stormwater runoff from construction activities into downstream aquatic resources. EPMs, including a SWPPP and a SPCC plan will be implemented to minimize these effects. A SWPPP will be developed and implemented for construction, which will meet the construction stormwater discharge permit requirements of the NMED Surface Water Quality Bureau. The SWPPP will include several measures to control runoff and to reduce erosion and sedimentation at construction sites. Similarly, a SPCC plan will be developed to minimize the potential for adverse impacts to surface waters or groundwater resulting from accidental spills or releases of hazardous materials. Stormwater best management practices included in the SWPPP will be used during construction to reduce potential impacts from erosion, sedimentation, and turbidity in surface waters during construction.

In addition, Rancho Viejo's 2022 hydrologic study indicated the slope in the central area of the solar facility is unsuitable for construction due to potential waterflow during stormwater events (Bohannan Huston 2022) (see Figure 2.1). Therefore, Rancho Viejo revised the design of the Project to detain stormwater with the intention of matching or decreasing the existing rate and volume of stormwater runoff from the Project site. Need to verify they do this on the construction drawings.

Water for construction uses, such as equipment washing, dust suppression, and structure foundations, will be acquired from the following off-site sources, or a combination thereof: Santa Fe County bulk water station commercial pipe water; Ranchland Utility Company Class A reclaimed water; Santa Fe County reclaimed water; or any other legally permitted commercial water sales. Construction water use will be approximately 100 to 150 acre-feet over a 12-month construction period. Long-term water use will be approximately 2 to 3 acre-feet per year and will be associated with operations and maintenance related activities, which may include periodic panel washing.This figure match previous sections? This is where to 48 million came from!

Postconstruction, temporary disturbed areas not needed for operations and maintenance will be reclaimed as described in Section 2.1.4. Reclamation of disturbed areas will minimize the potential for long-term erosion and stormwater runoff.

No water quality impacts will occur from the routine operations and maintenance activities described in Section 2.1.3. Impacts during decommissioning will be similar to those described during construction related to stormwater runoff and accidental spills or releases of hazardous materials.

3.14.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to water resources within the analysis area or surrounding areas because the Proposed Action will not be implemented. However, because the analysis area is privately owned and located primarily within the (RUR-F) zoning district (see Section 2.2), several other types of development projects could occur under the No Action Alternative and may result in its own set of impacts to water resources.

3.14.3 Environmental Protection Measures

EPMs related to water resources that will be implemented to avoid and minimize impacts as part of the Rancho Viejo Solar Project are described above and include the following:

- Impacts to any potentially jurisdictional WOTUS will be covered under NWP 14 or NWP 57 as long as impacts are below the 0.5-acre threshold. The use of an NWP will trigger USACE coordination and National Historic Preservation Act Section 106 consultation and coordination with NMED.
- A SWPPP will be developed and implemented as required by the NMED Surface Water Quality Bureau and obtain coverage under a National Pollution Discharge Elimination System Construction General Permit from the EPA pursuant to Section 402 of the Clean Water Act, 33 United States Code 1342. The SWPPP may include measures such as silt barrier fences to control runoff, sediment traps and basins, and minimizing exposed soils by using temporary and permanent seeding and mulching.
- Disturbed areas will be restored to their original condition to the extent practicable in order to meet SWPPP requirements for runoff and erosion control. Seed mixture and seeding rates will be developed through consultation with the local agency, experts, or landowner preference.
- Equipment will be properly maintained for fluid leaks.
- Spills will be cleaned up immediately.
- Matting and other temporary protective measures will be used on jurisdictional wetlands that cannot be avoided.
- An appropriate buffer zone of up to 50 feet around wetlands will be established as necessary to reduce disturbance (see Figure 2.1).
- Rancho Viejo will span and avoid placing structures in ephemeral floodplains and other surface water features, where feasible (see Figure 2.1).
- Collection/lines, cables, and access roads will be designed to minimally intersect the floodplain and will not change the base flood elevation or otherwise affect the floodplain. The placement of poles and structures for overhead collection will minimally intersect the floodplain without affecting the base flood elevation. If practicable, at the end of construction, underground collection cable trenches will be reclaimed to pre-existing contours without affecting the floodplain.
- Rancho Viejo will comply with Sections 401 and 404 of the Clean Water Act and obtain all necessary permits. All impacts to WOTUS will be evaluated against the requirements of the USACE for NWP, as applicable.

- Rancho Viejo will implement appropriate erosion control measures in areas with slopes, as provided in the SWPPP. To the extent practicable, temporary access roads will be designed following existing landform contours, where practicable, and revegetated with native or similar grasses, shrubs, or forbs, or as agreed to with the landowner.
- Hazardous materials will not be drained onto the ground or into streams or drainage areas.
- Construction waste including trash, other solid waste, petroleum products, and other potentially hazardous materials will be removed to a disposal facility authorized to accept such materials.
- Contractors will implement a hazard communication program for any on-site hazardous materials to include training, labeling, and posting of SDSs. Fuels and petroleum-based products will be stored in approved containers and away from excavated areas. Waste motor oil, hydraulic fluid, and liquid gear lube will be stored in approved containers in isolated areas and removed to an authorized disposal facility monthly and in accordance with regulations of NMED. All equipment using hydraulic hoses and cylinders will be inspected for leaks. Any equipment found to have petroleum leaks that cannot be repaired immediately will be removed from service and replaced.
- Contractors will have proper training, there will be spill kits on-site, and any leaking equipment will be repaired immediately. In the event contaminants are released, in addition to the requirements outlined in the environmental report, Rancho Viejo will adhere to the notification policies contained in 20.6.2.1203 NMAC.
- Compacted soils will be restored as closely as possible to preconstruction conditions as required for ground stabilization and erosion control.
- If required as part of the SWPPP, a native seed mixture will be applied to all temporary disturbance areas, followed by applications of mulch as required to provide additional erosion.
- Erosion will be reduced by applying and maintaining standard erosion and sediment control methods. These may include using certified weed-free straw wattles and bale barriers and silt fencing. Specific erosion and sediment control measures will be specified in a SWPPP.
- BESS battery enclosures have an ingress protection (IP) rating of IP55, which will prevent fluids from leaking at low pressure. FK-5-1-2 fire suppression injection system will be applied inside the BESS enclosure and any breach would only occur at temperatures above the boiling point of the injection system thereby limiting the discharge of fluids to the ground.

3.14.4 Cumulative Impacts

Additional reasonably foreseeable developments in the CIAA will incorporate similar management plans to prevent potential impacts to surface waters and groundwater resources. Therefore, there is minimal potential for the Proposed Action, in conjunction with other reasonably foreseeable developments in the CIAA, to cumulatively affect water resources.

3.14.5 Conclusion

Direct impacts to surface water features or special aquatic sites consist of less than 0.1-acre impact to one ephemeral drainage (Gallina Arroyo) from the construction of the Rancho Viejo Solar Project. Indirect impacts could occur from stormwater runoff during construction. Implementation of EPMs will minimize the direct and indirect impacts surface waters or groundwater during construction. Construction water use will be minimal, and there will be minimal long-term water use associated with operations and maintenance. Construction activities related to the Project will be conducted in compliance with a SWPPP that will be implemented to ensure that sediment is retained on-site and does not contribute to the surface

flows of drainages and washes within the Project vicinity. With implementation of EPMs, including adhering to a SWPPP and EPA standards, these impacts will be less than significant, and no irretrievable commitments of resources are anticipated.

3.15 Visual Resources

Data sources reviewed include:

- 10-meter resolution bare-earth digital elevation models
- Design parameters for proposed infrastructure
- Field survey site photographs
- Aerial imagery, site field reconnaissance, and elevation data (Google Earth 2022)

3.15.1 Environmental Setting

SWCA completed a viewshed analyses (seen/unseen) to identify and assess potential visibility of the Rancho Viejo Solar Project in Santa Fe, New Mexico, within the visual resource evaluation area (Figure 3.14). The evaluation area was defined based on the design characteristics and locations of the Project components (i.e., on-site substation, and gen-tie), the topography of the landscape, and the potential views from residential areas and highways, from the surrounding area. The visual resource evaluation area is used to disclose potential impacts to NHTs, the Santa Fe Regional Airport, and residential communities around the 1,143-acre analysis area.

All of the viewshed analyses were conducted using a 10-m-resolution bare-earth digital elevation model with a typical viewer height of 6 feet. The bare-earth modeling approach does not account for screening resulting from existing vegetation or structures, resulting in a conservative assessment of potential Project visibility. To identify the areas from which the Project could be visible, the viewshed analyses were conducted from the Project looking outward (see Figure 3.14). By looking outward from the Project, discrete seen and unseen areas were identified for the solar facility and the interconnection gen-tie. Additionally, aerial imagery, site field reconnaissance, and elevation data were used to develop this analysis (Google Earth 2022).

The distance threshold for visual impacts review is 5 miles in all directions from the center of the 1,143-acre analysis area to correspond with the distance in which the Project may be discernable to observers and to capture other sensitive viewing platforms within the area.

The existing visual landscape is characterized by its rural nature dominated by open-range, varied topography, and scattered residential communities. Vegetation within the region is consistent with expansive high-desert grasslands, and varied mountain ranges surrounding the analysis area. The analysis area is undeveloped and is surrounded by residential communities of Santa Fe, which include the San Marcos and Eldorado subdivisions. The existing landscape includes the following development: electric transmission lines, highways, residences, and correctional facilities. The predominant human-made visual features include transmission line, and residential communities.

The analysis area is located on gentle, softly undulating valley bottom approximately 9.8 miles southwest of city center of Santa Fe, New Mexico. The ground consists of tan to khaki-colored sandy soils that are easily eroded. The surrounding vegetation continuous with patchy, low indistinct grasses, and sporadic occurrences of varied cactus and cholla. Between the grass and cactus vegetation the landscape appears jagged and amorphous. Colors of vegetation range from dull tans to dark greens. The Santa Fe Mountains

are located approximately 8.9 miles to the northeast of the analysis area and provide an abrupt uplift in terrain with dark uniform vegetation colors contrasting with light khaki rock outcroppings.

In addition, there are three NHTs in northern New Mexico. These NHT byways include the El Camino Real, Turquoise Trail, and Route 66 pre-1937 alignment (Figure 3.15). The Route 66 pre-1937 alignment is approximately 5.7 miles northwest of the analysis area. The El Camino Real is located within the Interstate 25 corridor approximately 3.6 miles northwest of the analysis area. The Turquoise Trail occurs on State Highway 14, which is adjacent to the access road for the proposed facility and is the closest NHT to the Project. The Santa Fe Regional Airport is approximately 5.3 miles northwest of the analysis area (see Figure 3.15).

Casual observers or sensitive viewers (viewers) could include residents or other drivers passing by the analysis area using local roads, and users of adjacent land such as industry workers. There is a collection of transmission line corridors that are regularly maintained within the area as well as new renewable generation facilities proximal to the Project. The closest residential community is the San Marcos subdivision, which is adjacent to the proposed facility and encompasses approximately 80 single-family homes and the Turquoise Trail Charter School. The Eldorado subdivision is located approximately 1.3 miles east of the main solar facility; however, the gen-tie and substation are approximately 0.3 mile south of the subdivision.

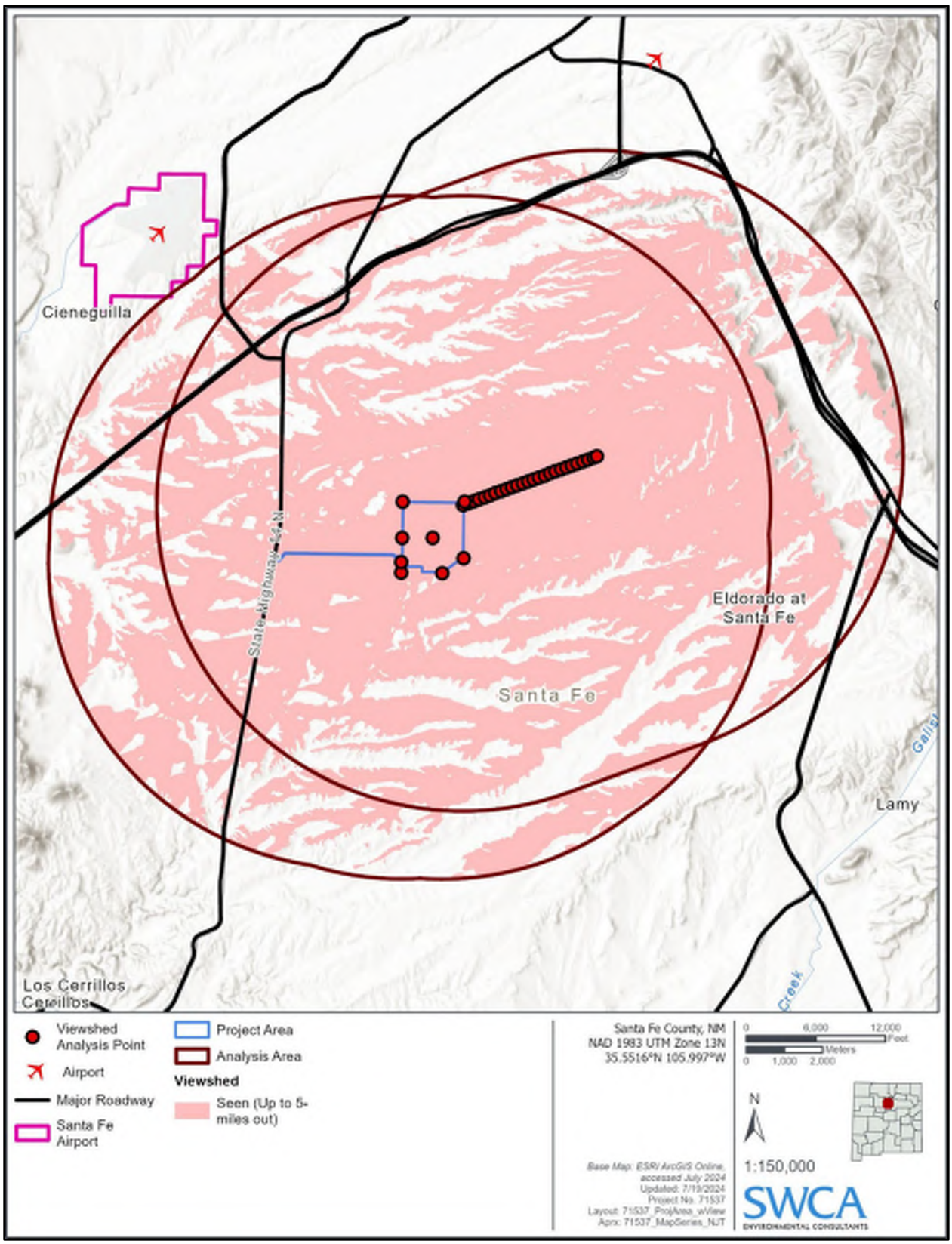


Figure 3.14. Viewshed analysis within the region.

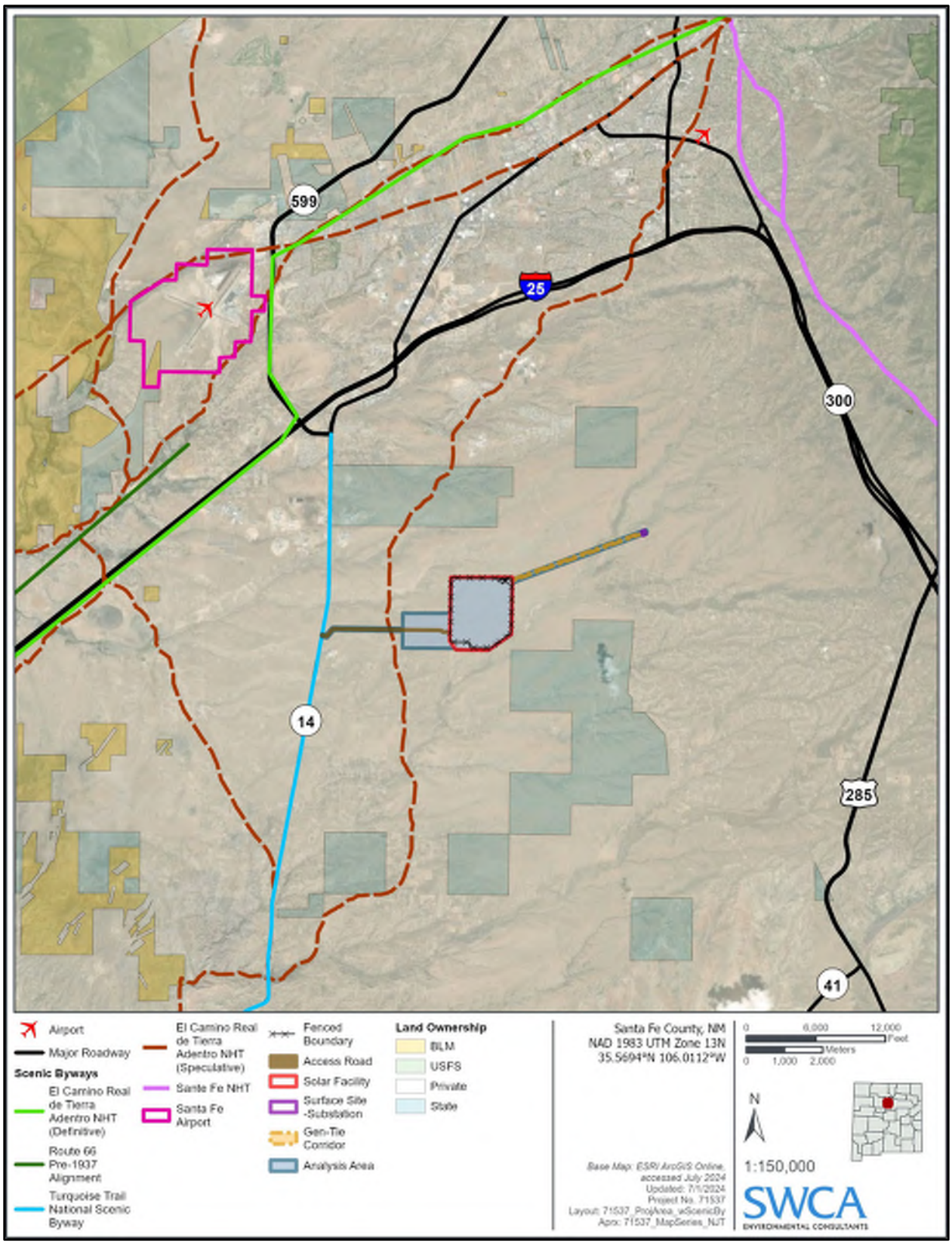


Figure 3.15. Scenic byways near the analysis area.

3.15.2 Environmental Effects

3.15.2.1 PROPOSED ACTION

Certain areas within the 1,143-acre analysis area will be cleared and graded during construction, where necessary. Vegetation will be removed, creating color contrast with the light, sandy exposed soil. Construction vehicles, equipment, fencing, and an increased human presence will be visible to any casual observer during the 12-month construction time frame. During construction, protection measures for visual resources will be implemented to minimize visual effects, including minimizing areas of surface disturbance as practical, controlling erosion, using dust suppression techniques, and minimizing the use of night lighting.

Once constructed, the Rancho Viejo Solar Project will consist of a fence yard approximately 680 acres in size, with steel structures, transmission poles, and solar PV panels. The maximum height of the gen-tie structures will be approximately 50 feet if the H-Frame option (Option 1) is selected and approximately 70 feet if the monopole option (Option 2) is selected. Both gen-tie options will have a weathered galvanized finish. The maximum height of the PV arrays will be 8 feet above ground level depending on spot topography based on current design. The new structural elements will introduce contrast in color, line, form, and texture. From 1 to 2 miles away, the new structures will be visible and may attract attention from superior viewing areas. From 3 to 5 miles away, the new structures will be visible in the greater distance from superior viewpoints but not anticipated to be visible from neutral viewpoints due to intervening topography and vegetation. Key observation points (KOPs) located in the San Marcos subdivision are expected to have views of the solar array and distant views of the gen-tie options; however, Project components will create weak to strong contrast in the existing landscape and overall low to moderate impacts (SWCA 2024b). Viewers at KOPs in the Eldorado at Santa Fe subdivision are not expected to have discernable views of the solar arrays due to the area's intervening topography, vegetation, and distance from the array, but will have prominent views of the gen-tie due to proximity. The gen-tie options are expected to have strong to moderate contrast with the existing landscape and overall high to moderate impacts (SWCA 2024b). The Turquoise Trail Scenic Byway is located approximately 2 miles west of the solar arrays. There is potential for viewers from this location to notice new structures in the distance, but the Project will not attract the attention of the viewer as they move along the scenic byway. Views of the Project from NHTs are not expected (see Figure 3.15). The primary visual features in the foreground and mid-ground of the viewshed include existing transmission lines, the San Marcos subdivision, the Eldorado subdivision, and roadways. The visual impact of the proposed Project will be minimal and will not degrade the existing landscape from what is already present.

Once the facility has reached the end of its lifespan, Rancho Viejo will decommission the facility. Materials will be recycled; permanent structures and concrete foundations will be removed. Rancho Viejo will reseed the area, and once revegetation is successful, no long-term visual impacts will remain.

3.15.2.2 NO ACTION

Under the No Action Alternative, there will be no impacts to visual resources within the analysis area. The Proposed Action will not be constructed, and the existing landscape will not be modified. However, because the analysis area is privately owned and located primarily within the (RUR-F) zoning district (see Section 2.2), several other types of development projects could occur under the No Action Alternative and may result in its own set of impacts to visual resources.

3.15.3 Environmental Protection Measures

EPMs related to visual resources that will be implemented to avoid and minimize impacts as part of the proposed Project include the following:

- Visual impacts will be reduced during construction by minimizing areas of surface disturbance as practical, controlling erosion, using dust suppression techniques as practical, and, if applicable, restoring exposed soils as closely as possible to their original contour and vegetation.
- Construction activities will primarily be limited to daytime hours. If night work is required during construction, lighting will be the minimum necessary for safety, and lighting will not be left on when not in use.
- Compacted soils will be restored as closely as possible to preconstruction conditions as required for ground stabilization and erosion control.
- If required as part of the SWPPP, a native seed mixture will be applied to all temporary disturbance areas, followed by applications of mulch as required to provide additional erosion control.
- Unless safety or functional requirements preclude it, all structures should be color treated to reduce contrasts with existing landscape.

3.15.4 Cumulative Impacts

Small-scale solar facilities transmission lines are present within the CIAA. No foreseeable actions within the CIAA have been identified that will significantly affect visual resources. There is potential for other generation companies to develop renewable energy facilities and transmission line corridors within the vicinity of the analysis area. These potential facilities will incrementally change the landscape character into a more industrialized area compared with its current open rangeland. Cumulative impacts from the proposed Project are not expected to significantly degrade the existing landscape character but are expected to incrementally change visual resources within the CIAA.

3.15.5 Conclusion

The Rancho Viejo Solar Project will add a new structural element to the landscape. The Proposed Action is expected to have both long- and short-term visual impacts. Short-term visual impacts range from low to moderate due to construction crews, potential fugitive dust plumes, and installation of Project components. Long-term visual impacts include operation and maintenance of Project components. Overall, these new elements will remain subordinate to the existing landscape character.

The level of change to the visual character of the area and impacts to KOPs are anticipated to range from low to high within the analysis area. Low to moderate impacts are associated with KOPs in the middleground of the Project (1.0–3.0 miles from the Project) for both the solar facility and transmission line options. Moderate to high impacts would be associated with KOPs in the immediate foreground and foreground of the proposed transmission line options (0.0–1.00 mile from the Project) due to proximity (SWCA 2024b). No irretrievable commitments of resources are anticipated following Project decommissioning.

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5 LIST OF ORGANIZATIONS AND PERSONS CONSULTED

- New Mexico Environment Department
- New Mexico Department of Energy, Minerals, and Natural Resources
- New Mexico Public Regulation Commission
- New Mexico Department of Transportation, District 5
- Santa Fe County
- Santa Fe County Fire Department
- New Mexico Historic Preservation Division
- Eldorado Community Improvement Association
- Turquoise Trail Community Association
- San Marcos Association
- El Vadito de Los Cerrillos Water Association
- Cerrillos Hills Park Coalition
- Concerned Citizens of Cerrillos
- Turquoise Trail Regional Alliance
- Stop Hunt Power Line, Inc
- Santa Fe Gateway Alliance
- Santa Fe Association of REALTORS
- Santa Fe Housing Action Coalition

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APPENDIX A

Santa Fe County Technical Advisory Committee Meeting
Summary Letter

SANTA FE COUNTY
TECHNICAL ADVISORY COMMITTEE

March 29, 2022

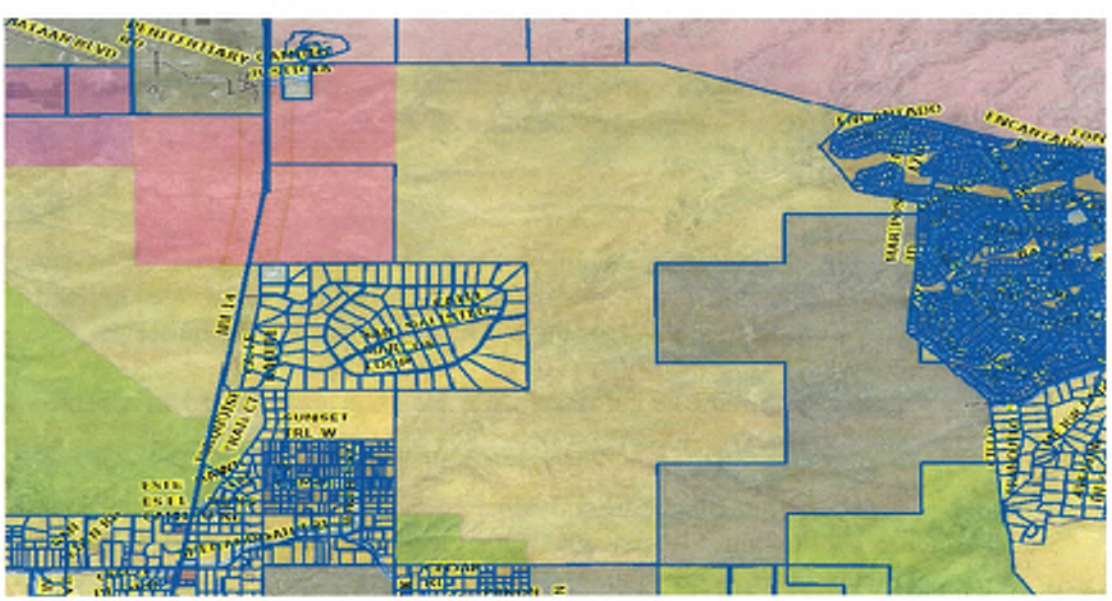
BY ELECTRONIC MAIL

Re: Rancho Viejo Solar LLC/Community Energy Solar, LLC Conditional Use Permit (CUP)

Thank you for presenting the above mentioned project at the pre-application Technical Advisory Committee (TAC) meeting on November 4, 2021. Below is a summary of relevant issues and follow-up actions in regard to your presentation.

Summary:

Rancho Viejo Solar LLC, Applicant, Jonathon W. Moore (Sr. Project Developer, Community Energy), Agent, request approval of a Conditional Use Permit (CUP) to allow a 96 Mega Watt solar facility on 800 ± acres (a portion of a 8,358.48 acre Tract). The project will be constructed as a single-axis tracker photovoltaic (PV) system. The panels will be supported by a horizontal racking system, attached to steel piers driven into the ground. There will be minimal disturbance to the existing grade and vegetation. The panels will rotate east to west tracking the sun and will sit approximately 9-12 feet above ground at their maximum tilt, closer to 4 feet midday. A six (6) foot high perimeter fence is being proposed. The site is zoned as Rural Fringe (RUR-F). Appendix B, Use Matrix illustrates that a commercial solar energy production facility is a Conditional Use within RUR-F zoning. The site will take access via Hwy. 14, SDA-2 (Commission District 5). Parcel ID # 910008950



Applicant Statements:

- The Applicant described the property/site details which included the location of the site, acreage, and scope of the proposed project;
- The Applicant summarized the design of the facility which included the size of the facility, proposed height of the arrays (9'), and setback from Hwy. 14 (one mile);
- The Applicant stated that approximately 200-300 workers would be on site during construction. Traffic after construction would be very minimal for maintenance only;
- The Applicant stated that a battery storage facility would be proposed;
- Construction of the facility would take approximately 9-12 months;
- The Applicant presented a concise report, aerials, and drawings to the TAC Committee.

Relevant Issues to be Addressed:

- Submittal shall comply with Ordinance No. 2016-9, the Sustainable Land Development Code (SLDC) inclusive of criteria set forth in Chapter 7 (Sustainable Design Standards) and Section 4.9.6 (Conditional Use Permits);
- Access via Highway 14 will require an NMDOT commercial access permit and a NMDOT Site Threshold Assessment;
- The Gentie line and connection to the main power line are also a Conditional Use Permit;
- SRA's required for this development are an Environmental Impact Report (EIR) and an Adequate Public Facilities & Services Assessment (APFA);
- An Archaeological Survey shall be required.

Fire Marshal Comments:

- Gate(s) must have an emergency unlocking/opening system (Knocks Box);
- Inside Radii of turning areas shall be 28'.

Notice Requirements:

- A pre Application Neighborhood Meeting is required. General requirements for Pre-Application Neighborhood meeting are outlined in Chapter 4, Section 4.4.4, of the SLDC including required notice;

- Notice Requirements for the Public Hearing are outlined in Chapter 4, Section 4.6 of the SLDC;

- Notice for the Neighborhood Meeting and Public Hearings shall include the following Registered Organizations (RO) and Community Organizations (CO).

Organization Name	Member Name	Member telephone number	Address	City	State	Zip Code	Email
Eldorado Community Improvement Association	Brenda Leonard	505-466-4248	1 La Hacienda Loop	Santa Fe	NM	87508	gm@eldoradosf.org

CORO 2022							
Organization Name	Member Name	Member telephone number	Address	City	State	Zip Code	Email
Turquoise Trail Community Association	Michael Smith	505-954-9479	1421 Luisa St. Suite R	Santa Fe	NM	87505	msmith@hoamco.com

CORO 2022							
Organization Name	Member Name	Member telephone number	Address	City	State	Zip Code	Email
San Marcos Association	Donna Reynolds	505-982-8385	42 San Marcos Rd. W.	Santa Fe	NM	87508	donna@sfar.com

CORO 2022							
Organization Name	Member Name	Member telephone number	Address	City	State	Zip Code	Email
El Vadito de Los Cerrillos Water Assocation	Todd Brown	505-438-3008	PO Box 6	Cerrillos	NM	87010	brownp52@yahoo.com

CORO 2022							
Organization Name	Member Name	Member telephone number	Address	City	State	Zip Code	Email
Cerrillos Hills Park Coalition	Ross Lockridge	505-471-9182	PO Box 22	Cerrillos	NM	87010	murlock@raintreecounty.com

CO and RO contacts 2016							
Organization Name	Member Name	Member telephone number	Address	City	State	Zip Code	Email
Concerned Citizens of Cerrillos	Ross Lockridge	505-471-9182	PO Box 22	Cerrillos	NM	87010	murlock@raintreecounty.com

CO and RO contacts 2016							
Organization Name	Member Name	Member telephone number	Address	City	State	Zip Code	Email
Turquoise Trail Regional Alliance	Karen Yank	505-281-0243	PO Box 23775	Santa Fe	NM	87502	hamonyank@cybermesa.com

CORO 2022							
Organization Name	Member Name	Member telephone number	Address	City	State	Zip Code	Email
Stop Hunt Power Line, Inc	Karen Koch	310-990-5308	369 Montezuma Ave. #132	Santa Fe	NM	87501	karenakoch@mac.com

CO and RO contacts 2016							
Organization Name	Member Name	Member telephone number	Address	City	State	Zip Code	Email
Santa Fe Gateway Alliance	Katherine Bilton	505-471-3227	131 E. Chili Line Rd.	Santa Fe	NM	87508	kmbilton@gmail.com

CORO 2022							
Organization Name	Member Name	Member telephone number	Address	City	State	Zip Code	Email
Santa Fe Association of REALTORS	Donna Reynolds	505-982-8385	510 N Guadalupe Ste E	Santa Fe	NM	87501	donna@sfar.com

CORO 2022

Organization Name	Member Name	Member telephone number	Address	City	State	Zip Code	Email
Santa Fe Housing Action Coalition	Michael Barrio	310-869-5311	501 Halona St.	Santa Fe	NM	87505	mbarrio@santafehousingaction.org

If you have any questions, please do not hesitate to contact this office at 986-6296.

Sincerely,

Jose E. Larrañaga

Jose E. Larrañaga
Development Review Team Leader

Pre-Application Neighborhood Meeting Report

After conducting the pre-application neighborhood meeting with neighborhood contacts you were given, submit the following list of items to the Santa Fe County Case Manager, with checklist attached.

Please check off the following Pre-Application Neighborhood Meeting Report Items:

- ☐ Date and location of the neighborhood meeting or meetings _____
- ☐ A list of persons and organizations invited to the meeting (attach page)
- ☐ A copy of the notice of pre-application meeting issued together with return receipts from letters mailed (attach page)
- ☐ A list of persons and organizations who attended the pre-application meeting (attach page)
- ☐ A copy of all materials distributed at the neighborhood meeting (attach pages)
- ☐ A summary of all concerns, issues and problems identified at the meeting, including how the applicant has addressed or intends to address the concerns and whether the applicant is unable to address them. Specific attention should be paid to any conditions or mitigating measures agreed to at the meeting.

Notification of Public Pre-Application Neighborhood Meeting

Name of the applicant and the name of the person(s) who the applicant is agent for or otherwise representing in the application

Dear Santa Fe County Neighborhood,

This letter is to invite you to a pre-application neighborhood meeting to be held:

Place
Date
Time

The meeting will discuss:

Include a minimum of the following information:

- *The general location of the parcel that is the subject of the application*
- *The road address of the property subject to the application or, if the road address is unavailable, a legal description by metes and bounds*
- *The current zoning classification(s) and zoning district in which the property is located, and the present use of the property*
- *The nature and type of approval requested and a brief description of the proposed development, including proposed density or building intensity, zoning classification and uses requested*
- *The times, date and location where a decision on the application is expected*
- *A phone number to contact the County, and*
- *A statement that interested parties may appear at a public hearing*

APPENDIX B

Pre-Incident Plan

INCOMPLETE UNTIL SITE OPERATION
AES RANCHO VIEJO 96MWAC SOLAR & 48MWAC BESS PRE-INCIDENT PLAN
(4152 NM 14, Santa Fe, NM 87508)
35.5415, -106.0106

FACILITY: Rancho Viejo BESS	BUILT: In Progress #Units 38 CENs	DATE: July 2024
24 Hr Emergency Contact: SLC ROCC - 855-679-3553	Contents: Lithium-Ion Battery ES Array	

Santa Fe County FD

Review Date: _____

By: _____

WATER N/A

GAS N/A

ELECTRIC PNM (505) 438-6781

UTILITY SHUTOFFS

FIRE PROTECTION, FIRE ALARM & SAFETY SYSTEMS

- Battery Management System
- Novec Suppression
- Monitored 24/7 SLC ROCC
- Fire Detection
- Gas Detection (H2 & CO)
- Fire Alarm Panel
- E / F Stops
- Manual Pull Station
- Exterior Horn/Strobe
- Explosion Venting

CONSTRUCTION INFORMATION

Type	Height	Length	Width
Metal	9.5ft	40ft	8ft

Enclosure Design:
"AES Spec" CEN Unit
Samsung SDI-E5S Modules

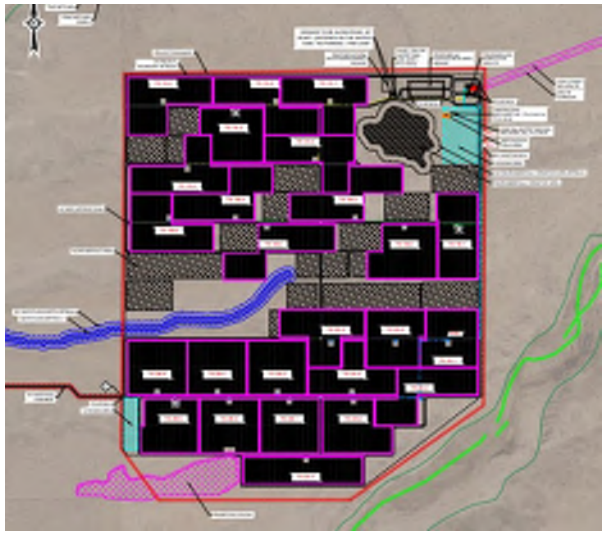
Occupant Load: Unmanned

Onsite Water Supply

1. 29K Gallon Tank

Fire Flow: N/A

Exposures
•North –
•South –
•East –
•West –



SPECIAL CONDITIONS AND HAZARDS

- STOP: (Maintain 150 ft) Emergency Responders DO NOT MAKE ENTRY into the AREA or ENCLOSURE without Prior BESS & PIP Training & BESS ESCORT

LITHIUM-Ion BATTERIES & HIGH VOLTAGE

- EMERGENCY Battery Cutoff (FOR AES USE ONLY) is located at the BESS Enclosure.
- CAUTION: Overhead High Voltage Lines.
- CAUTION: Sample BESS Area LEL Before Entry; Battery Off Gases can provide an explosive atmosphere.
- CAUTION: After power shutoff (Stranded Energy still Exists)
- CAUTION: Bulging & Heating of the Batteries, White Smoke & Hissing are signs of impending Failure.
- CAUTION: DO NOT come in contact with batteries/frames.
- Utilize SCBAs, Thermal Imaging/Gas Detection for initial entry & throughout the entire operation.
- Rescue Ops, utilize WATER Fog Pattern @ a 10 degree angle @ a 5-ft min distance, DO NOT use Class D Fire Extinguisher.
- Ensure PPE is Thermal, High Voltage & HazMat Rated.
- Enclosure is ONE Fire Area; Lithium-Ion Battery Arrays in Open Racks throughout Each Enclosure.
- "Stranded Energy" Do not perform SALVAGE Operations.

RESPONSE AND STAGING INFORMATION

- FIRST ALARM: Stage at Main Entry and await AES / REP!
- NOTE: Water Tinder Needed for additional water. Exposure Protection, and Defensive Posture Only.
  - UNLESS Rescue is needed!
- NOTE: If horn / strobe of a Container is alarming,wait 6 hrs before approaching with AES Personnel escort, then evaluate. If heat or gas are elevated, wait another 4 hrs.

24/7 Emergency Notification	Phone
SLC ROCC	855-679-3553

APPENDIX C

Noise Technical Report

Noise Technical Report Rancho Viejo Solar Project

Santa Fe County, New Mexico

JULY 2024 (REVISED NOVEMBER 2024)

PREPARED FOR

Rancho Viejo Solar, LLC

PREPARED BY

SWCA Environmental Consultants

NOISE TECHNICAL REPORT
RANCHO VIEJO SOLAR PROJECT
SANTA FE COUNTY, NEW MEXICO

Prepared for

Rancho Viejo Solar, LLC
282 Century Place, Suite 2000
Louisville, Colorado 80027

Prepared by

SWCA Environmental Consultants
20 East Thomas Road, Suite 1700
Phoenix, Arizona 85012
www.swca.com

July 2024 (Revised November 2024)

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1 INTRODUCTION

SWCA Environmental Consultants (SWCA) prepared this noise technical report in support of the proposed Rancho Viejo Solar Project (project). The project would be developed by Rancho Viejo Solar, LLC. The project would be in unincorporated Santa Fe County, New Mexico (county), in the northern part of the state.

This report presents the analysis and noise impact estimates for the construction and operation of the project at the property boundaries and at noise sensitive areas (NSAs) to demonstrate that the proposed activities associated with this project will not result in a substantial permanent increase in ambient noise levels in the vicinity of the project.

1.1 Project and Study Description

Rancho Viejo Solar, LLC proposes to design, construct, operate, and maintain a solar energy generation and storage site in Santa Fe County, New Mexico. The project includes the development of a 96-megawatt solar facility, a 48-megawatt battery energy storage system (BESS), a substation, an operations building, a water storage tank, a generation tie-in line, and an access road on private land approximately 3 miles south of Santa Fe city limits and approximately 4.2 miles east of La Cienega (Figure 1). A general layout of the facility based on its current design is provided in Figure 2.

Potential noise impacts from the construction and operation of the project were evaluated by determining the projected noise increases over ambient conditions and potential exposure of sensitive receptors to excessive noise from the proposed noise-generating sources.

Construction of the project will consist of earthwork (e.g., site grading) and the construction of a solar facility. Predicted construction-generated noise levels at nearby NSAs were calculated using the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM). The RCNM is FHWA's national model for the prediction of construction noise

Among project operational components, the sources with potential to impact ambient noise levels are inverters, transformers, BESS equipment and solar trackers.

The noise impact evaluation for the operation of the project, provided herein, consists of computer noise modeling using SoundPLAN Essential Version 5.1 and assessment of the outputs as they pertain to the sound (noise) standards and nearest property boundaries and NSAs (i.e., residences).

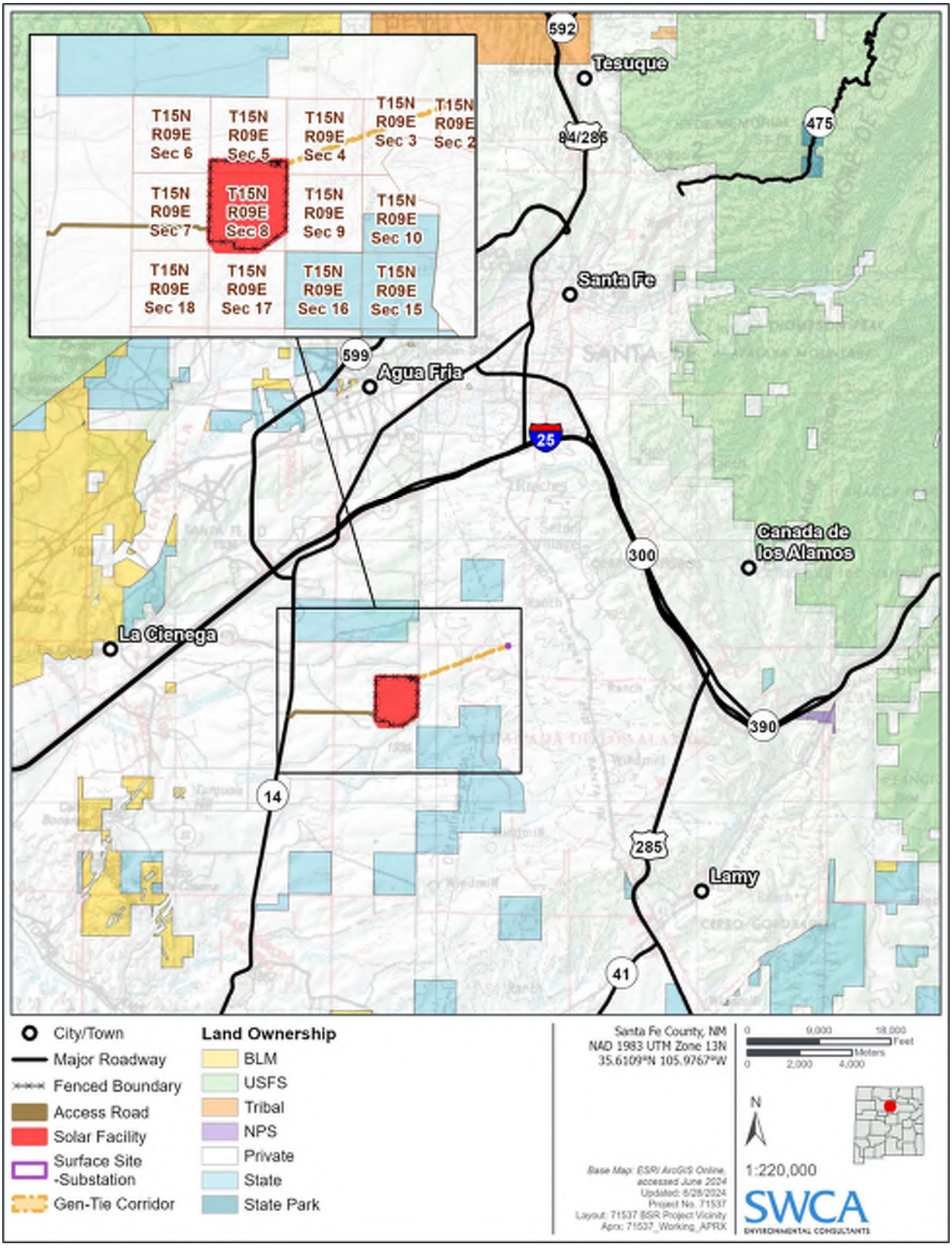


Figure 1. Project vicinity map.

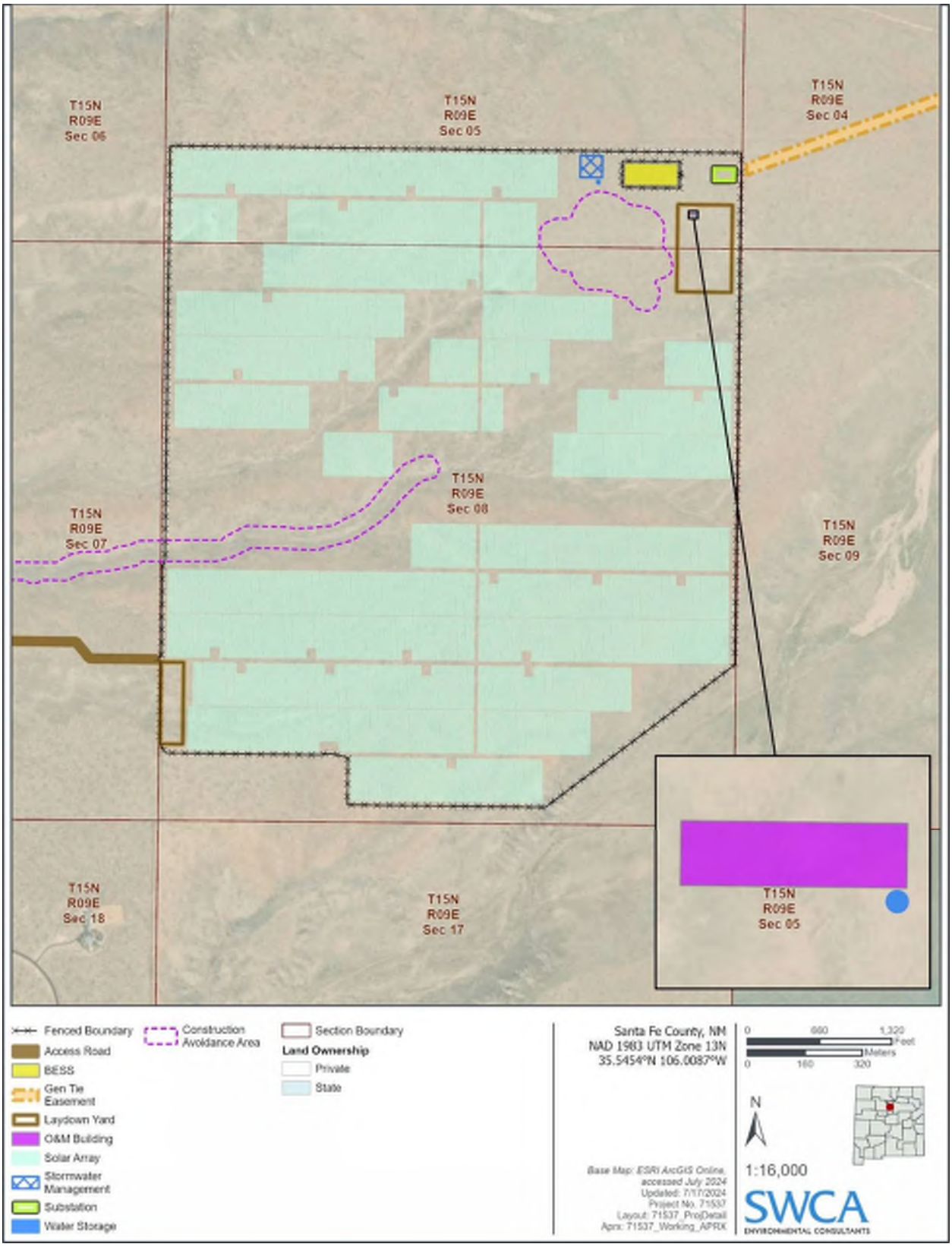


Figure 2. Project layout.

1.2 Sound Fundamentals – Background

Sound is defined as a form of energy that is transmitted by pressure variations, which the animal or human ear can detect. Noise can be defined as any unpleasant or unwanted sound that is unintentionally added to a desired sound or environment. The noise effects in humans include interference with communication, learning, rest, or sleep and physiological health effects. There are two main properties of sound: the amplitude and the frequency. Amplitude refers to the level of energy that reaches the ear (how loud we perceive the sound), while frequency is the number of cycles or oscillations per unit of time completed by the source. Frequency is normally expressed in hertz (Hz).

Sound power is defined as the measurement of the ability of a source to make sound. It is independent of the acoustic environment in which is located. The sound power level (L_w) of a source is the amount of energy it produces relative to a reference value and is normally expressed in decibels. The decibel is a logarithmic scale to describe the sound pressure ratio.

Humans perceive a frequency range of about 20 Hz to about 20,000 Hz. An internationally standardized frequency weighting, the A-weighting scale, was designed to approximate the audible range of frequencies of a healthy human ear. The A-weighting scale corresponds to the fact that the human ear is not as sensitive to sound at the lower frequencies as it is at the higher frequencies.

1.2.1 Definition of Acoustical Terms

Several different descriptors of time-averaged sound levels are used to account for fluctuations of sound intensity over time. The sound descriptors calculated by the sound meters and used in this report to describe environmental sound are defined below.

- Ambient sound level is defined as the composite of noise from all sources near and far, the normal or existing level of environmental noise at a given location.
- Decibel (dB) is the physical unit commonly used to measure sound levels. Technically, a dB is a unit of measurement that describes the amplitude of sound equal to 20 times the base 10 logarithm of the ratio of the reference pressure to the sound of pressure, which is 20 micropascals (μPa).
- Equivalent noise level (L_{eq}) is the energy average A-weighted noise level during the measurement period.
- Day-night sound level (L_{dn}) is the A-weighted equivalent sound level for a 24-hour period with an additional 10 dB weighting imposed on the equivalent sound levels occurring during night-time hours (10 p.m. [22:00] to 7 a.m. [07:00]).
- Daytime Sound Level (L_d) is defined as the equivalent sound level for a 15-hour period between 7 a.m. (07:00) and 10 p.m. (22:00).

1.2.2 Sound Levels of Representative Sounds and Noises

The U.S. Environmental Protection Agency (EPA) has developed an index to assess noise impacts from a variety of sources using residential receptors. If L_{dn} values exceed 65 dBA, residential development is not recommended (EPA 1979). Noise levels in a quiet rural area at night are typically between 32 and 35 dBA. Quiet urban night-time noise levels range from 40 to 50 dBA. Levels above 70 dBA tend to be associated with task interference. Levels between 50 and 55 dBA are associated with raised voices in a normal conversation. Noise levels during the day in a noisy urban area are frequently as high as 70 to 80 dBA. Noise levels above 110 dBA become intolerable. Table 1 presents sound levels for some common noise sources and the human response to those decibel levels.

Table 1. Sound Levels of Representative Sounds and Noises

Source and Distance	Sound Level (dBA)	Human Response
Jet takeoff (nearby)	150	
Jet takeoff (15 m/50 feet)	140	
50-hp siren (30 m/100 feet)	130	
Loud rock concert (near stage)	120	Pain threshold
Construction noise (3 m/10 feet)	110	Intolerable
Jet takeoff (610 m/2,000 feet)	100	
Heavy truck (8 m/25 feet)	90	
Garbage disposal (0.6 m/2 feet)	80	Constant exposure endangers hearing
Busy traffic	70	
Normal conversation	60	
Light traffic (30 m/100 feet)	50	Quiet
Library	40	
Soft whisper (4.5 m/15 feet)	30	Very quiet
Rustling leaves	20	
Normal breathing	10	Barely audible
Threshold of hearing	0	

Source: Beranek (1988).

Table 2 provides criteria that have been used to estimate an individual's perception of increases in sound. In general, an average person perceives an increase of 3 dBA or less as barely perceptible. An increase of 10 dBA is perceived as a doubling of the sound.

Table 2. Average Human Ability to Perceive Changes in Sound Levels

Increase in Sound Level (dBA)	Human Perception of Sound
2–3	Barely perceptible
5	Readily noticeable
10	Doubling of the sound
20	Dramatic change

Source: Bolt Beranek and Newman, Inc. (1973).

2 EXISTING CONDITIONS

2.1 Existing Land Use and Site Conditions

The site is located in Santa Fe County, New Mexico. The lands within the Project area are privately managed. State Land Office–managed lands are located north (0.8 mile) and southeast (0.2 mile) of the Project area. The project is located in a rural setting with predominantly undeveloped rangelands; however, there are several existing residential and commercial developments and industrial uses. The nearest noise sensitive receptor to a project boundary is a residence located approximately 1,400 feet to the southwest.

2.2 Existing Sound Conditions

2.2.1 Existing Sound Levels

Santa Fe County is a semi-rural, semi-urban county in central New Mexico. The acoustical environment in the Project area and its immediate vicinity generally features relatively low ambient noise levels characteristic of rural settings. Noise in the region typically ranges from very quiet, dominated by natural sounds such as birds, wind, and occasional wildlife, to moderately noisy in localized areas near towns, highway crossings, or other human activities. Small ranches and rural residences are scattered throughout the area, contributing minimally to the overall soundscape.

The American National Standards Institute (ANSI) has published a standard (Acoustical Society of America ANSI/ASA S12.9-2013/Part 3) (ANSI 2013) that provides estimates of general ambient noise levels based on detailed descriptions of land use categories. The ANSI document classifies land use into six categories. Based on an analysis of the area surrounding the Project, the noise at the property lines of interest aligns most closely with ANSI's *Category 6 – Very Quiet Suburban and Rural Residential Areas*, which assumes an ambient daytime noise level (L_d) of 40 dBA and an ambient nighttime noise level (L_n) of 34 dBA.

Santa Fe County recently conducted ambient noise measurements in the Project area. Two readings were taken on Friday, November 15, 2024, around 10:00 AM, near the location of the BESS and at the closest point from the Project to the neighborhood on the southwest corner. The average daytime ambient noise level recorded by the County was 38.4 dBA (J.A. Yutzy, email communication, November 20, 2024), slightly below the ANSI Category 6 daytime assumption.

Based on this information, the study assumes an ambient L_d of 38.4 dBA, as measured by the County, and an ambient nighttime noise level L_n of 34 dBA, consistent with ANSI Category 6 for very quiet suburban and rural residential areas.

2.3 Regulatory Setting

Federal, state, and local agencies have set noise regulations and policies to protect the health and welfare of the public, as described below.

2.3.1 Applicable Noise Standards

2.3.1.1 FEDERAL

In 1974 the EPA published Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin on Safety. In this publication, the EPA evaluated the effects of environmental noise with respect to health and safety and determined an L_{dn} of 55 dBA (equivalent to a continuous noise level of 48.6 dBA) to be the maximum sound level that will not adversely affect public health and welfare by interfering with speech or other activities in outdoor areas.

2.3.1.2 STATE

No state laws regulating noise were identified during a review of potentially applicable regulations.

2.3.1.3 SANTA FE COUNTY

Sante Fe County Ordinance No. 2016-9 Chapter 7 – Sustainable Design Standards

This ordinance provides restrictions on noise generating activities that occur within Santa Fe County. Under section 131.21 Prohibitions of this ordinance, it is stated that:

> The maximum permissible noise limit at the property line shall not exceed the following depending on the zoning district:
>
> **Industrial and Commercial Zoning Districts:**
>
> - Daytime (7:00 a.m. to 10:00 p.m.): 75 dB(A), or 10 dB(A) above ambient; whichever is less
> - Nighttime (10:00 p.m. to 7:00 a.m.): 60 dB(A), or 5 dB(A) above ambient; whichever is less
>
> **All Other Districts:**
>
> - Daytime (7:00 a.m. to 10:00 p.m.): 55 dB(A), or 5 dB(A) above ambient; whichever is less
> - Nighttime (10:00 p.m. to 7:00 a.m.): 45 dB(A), or 5 dB(A) above ambient; whichever is less

Based on the Santa Fe County Zoning Maps, no Industrial or Commercial Zoning Districts are located immediately adjacent to the Project. As a result, the noise limits for All Other Districts were applied in this analysis to assess noise impacts.

Consistent with the Santa Fe County measured value, the assumed daytime ambient noise level used for this noise analysis is 38.4 dBA. According to the language of the ordinance, the maximum allowable noise limit is determined as 5 dBA above the ambient noise level or 55 dBA, whichever is lower. For daytime, adding 5 dBA to the ambient noise level results in a threshold of 43.4 dBA, which is lower than the fixed limit of 55 dBA. Therefore, 43.4 dBA is the applicable daytime noise limit.

Similarly, the assumed nighttime ambient noise level is 34 dBA. Adding 5 dBA to the ambient noise level results in a threshold of 39 dBA, which is lower than the fixed limit of 45 dBA. Therefore, 39 dBA is the applicable nighttime noise limit.

Sante Fe County Ordinance No. 2009-11

The Santa Fe County Noise Control and Public Nuisance Ordinance (2009-11) establishes specific restrictions on noise-generating activities to safeguard public health, safety, and quality of life. It defines maximum permissible sound levels and outlines enforcement procedures, while also identifying certain exceptions to its application.

The ordinance specifies that sound levels should not exceed 60 dBA between 10:00 p.m. and 7:00 a.m. or 75 dBA between 7:00 a.m. and 10:00 p.m. Compliance with these limits is determined based on measurements taken at 25 feet from the perimeter of a noise-sensitive unit or within the noise-sensitive unit itself. These limits must not be exceeded for more than five consecutive minutes, ten minutes in any half-hour, or intermittently on ten or more occasions within the same period.

Several exceptions to the sound restrictions are provided under the ordinance. For instance, noise caused by emergency work, regulated industrial activities, or agricultural operations is exempt. Additionally, public or private utility work related to maintenance, construction, or repairs conducted in easements, property, or public rights-of-way is also excluded from the ordinance's limitations.

For the Rancho Viejo Solar Project, compliance with these sound limits will be required to ensure adherence to the ordinance during both daytime and nighttime operations. While certain project-related activities may qualify for exemptions under the ordinance's provisions, routine operations must align with the specified sound thresholds.

For this analysis, the noise thresholds in Santa Fe County Ordinance No. 2016-9, Chapter 7 – Sustainable Design Standards were applied instead. These limits, set at 55 dBA or 5 dBA above ambient during the day and 45 dBA or 5 dBA above ambient at night (whichever is lower), are tailored to specific zoning districts and better reflect the rural and residential land use surrounding the project site.

The Sustainable Design Standards provide a more localized and stringent framework for evaluating noise impacts in alignment with the zoning and land use characteristics of the project area.

2.3.1.4 CITY OF SANTA FE

Santa Fe, New Mexico – Code of Ordinances, Chapter X – Environmental Regulations, Section 10-2 – Noise

This ordinance provides restrictions on noise generating activities in order to ensure residents of Santa Fe are provided with an environment free from such excessive sound that may jeopardize their health, welfare and safety, or degrade the quality of life.

Section 10-2.4 of this ordinance (Noises Prohibited) restricts the allowable hours for construction activities within the city of Santa Fe. This section specifically applies to construction activities occurring within the city limits. Because the project is located outside of the city limits, this section is not applicable and no limitations on the allowable hours for construction activities based on noise ordinances have been identified.

Section 10-2.5 of this ordinance (Zone district noise levels; maximum; correction) provides the maximum allowable noise levels that are permitted at different receiving zones. This regulation stipulates that:

A. It is a violation of this section for any person to operate or permit to be operated any stationary source of sound in such a manner as to create a ninetieth percentile sound pressure level (L90) for a measurement period of ten (10) minutes or more unless otherwise provided in this section, which exceeds the limits set forth for the following receiving zones. The location for measuring exterior sound levels shall be at least one foot (1') inside the property line of the affected property and three to six feet (3' to 6') above ground level and at least four feet (4') from walls and other reflective surfaces.

Table 3. Maximum Permissible Noise Levels at Noise Receiving Zones Provided in Santa Fe, New Mexico – Code of Ordinances, Chapter X – Environmental Regulations, Section 10-2 – Noise

Zone District	9:00 p.m. to 7:00 a.m.	7:00 a.m. to 9:00 p.m.
Residential	**50 dBA**	**55 dBA**
R-1, R-2, R-3, R-4, R-5, R-7, RC-5, RC-8, RM, RAC, AC, PRC, PRRC, HZ, Mobile Home Park		
Commercial	**55 dBA**	**60 dBA**
C-1, C-2, C-4, SC, BCD		
Industrial-Agricultural	**70 dBA**	**75 dBA**
I-1, I-2, IP		

When a noise source can be identified and its noise measured in more than one (1) land use category, the limits of the more restrictive use shall apply at the boundaries between different zones.

Although the project is located outside the City of Santa Fe, potential noise impacts within the city are acknowledged. However, Santa Fe County Ordinance No. 2016-9, Chapter 7 – Sustainable Design Standard provides more restrictive noise limits than those established by the City of Santa Fe. Because this ordinance imposes stricter thresholds for allowable noise levels, it was applied to assess the project's potential noise impacts.

By demonstrating compliance with the stricter standards set forth in Santa Fe County Ordinance No. 2016-9, the project inherently complies with the City of Santa Fe's noise requirements. Therefore, the city ordinance was not independently applied in this analysis.

3 NOISE IMPACTS

The following section provides results and interpretation of potential impacts from noise generated by the project during construction and operation phases.

3.1 Noise Assessment Components

A noise assessment is based on the following components: a sound-generating source, a medium through which the source transmits, the pathways taken by these sounds, and an evaluation of the proximity to impact locations. Soundscapes are affected by the following factors:

- Source. The sources of sound are any generators of small back-and-forth motions (i.e., motions that transfer their motional energy to the transmission path where it is propagated). The acoustic characteristics of the sources are very important. Sources must generate sound of sufficient strength, approximate pitch, and duration so that the sound may be perceived and can cause adverse effects, compared with the natural ambient sounds.
- Transmission path or medium. The transmission path or medium for sound or noise is most often the atmosphere (i.e., air). For the noise to be transmitted, the transmission path must support the free propagation of the small vibratory motions that make up the sound. Atmospheric conditions (e.g., wind speed and direction, temperature, humidity, precipitation) influence the attenuation of sound. Barriers and/or discontinuities (e.g., existing structures, topography, foliage, ground cover, etc.) that attenuate the flow of sound may compromise the path. For example, sound will travel very well across reflective surfaces such as water and pavement but can attenuate across rough surfaces (e.g., grass, loose soil).
- Proximity to NSAs. An NSA is defined as a location where a state of quietness is a basis for use or where excessive noise interferes with the normal use of the location. Typical NSAs include residential areas, parks, and wilderness areas, but also include passive parks and monuments, schools, hospitals, churches, and libraries.

3.2 Construction Noise

The noise levels generated by construction equipment vary significantly and depend on several different parameters, such as the type, model, size, and condition of the equipment; the operation schedule; and the condition of the area being worked. Additionally, construction projects are accomplished in several different stages. Each stage has a specific equipment mix, depending on the work to be completed.

3.2.1 Equipment and Machinery

The use of heavy equipment such as hoist cranes, excavators, dozers, and backhoes during construction will temporarily elevate ambient noise levels in the vicinity of the project site. Standard construction equipment typically operates within a range of 75 to 85 dBA at a distance of 50 feet from the source. In outdoor environments, noise levels decrease with distance, influenced by factors such as topography, vegetation, weather, and nearby traffic. On average, noise from a point source decreases by 6 dBA with each doubling of distance (Berger et al. 2003; Radtke 2016).

Noise impact calculations for this project use established noise attenuation principles and sound level reduction formulas for construction equipment, with a reference distance of 50 feet from the sound source (Thalheimer 2000). The noise generated by equipment operating within the range of 75 to 85 dBA is shown to attenuate predictably over distance, as illustrated in Table 4.

Additional sources of noise, such as worker commutes and material delivery vehicles, are expected to be short-term and sporadic, with minimal impact on hourly average noise levels. These temporary sources will have limited influence on overall noise conditions at sensitive receptors in the project area.

Table 4. Summary of Predicted Noise Generation from the Proposed Construction Equipment by Distance

Equipment - 75 dBA at 50 feet		Equipment - 80 dBA at 50 feet		Equipment - 85 dBA at 50 feet	
Distance in Feet from the Source (miles [approximate])	Noise Level (dBA)	Distance in Feet from the Source (miles [approximate])	Noise Level (dBA)	Distance in Feet from the Source (miles [approximate])	Noise Level (dBA)
50 (0.01)	75	50 (0.01)	80	50 (0.01)	85
100 (0.02)	69	100 (0.02)	74	100 (0.02)	79
200 (0.04)	63	200 (0.04)	68	200 (0.04)	73
400 (0.08)	57	400 (0.08)	62	400 (0.08)	67
800 (0.15)	51	800 (0.15)	56	800 (0.15)	61
1,600 (0.30)	45	1,600 (0.30)	50	1,600 (0.30)	55
3,200 (0.60)	39	3,200 (0.60)	44	3,200 (0.60)	49
6,400 (1.21)	33	6,400 (1.21)	38	6,400 (1.21)	43
12,800 (2.42)	27	12,800 (2.42)	32	12,800 (2.42)	37

Based on noise attenuation, construction equipment noise levels will be expected to dissipate to below background levels (assumed to be 38.4 dBA) within approximately 0.5 mile to 1.7 miles of the Project area. The closest sensitive noise receptor, a residence located approximately 1,400 feet (0.27 miles) away, will experience a temporary increase in ambient outdoor noise levels during the 12-month construction period. At this distance, noise levels from equipment operating at 85 dBA are estimated to attenuate to approximately 56 dBA, comparable to the noise level of a normal conversation in a quiet room or light office noise.

Sensitive noise receptors between 1,600 feet (0.3 mile) and 3,200 feet (0.6 mile) away consist of 114 residences and the Turquoise Trail Charter School and will experience a temporary increase in ambient outdoor noise levels, which will attenuate to approximately 55 dBA or less, comparable to the noise level of a quiet suburban street. Sensitive noise receptors between 3,200 feet (0.6 mile) and 6,400 feet (1.2 miles) away consist of 262 residences and will experience a temporary increase in ambient outdoor noise levels, which will attenuate to levels 43 dBA or less comparable to the noise level of a quiet library or soft whisper.

It is expected that construction would occur primarily during daytime hours, though it is potential that some nighttime construction activities may be required. Santa Fe County Ordinance No. 2009-11, Section 7, exempts sounds made by activities performed at the direction of Santa Fe County or by any public or private utility for maintenance, construction, or repair of public improvements. It is anticipated that the project will qualify for this exemption.

3.3 Operational Noise

To determine the potential noise impact from these sources, detailed noise modeling was conducted. The noise levels at the property boundaries and at identified NSAs in the vicinity of the project from the operation of the project have been predicted and compared with the relevant noise criteria, including the Sante Fe County Ordinance No. 2016-9 Chapter 7 – Sustainable Design Standards at property boundaries and the EPA's L_{dn} of 55 dBA at residential NSAs.

3.3.1 Operational Activities

The primary noise sources anticipated during operation of the proposed project are inverters, BESS equipment, solar trackers, and transformers.

3.3.2 Noise Profile

The sound power level (L_w) and quantities for each equipment noise source is listed in Table 5. All equipment sound levels were estimated based on available data from the equipment manufacturers or obtained from other sources or calculations where manufacturer's data were not available.

Table 5. Equipment Sound Power Levels

Equipment	1/1 Octave Spectrum									dBA	Qty.
	31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz		
Aux Transformer	84	90	92	87	87	81	76	71	64	87.4	1
Substation Transformer	84	90	92	87	87	81	76	71	64	87.4	1
BESS HVAC	94	94	94	94	92	87	87	86	80	72 [1]	38
BESS Chiller	94	94	94	94	92	87	87	86	80	61 [1]	19
PCS Inverter	86	87	91	86	92	83	83	73	74	95.8	19
SG4400UD-MV-US	84	90	92	87	87	81	76	71	64	96	25
Solar Tracker Motor	94	94	94	94	92	87	87	86	80	72 [1]	72

[1] Representative spectra were used for equipment for which only dBA levels were used. dBA values noted here are the dBA values resulting from converting the spectra to a dBA value, then applying a correction factor. As a result, frequency values presented here do not directly correspond to the noted dBA values.

In addition to the equipment listed in Table 5, a 115 kV transmission line is proposed. However, based on previous analyses, it is generally accepted that 115 kV transmission lines are not responsible for audible noise that can be perceived by humans during fair weather (CH2M 2012). Additionally, any corona discharges resulting in increased noise levels during foul (wet) weather would typically be quieter than the rain that would cause the increase in noise levels from the transmission line and would similarly not be perceptible to a human observer. It is expected that any noise generated during foul weather would attenuate to less than background noise levels at the edge of the right of way for the transmission line. For this reason, the 115 kV transmission line was not included in the SoundPLAN model.

3.3.2.1 INTERMITTENT NOISE SOURCES

An intermittent noise source represents any stationary noise source which is periodically or intermittently active during the day or night. Solar trackers were modeled in SoundPLAN assuming that they would only be operational during daytime hours, and that they would be intermittent sources of noise. Other noise-emitting sources with intermittent daily operation of 4 hours or less, or emergency operation only units, were not considered in the model.

3.3.3 Assessment Methodology

Based on the sound power levels for each of the sources, SoundPLAN estimates noise contours of the overall project in accordance with a variety of standards, primarily International Standards Organization (ISO) 9613-2:1996, Acoustics, standards for noise propagation calculations. All sound propagation losses, such as geometric spreading, air absorption, ground absorption, and barrier shielding, are calculated in accordance with these recognized standards.

The model accounts for reflection, from adjacent structures and the ground. The model uses industry-accepted propagation algorithms and accepts sound power levels (in dB) provided by the manufacturer and other sources. The calculations account for classical sound wave divergence, plus attenuation factors resulting from air absorption, basic ground effects, and barrier/shielding. SoundPLAN does not account for noise modulation or refraction.

The sound propagation model considers the following influences:

- sound power levels and locations of noise sources
- distance between noise sources and receivers
- topography of the area
- influence of the absorption provided by the ground
- shielding from structures or vegetation
- air absorption
- meteorological conditions

The ISO 9613-2 methodology provides tables and equations for estimating the atmospheric absorption coefficient corresponding to various temperatures and humidity levels. Topographic inputs were also included in the model.

The ISO 9613-2 standard estimates sound pressure levels at a specified distance by subtracting the attenuation factors from the source sound power level for each source in octave frequency bands. Attenuation factors include geometrical divergence, atmospheric attenuation, ground effect, and barrier attenuation. These terms are defined as follows.

- Geometrical divergence occurs as the source sound power is spread out over an increasing surface area (i.e., as the distance from the source increases). The estimated loss rate is the same for all frequencies. This is considered the most significant loss associated with propagation. Attenuation due to geometrical divergence is highly dependent on the distance between the source and the receiver. Direction also affects the noise level; 0° direct line of sight noise level will be higher than 90° direction line of sight to a stack emission point. Therefore, the differences in ground elevation and receiver height and hub height (source height) are important parameters.

- Losses due to atmospheric attenuation occur as the energy in the sound wave is transformed to heat. As this attenuation is frequency dependent and high frequencies are more readily attenuated than low frequencies, these losses are highly influenced by humidity and temperature.

- Ground effect is described according to the parameter Ground Factor, which varies between 0 for surfaces with low porosity ("hard" ground) and 1 for "soft" ground (surfaces including loose dirt, grass, crops, and other vegetation). This factor describes the effect of sound waves reflected off the ground. Parameters influencing the ground effect are the source height, receiver height, and propagation distance between the source and receiver and the ground conditions. Barrier attenuation describes the effect of sound waves refracted around an imperforate element or barrier.

- A barrier could include human-made objects such as structures, buildings, and fences, as well as topographical features. Therefore, the differences in ground elevation, source height, receiver height, dimensions, and location absorption and reflection coefficients of human-made structures and topographic features are important parameters when estimating barrier attenuation in SoundPLAN.

The following assumptions were made when running SoundPLAN:

- The model assumed all proposed noise-generating sources operated concurrently.
- Noise impacts at the selected impact locations and depicted in the isopleths were estimated assuming a receiver height of 5 feet above ground level.
- Elevations of the sources and of the receptors examined in the modeling were determined from U.S. Geological Survey Digital Elevation Map (DEM) and are based on North American Datum of 1927. The DEM files each had a 100-foot resolution (7.5-minute DEM providing coverage of 7.5 × 7.5-minute blocks).
- To better represent the actual conditions of the proposed project and to ensure that both hard and soft ground absorption were considered, acoustically hard sites including surfaces such as pavement and bare hard ground were assumed to have high reflectivity properties and a ground absorption coefficient of 0.0 was used. Ground cover in the vicinity of the project was analyzed using satellite imagery from Google Earth. A higher ground factor of 1.0 was defined for more absorptive ground, such as vegetation and loose soil. Semi-hard materials such as gravel and sand were assumed to have a ground absorption coefficient of 0.6.

3.3.4 Operational Noise Impacts

The calculated noise levels emitted by the Project comply with the Santa Fe County Ordinance No. 2016-9 Chapter 7 and are also below the EPA's recommended 55 dBA L_{dn} standard (equivalent to 48.6 dBA L_{eq}) at the NSAs. The highest noise levels due to project operations at the property boundary, where the maximum noise impacts are expected, were estimated to be 36.5 dBA during both daytime and nighttime hours. When including assumed ambient noise levels, the total estimated noise level at the closest property boundary is 40.6 dBA during daytime hours and 38.4 dBA during nighttime hours.

These noise levels were determined using estimates generated by SoundPLAN modeling software at the nearest property boundary located southwest of the project area. All other property boundaries are expected to experience lower noise levels from project operations due to increased distance or shielding effects. Consequently, the project's noise remains below the specified standards.

Table 6 summarizes the overall noise levels, including background noise, project contributions, and total noise levels, at the property boundary expected to experience the maximum impact in A-weighted decibels.

Table 6. Summary of Estimated Noise Levels from Project Operation

Description	Project Contribution (dBA)	Representative Background Noise Levels (dBA)	Total Calculated Noise Levels (dBA)	Estimated Noise Increase (dBA)
Loudest Property Line Modeled Noise Level	36.5	38.4 *	40.6	2.2
Santa Fe County Noise Limit (daytime)	-	-	43.4	-
Loudest Property Line Modeled Noise Level	36.5	34.0 †	38.4	4.4
Santa Fe County Noise Limit (nighttime)	-	-	39.0	-

* Based on measurements conducted by Santa Fe County near the Project site on November 15, 2024 (J.A. Yutzy, email communication, November 20, 2024)
† The nighttime ambient noise level of 34.0 dBA is derived from ANSI/ASA S12.9-2013/Part 3, which defines typical noise levels for Category 6 – Very Quiet Suburban and Rural Residential Areas (ANSI 2013).

The Project's operational noise levels comply with the Santa Fe County Ordinance No. 2016-9 Chapter 7 – Sustainable Design Standards. As summarized in Table 6, the loudest modeled noise level at the property boundary during daytime hours is 36.5 dBA. When combined with the ambient noise level of 38.4 dBA, the total calculated daytime noise level is 40.6 dBA, which remains below the applicable 43.4 dBA daytime noise limit. Similarly, during nighttime hours, the loudest modeled noise level is also 36.5 dBA. When combined with the ambient nighttime noise level of 34.0 dBA, the total calculated nighttime noise level is 38.4 dBA, which remains below the applicable 39.0 dBA nighttime noise limit. These results confirm that the Project will comply with Santa Fe County's noise standards for both daytime and nighttime conditions.

Regarding human perception of changes in sound levels (i.e., potential increases above ambient), the estimated increase at the property boundary is 2.2 dBA during daytime hours and 4.4 dBA during nighttime hours. According to established thresholds for human perception, an increase of 2–3 dBA is considered barely perceptible, while an increase of 5 dBA is readily noticeable. Therefore, the daytime increase would be barely perceptible to the average human observer, and the nighttime increase would be at the upper end of "barely perceptible" but not reach the threshold of a "readily noticeable" change.

These increases are estimated at the property boundary, where the highest noise impacts are predicted. At NSAs, the increases are expected to be lower due to the additional distance and attenuation effects.

As a result, the proposed operation is not expected to result in a substantial permanent increase in ambient noise levels in the vicinity of the project. The predicted noise increases would not produce sound levels that are audibly distinct to residents at these locations.

Noise contour grid maps were generated by SoundPLAN software and are presented in Appendix A. The maps depict the extent of noise propagation from the SoundPLAN models that were developed for the noise impact assessment. The noise contour map illustrates the extent of noise associated with the proposed development. It is important to note that the extent of the impacts depicted in these figures does not include the contribution of the existing background noise.

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APPENDIX A

Project Operation Noise Maps

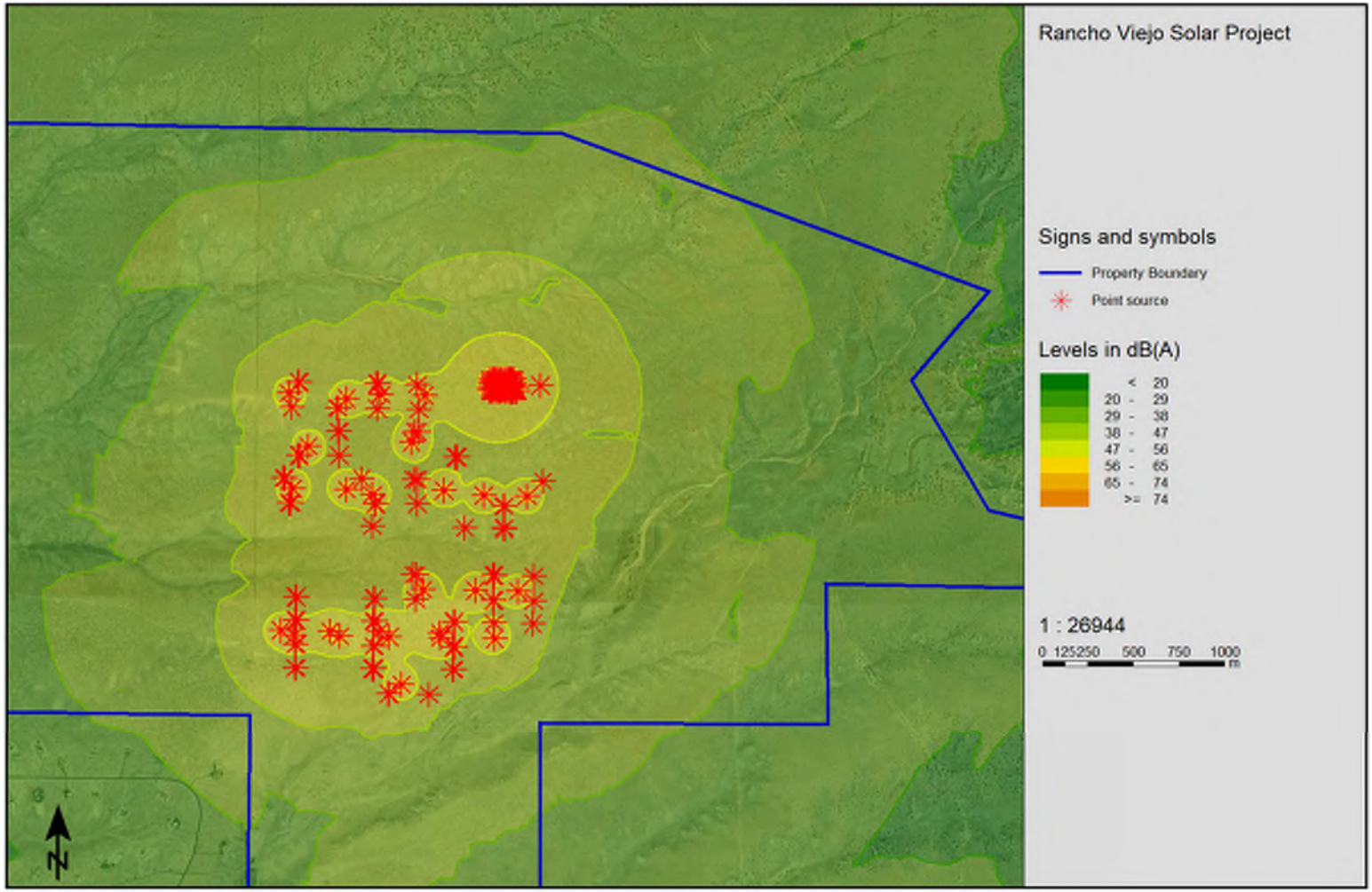


Figure A-1. Project operation noise isopleth

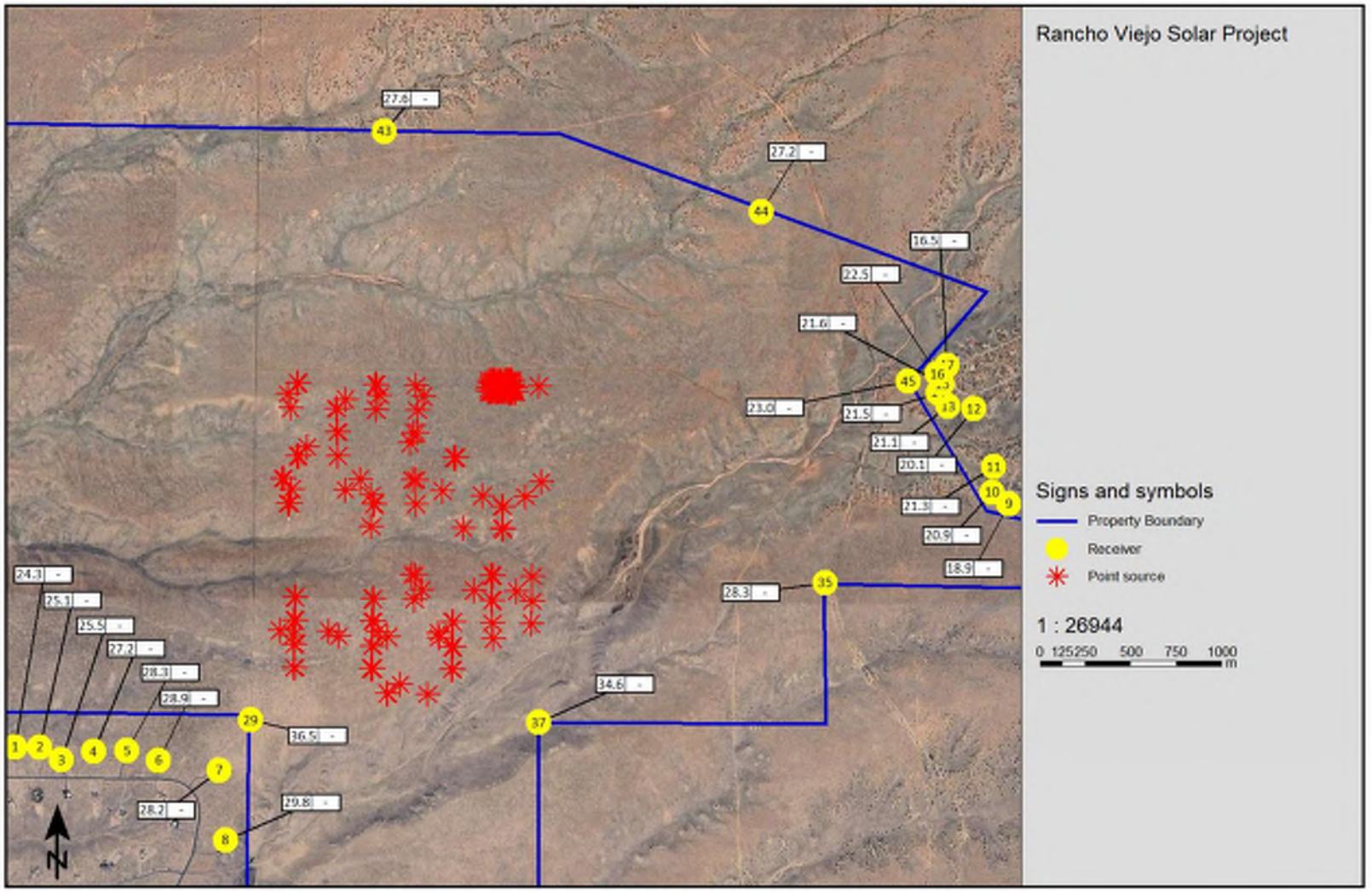


Figure A-2. Project operation noise single point map

APPENDIX D

Geotechnical Engineering Report

Revised Geotechnical Engineering Report

Rancho Viejo Solar Array, Substation, BESS, and Transmission Line

Near NM 599 and NM 14, Santa Fe, New Mexico

April 16, 2024

Terracon Project No. 66225093

Prepared for:

AES Clean Energy

282 Century Place, Suite 2000

Louisville, Colorado 80027

Prepared by:

Terracon Consultants. Inc.

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April 16, 2024

AES Clean Energy
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Louisville, Colorado 80027

Attn: Mr. Jourdan Labonte, P.E., M.Eng.
P: (737) 239-9060
E: Jourdan.Labonte@aes.com

Re: Geotechnical Engineering Report
Rancho Viejo Solar Facility
Santa Fe County, New Mexico
Terracon Project No. 66225093

Dear Mr. Labonte,

Terracon Consultants, Inc. (Terracon) has completed the Design-Level Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with our proposal number P66225093 – Revision No. 2 dated June 6, 2023. This geotechnical engineering report presents the results of the subsurface exploration, laboratory testing, pile load testing, engineering analyses and design-level geotechnical engineering recommendations with regard to the design and construction of the proposed Rancho Viejo Solar Array, Substation, BESS, and Transmission Line.

We appreciate the opportunity to continue to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon

Stenson D. Lee
Staff Professional

BRANDI L. BUTTS
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PROFESSIONAL ENGINEER

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Appendix G – Pile Load Testing Results – Axial Tensile Load
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Appendix H – Pile Load Testing Results – Lateral Load
Lateral Load Test Results ..... H-1 thru H-32

Appendix I – Double Ring Infiltration Test Results
Double Ring Infiltration Test Location Plan I-1
Double Ring Infiltration Test Results ..... I-2 through I-3

Appendix J – JDH Corrosion Analysis ..... J-1 through J-14

1.0 Introduction

Terracon Consultants, Inc. (Terracon) is pleased to submit this geotechnical engineering report detailing the completed pile load testing and design-level geotechnical engineering services performed for the proposed Rancho Viejo Solar Array, Substation, BESS, and Transmission Line to be located in Santa Fe County, New Mexico. The Site Location (Exhibit A-1) is included in Appendix A of this report. The purpose of these services is to provide subsurface information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Site preparation and earthwork
- Thermal resistivity of trench/backfill
- Pile load test results
- Unpaved access roads
- Groundwater conditions
- Seismic considerations
- Electrical resistivity for grounding design
- Foundation design and construction
- Corrosion considerations

Our geotechnical engineering scope of work for this project included the following:

- A total of 35 test borings drilled to approximate depths from 6 to 41½ feet below the existing ground surface (bgs);
- A total of 17 test pits excavated approximate depths from 1 to 10 feet;
- Field electrical resistivity testing at 22 locations;
- Pile load testing at 10 locations that includes 1 axial compression load tests, 9 axial tensile load tests, and 9 lateral load tests;
- Thirteen (13) laboratory thermal resistivity dry-out curves tested by Geotherm USA;
- Corrosion testing performed on bulk samples obtained at 6 locations;
- Laboratory testing of soil samples;
- Geotechnical engineering analysis; and
- Preparation of this report.

Terracon previously performed a preliminary geotechnical engineering report, dated December 21, 2022, for the project which included the following scope of work, portions of which have been incorporated into this report:

- Field electrical resistivity testing at 4 locations;
- A total of 16 test borings drilled to an approximate depth of approximately 16½ to 31½ feet bgs;
- Pile Load testing at 6 locations that included 6 axial compression tests, 12 axial tensile load tests, and 12 lateral load tests;
- Corrosion testing performed on bulk samples obtained at 16 locations; and
- Laboratory testing of soil samples

The locations of the borings and test pits are shown on the Exploration Plans (Exhibits A-2 and A-5) in Appendix A. A log of each boring and test pit is included in Appendix A (Exhibits A-10 thru A-81) of this report. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and in Appendix B (Exhibits B-1 through B-64) of this report. The location of the thermal resistivity tests is shown on the Thermal Resistivity Test Plan (Exhibit C-1) in Appendix C. The thermal resistivity test results are included in Appendix C of this report. The location of the field electrical resistivity tests is shown on the Field Electrical Resistivity Testing Map (Exhibit D-1) in Appendix D. The field electrical resistivity test results are included in Appendix D of this report. The pile load testing locations are shown on the Pile Load Test Zoning Plan (Exhibit E-1) in Appendix E, along with the pile drive times as shown on Exhibits E-2 through E-8. The pile load testing results are included in Appendices F, G and H.

2.0 Project Information

2.1 Project Description

Item	Description
Project Description	The project consists of providing site and subsurface conditions for a proposed solar project. The size of the project in acres is estimated to be about 762 acres and will include a Battery Energy Storage System (BESS) and substation. We also understand a 2.3-mile-long gen-tie alignment is planned to tie the project substation to an existing off-site substation. Services associated with the substation and gen-tie have been provided under a separate report.
Proposed Construction	We understand the solar structures will be supported by driven steel piles, and equipment structures will be supported by driven steel piles or mat foundations.
Maximum Loads	Structural loads were not provided, but have been estimated based on our experience on projects using single axis tracking rack systems: ■ Downward: 1 to 7 kips ■ Lateral 1 to 3.5 kips ■ Uplift: 0.5 to 3 kips ■ Moments: 0.1 to 30 kip-ft.
Grading/Slopes	The site is relatively flat, and we understand the arrays will generally follow the existing topography, therefore, minimal site grading is anticipated.
Access Roads	Unpaved access roads are planned for the site as described below:

Item	Description
	■ Interior access roads are to support post-construction traffic which we understand will be primarily light maintenance vehicles. The roads will be required to support a maximum vehicle load of 80,000 pounds for emergency vehicle and/or fire truck access. Additionally, the substation access road should be able to support heavy vehicle delivery (HS-20 loading) up to two times per year throughout the design life. ■ We understand it is acceptable for the access roads to require ongoing maintenance throughout their design life.
Storm Water Management	Terracon understands that up to 2 retention basins are planned as part of the storm water management system for the site. Our scope of services included performing percolation testing within the proposed basin areas.

2.2 Site Location and Description

Item	Description
Parcel Information	The proposed solar facility is located near the intersection of NM 599 and NM 14 in Santa Fe County, New Mexico. Coordinates near the approximate center of the site are: 35.5445°N latitude and -106.0111°W longitude. Total Area: Approximately 1,000 acres Buildable array area: Approximately 762 Acres See Exhibit D for site location.
Existing Improvements	The project site is currently an undeveloped parcel consisting of ranch and farmland with unimproved trails.
Current Ground Cover	Soil and vegetation
Existing Topography	The site is relatively flat with a slight slope going down from west and southwest. Based on review of topographic map information, the elevation across the site varies from approximately 6,340 to 6,490 feet MSL.

3.0 Exploration and Testing Procedures

3.1 Field Exploration

The field exploration on the project consisted of the following exploration plan. The approximate exploration locations are shown on the Exploration Plans (Exhibits A-2 and A-3) in Appendix A.

Number of Explorations	Type of Exploration	ID Nos.	Approximate Depth (feet)	Location
30	Borings	A-01 through A-15 B-01 through B-15[1]	16½ to 21½	Proposed Array Areas
14	Test Pits	TP-1 through TP-15	10	
3	Borings	BESS-01 and BESS-03	36½ to 41½	Proposed BESS Area
1	Test Pit	TP-BESS	10	
3	Borings	B-Sub[1], Sub-01, Sub-02	31½ to 41½	Proposed Substation Area
1	Test Pit	TP-SUB	10	
3	Borings	BW-01 through BW-03	31½	Proposed Switching Station
1	Test Pit	TP-SW	10	
4	Borings	T-01 through T-04	31½	Proposed T Line Overhead
8	Borings	P-01 through P-08	6 to 6½	Proposed Access Road

1. Performed as part of the preliminary phase.

Additionally, 2 double ring infiltrometer tests (DRI-01 and DRI-02) were performed in proposed retention basin areas across the site. The approximate infiltration test locations are shown on the Infiltration Test Location Plan (Exhibit I-1) in Appendix I. The infiltration testing was performed in general accordance with ASTM D3385. The infiltration testing consisted of two cylinders that are driven into the soil with the smaller cylinder inside the larger. Both the outside ring and the inside cylinder are filled with water and measurements are obtained from the inside ring. This method of determining infiltration rates of the soil substantially prevents lateral flow of the water and therefore a more accurate infiltration rate of downward flow. Subsequently, a Terracon geotechnical field geologist/engineer performed the infiltration tests. The field measurements of the infiltration testing in inches per hour are summarized on Exhibits I-2 through I-3 in Appendix I.

The infiltration test field measurements are provided to aid with the design of the proposed storm-water retention basins. We understand the storm-water retention basin design will be performed by others. The field infiltration rates measured are based on the soil conditions encountered at the particular location of the infiltration tests, and the actual infiltration rates may vary from the values reported here. It should be noted that siltation and vegetation growth along with other factors may affect the infiltration rates of the on-site areas. The infiltration rates presented in this addendum are unfactored field measurements, and appropriate de-rating factors should be applied to these infiltration rates during the design of the proposed storm-water retention basins (performed by others).

We recommend the proposed retention basins be constructed/excavated with light weight equipment to help reduce compaction of the basin bottom surface, which will ultimately be used for infiltration of storm water. Once constructed, no traffic should be allowed to travel across the basin bottom. It should be noted that compaction of the basin bottom will result in reduced infiltration rates. If compaction of the basin bottom does occur, the exposed surface should be scarified to a minimum depth of 8 inches and left uncompacted.

Exploration Layout and Elevations: Terracon provided the exploration layout. Exploration points in the field were located with a handheld GPS unit (estimated horizontal accuracy of about ±15 feet). Approximate elevations were obtained from Google Earth Pro. If a more precise layout or elevations are desired, we recommend the explorations be surveyed.

15' accuracy is really high. Why wasn't elevation taken from the GPS unit?

Boring Procedures: We advanced the borings with a truck-mounted CME-75 and CME-55 drill rig utilizing 7 to 8-inch outside diameter hollow-stem augers. At selected intervals, samples of the subsurface materials were taken at each boring location by driving split-spoon (SPT) or ring-lined barrel samplers in general accordance with ASTM Standards. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch O.D. split-barrel sampling spoon with 2.5-inch I.D. ring lined sampler was used for sampling in the upper ten feet in the soil borings. Ring-lined, split-barrel sampling procedures are similar to standard split spoon sampling procedure; however, blow counts are typically recorded for 6-inch intervals for a total of 12 inches of penetration. Bulk samples of subsurface materials were obtained from all the borings. For safety purposes, all borings were backfilled with auger cuttings after their completion.

Test Pit Procedures: The test pits were excavated using a Komatsu PC170 excavator equipped with a 36-inch-wide bucket. Continuous lithologic logs of each test pit were recorded by our field engineer during the field exploration. Samples were collected from the test pits and then transported to our laboratory for further observations, testing, and classifications. The test pits were backfilled with the excavated soils upon completion. Groundwater was not encountered in any of the test pits at the time of the field exploration.

3.2 Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) and Rock Classification described in Exhibits A-5 and A-6 in Appendix A. At that time, the field descriptions were confirmed or modified as necessary, and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

Laboratory tests were conducted on selected soil samples and the test results are presented in Appendix B (Exhibits B-1 through B-64) of this report. These results were used for the geotechnical engineering analyses, and the development of foundation recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards. Selected soil samples obtained from the site were tested for the following engineering properties:

- Atterberg Limits
- Moisture Content
- One-Dimensional Consolidation
- Soluble Sulfate
- Soluble Chloride
- Total Salts
- Oxidation-Reduction Potential
- Sieve Analysis
- Dry Density
- R-Value
- Moisture Density Relationship
- pH
- Minimum Electrical Resistivity
- Thermal Resistivity

4.0 Subsurface Profile

4.1 Typical Subsurface Profile

Specific conditions encountered at each boring and test pit location are indicated on the individual logs presented in Appendix A (Exhibits A-7 thru A-81) section of this report. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Based on conditions encountered in the borings, subsurface conditions on the project site can be generalized as follows:

Array Area

Description [1]	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency / Relative Density / Strength
Stratum 1	2 to 21½ (maximum depth explored)	Silty Sand, Clayey Sand, Silty Clayey Sand, Poorly Graded Sand with Silt, Well Graded Sand with Silt	Loose to Very Dense

Array Area

Description [1]	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency / Relative Density / Strength
Stratum 2	2 to 21½ (maximum depth explored)	Sandy Lean Clay, Lean Clay with Sand, Silt and Sandy Silt	Soft to Hard

1. Topsoil thickness in array area noted at 2” to 4” with an average depth of approximately 3".

BESS and Substation Area

Description [1, 2]	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency / Relative Density / Strength
Stratum 1	2 to 6½	Silty Sand, Clayey Sand, Well Graded Sand with Silt, Poorly Graded Sand with Silt	Loose to Dense
Stratum 2	2½ to 41½ (maximum depth explored)	Sandy Lean Clay and Lean Clay with Sand	Very Stiff to Hard

1. Topsoil thickness in BESS and Substation area noted at 3” to 4” with an average depth of approximately 3.40”.
2. Weak to moderate calcium carbonate cementation was observed in Stratum 1 soils and weak to strong calcium carbonate cementation was observed in the Stratum 2 soils.

Transmission Line Overhead Area

Description [1, 2]	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency / Relative Density / Strength
Stratum 1	2 to 31½ (maximum depth explored)	Silty Sand, Clayey Sand and Silty Clayey Sand	Loose to Very Dense
Stratum 2	2 to 31½ (maximum depth explored)	Sandy Lean Clay, Lean Clay with Sand and Sandy Silt	Soft to Hard

1. Topsoil thickness in Transmission Line Overhead Area noted at 2” to 4” with an average depth of approximately 3”.
2. Weak to moderate calcium carbonate cementation was observed in Stratum 1 soils and weak to strong calcium carbonate cementation was observed in the Stratum 2 soils.

Switching Station Area

Description [1, 2]	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency / Relative Density / Strength
Stratum 1	2 to 31½ (maximum depth explored)	Silty Sand, Clayey Sand, Poorly Graded Sand with Silt	Loose to Very Dense
Stratum 2	2 to 31½ (maximum depth explored)	Lean Clay with Sand, Sandy Silt	Soft to Hard

1. Topsoil thickness in Switching Station Area noted at 4" to 5" with an average depth of approximately 4.33".
2. Weak to moderate calcium carbonate cementation was observed in Stratum 1 soils and weak to strong calcium carbonate cementation was observed in the Stratum 2 soils.

Access Road Area

Description [1, 2]	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency / Relative Density / Strength
Stratum 1a	1 to 6½ (maximum depth explored)	Silty Sand, Clayey Sand	Loose to Very Dense
Stratum 1b	1 to 6½ (maximum depth explored)	Sandy Lean Clay and Sandy Silt	Soft to Hard

1. Topsoil thickness in Access Road Area noted at 3" to 4" with an average depth of approximately 3.40".
2. Weak to moderate calcium carbonate cementation was observed in Stratum 1 soils

In response to wetting of relatively undisturbed samples while supporting typical foundation pressures, the near surface soils exhibited low to moderate hydro-compaction (collapse) potential at in-situ moisture content and density. Hydro-compactive soils, sometimes referred to as collapsible soils, are capable of supporting typical building loads at natural moisture contents, these same materials however, undergo volume decrease (settlement/consolidation) when subjected to increases in moisture content under constant load. These same soils indicate low to moderate compression under typical foundation pressures.

4.2 Groundwater

Groundwater was not observed in the borings while drilling, or for the short duration the borings could remain open. Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Based on information obtained from the USGS Groundwater database (USGS Groundwater for USA: Water Levels -- 1 sites), the depth to regional groundwater was measured in July 1977 to be approximately 262 feet below the ground surface (approximate elevation of 6,508 feet above mean sea level) at an USGS monitored well site (Local I.D.: USGS 353427105570701) located approximately ¾-mile northeast of the site.

4.3 Thermal Resistivity Laboratory Testing

Thermal resistivity testing was performed by Geotherm USA on 16 soil samples obtained at 16 test locations. Tests were conducted on 16 bulk samples from depths of 1 to 5 feet below the existing ground surface. The thermal resistivity testing was performed in general accordance with the Institute of Electrical and Electronics Engineers (IEEE) standard. The dry-out curves were developed from the bulk samples compacted to 85% and 90% of the maximum density determined in accordance with Standard Proctor criteria (ASTM D698) at the optimum moisture content and dried to 0% moisture while obtaining intermediate moisture contents to develop the dry-out curves. Thermal samples compacted to 95% were not completed. Additional samples will be gathered and tested to be included in the final report. The results of the thermal resistivity testing are presented in Appendix C.

4.4 Field Electrical Resistivity Test Results

Field measurements of soil resistivity were performed at 22 locations across the site in general accordance with ASTM Test Method G57, and IEEE Standard 81, using the Wenner Four-Electrode Method. The approximate soil electrical resistivity test locations are shown on Exhibit D-1 in Appendix D. The soil resistivity measurements were performed using a MiniRes Ultra manufactured by L & R Instruments, Inc. The Wenner arrangement (equal electrode spacing) was used with the “a” spacing of 1, 2, 3, 5, 10, 20, and 50 feet at 17 locations (FER-A-01 through FER-A-12, FER-T-01 through FER-T-05) spread throughout the solar array and t-line overhead area. Additionally, five test locations (FER-Sub-01, FER-Bess-01 and FER-Bess-02, FER-BW-01 and FER-BW-02) using “a” spacings of 1, 2, 3, 5, 10, 20, 50, 100, 200, and 300 feet was also performed within the Substation, Switching Station, and BESS area. The testing was performed in both north-south and east-west orientations at each location.

Tests were also performed for the preliminary phase of the project at 3 locations throughout the array area using “a” spacings of 1, 2, 3, 5, 10, 20, 50, and 100 feet. One test was also

completed in the substation area using “a” spacings of 1, 2, 3, 5, 10, 20, 50, 100, 200, and 300 feet. The “a” spacing is generally considered to be the depth of influence of the test. Results of the field soil resistivity measurements are presented in tabular and graphical format in Appendix D (Exhibits D-4 through D-29).

4.5 Corrosivity

The table below lists the corrosivity test results performed on samples collected from the borings. These values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Corrosivity Test Results Summary

Boring	Sample Depth (feet BGS)	pH	Sulfate (mg/kg)	Sulfides (mg/kg)[1]	Chlorides (mg/kg)	Red-Ox (mV)	Total Salts (mg/kg)[1]	Minimum Electrical Resistivity (Ω-cm)[2]
B-01[3]	0 – 4	7.55	94	-[4]	97	+734	-[4]	6,700
B-02[3]	0 – 4	8.16	113	-	120	+733	-	2,345
B-03[3]	0 – 4	8.35	129	-	155	+726	-	1,340
B-04[3]	0 – 4	7.55	76	-	37	+735	-	3,350
B-05[3]	0 – 4	7.52	107	-	65	+735	-	3,484
B-06[3]	0 – 4	7.17	94	-	75	+735	-	4,556
B-07[3]	0 – 4	6.84	120	-	80	+734	-	3,551
B-08[3]	0 – 4	7.08	94	-	70	+735	-	5,427
B-09[3]	0 – 4	6.80	92	-	90	+732	-	3,350
B-10[3]	0 – 4	7.22	127	-	65	+734	-	4,221
B-11[3]	0 – 4	6.66	72	-	47	+728	-	1,474
B-12[3]	0 – 4	6.60	75	-	50	+735	-	5,962
B-13[3]	0 – 4	6.58	95	-	47	+734	-	6,633
B-14[3]	0 – 4	6.84	133	-	102	+732	-	4,891
B-15[3]	0 – 4	7.38	88	-	57	+723	-	1,943
B-16/B-Sub[3]	0 – 4	7.69	103	-	50	+731	-	2,278
A-7	0 – 4	6.35	85	Nil	87	+733	280	3,417

Corrosivity Test Results Summary

Boring	Sample Depth (feet BGS)	pH	Sulfate (mg/kg)	Sulfides (mg/kg)[1]	Chlorides (mg/kg)	Red-Ox (mV)	Total Salts (mg/kg)[1]	Minimum Electrical Resistivity (Ω-cm)[2]
BW-2	0 – 4	8.29	74	Nil	62	+725	780	2,144
BW-3	0 – 4	8.26	68	Nil	125	+720	1304	1,273
Sub-1	0 – 4	7.10	24	Nil	75	+733	269	5,896
Bess-1	0 – 4	6.38	27	Nil	87	+732	341	3,350
Bess-2	0 – 4	7.19	52	Nil	100	+733	264	4,087
MINIMUM		6.35	24	---	37	+720	264	1273
MAXIMUM		8.35	133	---	155	+735	1304	6700
AVERAGE		7.25	88	---	79	+731	540	3712

1. Tests not performed on preliminary phase
2. Laboratory electrical resistivity testing was performed on saturated samples.
3. Tests performed as part of preliminary phase
4. Tests not performed as part of preliminary phase

Results of soluble sulfate testing indicate that samples of the on-site soils tested classify as S0 according to Table 19.3.1.1 of Section 318 of the American Concrete Institute (ACI) Building Code Requirements for Structural Concrete. Therefore, the American Society for Testing and Materials (ASTM) Type I/II portland cement is considered suitable for concrete at the site in contact with similar soluble sulfate concentrations. Concrete should be designed in accordance with the provisions of the ACI Building Code Requirements for Structural Concrete, Section 318, Chapter 19.

These test results are provided to assist in determining the type and degree of corrosion protection that may be required. We recommend that a certified corrosion engineer be retained to analyze the need for corrosion protection and to design appropriate protective measures, if required. The test results indicate that some of the samples exhibit elevated levels of total salts and low minimum electrical resistivity values.

As discussed in Section 10.7.5 of the AASHTO LRFD Bridge Manual, 8th Edition, 2017, the following soil or site conditions should be considered as indicative of potential deterioration or corrosion situation for steel piles:

- Soil minimum electrical resistivity less than 2,000 ohm-cm
- pH less than 5.5
- pH between 5.5 and 8.5 with high organic content

- Sulfate concentration greater than 1,000 ppm (mg/kg)

4.6 Seismic Considerations

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Class is required to determine the Seismic Design Category for a structure. The Site Class is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties encountered at the site and as described on the exploration logs and results, it is our professional opinion that the Seismic Site Class is D. Subsurface explorations at this site were extended to a maximum depth of 41½ feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth. The values below must be verified by the structural engineer.

Description	Value
Seismic Risk Category	II
2021 International Building Code Site Classification (IBC) [1]	D [2]
Site Latitude	39.56010°
Site Longitude	110.67923°W
S_S MCE_R ground motion (for 0.2 second period) [3]	0.86g
S_1 MCE_R ground motion (for 0.1 second period) [3]	0.128g
SDs	0.384g
SD1	0.201g
SMs	0.576
SM1	0.301
PGA_M Site modified peak ground acceleration [3]	0.25g

1. Seismic site classification in general accordance with the *2018 International Building Code*, which refers to ASCE 7-16.
2. The 2021 International Building Code (IBC) uses a site profile extending to a depth of 100 feet for seismic site classification. Borings at this site were extended to a maximum depth of 41½ feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.
3. These values were obtained using online seismic design maps and tools provided by the ASCE 7 Hazard Tool (https://gis.asce.org/beta-7-22/).

4.7 Liquefaction

Liquefaction is the phenomenon where saturated soils develop high pore-water pressures during seismic shaking and lose their strength characteristics. This phenomenon generally occurs in areas of high seismicity, where groundwater is shallow and loose granular soils or relatively low- to non-plastic fine-grained soils are present. The project site generally exhibited medium dense to very dense granular soils, very stiff to hard cohesive soils, and a lack of shallow groundwater. Due to these factors, the risk of liquefaction is considered very low.

4.8 Slope Hazards

Slopes within the project site generally average between 0 and 5 percent, therefore, slope issues are not anticipated at the project site. Any slopes created by site grading should be placed at a minimum of 3H:1V for slopes less than 5 feet in height. Any slopes anticipated greater than 5 feet in height will require a stability analysis be performed.

4.9 Hydro-collapse

In response to wetting of relatively undisturbed samples while supporting typical foundation pressures, the near surface soils exhibited low to moderate hydro-compaction (collapse) potential at in-situ moisture content and density. Hydro-compactive soils, sometimes referred to as collapsible soils, are capable of supporting typical building loads at natural moisture contents, these same materials however, undergo volume decrease (settlement/consolidation) when subjected to increases in moisture content under constant load. These same soils indicate low to moderate compression under typical foundation pressures.

We recommend a minimum of 4 feet engineered fill placed within the geometric configurations and depths below foundations as outlined in Section 9.0 of this report.

5.0 Full-Scale Pile Load Testing (PLT) Program

We have performed a full-scale pile load testing program that included:

- Directing the installation of a group of two test piles at each of 16 locations (6 during the preliminary phase and 10 during the design-level phase).
- Performing full-scale testing under axial compressive loads for 1 test pile at each of the 7 locations with three test piles.
- Performing full-scale testing under axial tensile loads for 2 test piles in each group.
- Performing full-scale testing under lateral loads for 2 test piles in each group.

These activities are further described in the following sections.

5.1 Pile Location Procedures

The field-testing locations are indicated on the attached Pile Load Test Zoning Plan (Exhibit E-1) in Appendix E. These locations were established in the field by using a hand-held GPS (accurate to about 15 feet). The mapped test locations should be considered accurate only to the degree implied by the means and methods used to define them.

5.2 Test Pile Installation

Pile installation was performed initially in August of 2023 with additional piles installed in March of 2024, all piles were allowed to sit undisturbed for a minimum of 72 hours before testing began. The test piles consisted of wide-flange, bare steel W6x9 sections. A group of 2 test piles were installed at 16 locations across the project site. At 6 of the 16 locations, a third test pile was installed for compression testing with an additional location with just a lone compression test. The test piles have been identified using an alphanumeric system. The pile identification system for each location begins with "PLT-" and is followed by the number corresponding to the test pile group location while the assigned letters "A", "B", and "C" correspond to the embedment depth of the pile. The numeric portion of the identifier that follows the first digit "1" matches the boring location the PLT was performed at. For example, PLT-101 was performed at boring location B-001.

Two instances of refusal (defined as less than 1 foot of advancement in 120 seconds) were observed when driving piles at this site, at PLT-102AC and PLT-110AC, both before 5 feet below grade. Based on pile driving results, two out of 44 piles installed on the site experienced refusal, therefore, Terracon anticipates a small percentage of pile driving refusal may occur during construction.

The pile driving operation was performed with a track mounted GAYK Model HRE 1000 with an Atlas Copco PB420 hydraulic hammer. The pile driving hammer was set up to run at 100 percent of the full driving capacity. A summary of the time required to advance each pile to its specified embedment depth is summarized in the following table:

Test Location	PILE (A)			PILE (B)			PILE (C)		
	Embedment Depth	Total Drive Time	Average Drive Time	Embedment Depth	Total Drive Time	Average Drive Time	Embedment Depth	Total Drive Time	Average Drive Time
	Ft.	Sec.	Sec./ft.	Ft.	Sec.	Sec./ft.	Ft.	Sec.	Sec./ft.
PLT-01[1]	5	39.7	7.9	8	50.8	6.4	5	32.8	6.6
PLT-02[1]	5	35.4	7.1	8	37.1	4.6	5	6.8	1.4

Test Location	PILE (A)			PILE (B)			PILE (C)		
	Embedment Depth	Total Drive Time	Average Drive Time	Embedment Depth	Total Drive Time	Average Drive Time	Embedment Depth	Total Drive Time	Average Drive Time
	Ft.	Sec.	Sec./ft.	Ft.	Sec.	Sec./ft.	Ft.	Sec.	Sec./ft.
PLT-03[1]	5	97.2	19.4	8	239.4	29.9	5	61.2	12.2
PLT-04[1]	5	27.6	5.5	8	208.7	26.1	5	25.6	5.1
PLT-05[1]	5	15.0	3.0	8	27.3	3.4	5	10.0	2.0
PLT-06[1]	5	29.8	6.0	8	75.7	9.5	5	41.4	8.3
PLT-101	5	26.1	5.2	8	14.6	2.9	---	---	---
PLT-103	5	5.9	1.2	8	11.3	1.4	---	---	---
PLT-104	5	5.3	1.1	8	15.9	2.0	---	---	---
PLT-105	5	20.8	4.2	8	56.9	7.1	---	---	---
PLT-106	5	14.6	2.9	8	39.0	4.9	---	---	---
PLT-107	5	12.9	2.6	8	23.9	3.0	---	---	---
PLT-108	5	8.1	1.6	8	9.2	1.2	---	---	---
PLT-109	5	16.7	3.3	8	37.6	4.7	---	---	---
PLT-110	---	---	---	---	---	---	5	7.5	1.5
PLT-102A	5	189	37.8	8	212	26.5	4.42	258	58.4
PLT-110A	5	52	10.4	8	136.0	17.0	3.83	154.0	40.2

1. Pile test location was performed as part of the preliminary phase.

Pile installation was performed initially in August of 2023 with additional piles installed in March of 2024, all piles were allowed to sit undisturbed for a minimum of 72 hours before testing began. Testing occurred during September and October of 2023 on the initial piles, with follow up testing in March 2024.

5.3 Testing Under Axial Compressive Load

A total of 7 piles were tested under axial compressive load. Please note that test piles with the designation “C” were tested under axial compressive load. Piles with the designation “C” were all embedded 5 feet below the ground surface.

We performed tests under axial compressive loads as generally described below. These procedures were developed with reference to ASTM D1143, *Test Methods for Deep Foundations under Static Axial Compressive Load.*

A Komatsu PC170 excavator was mobilized to the site to provide a reaction for the applied vertical compression test loads. A load cell was placed on the top of the pile, and a hydraulic cylinder (jack) was placed above the load cell and under the excavator counterweight.

The loads were applied in 500 lbs. increments up to a load of 15,000 lbs. or until the pile reached ¾-inch deflection. Each load increment was held for about 60 seconds and the stabilized deflection reading of both indicator gauges were recorded.

Deflections were measured with digital dial gauges and loads were measured with a digital weight indicator connected to a load cell. The gauges were read, and the data was recorded manually by Terracon field personnel.

5.4 Testing Under Axial Tensile ("pull-out") Load

We performed testing under axial tensile load for the piles at each location using the procedures generally outlined below.

A total of 30 piles, two piles at 15 PLT locations, were tested under axial tensile ("pull-out") load. Please note that test piles with the designations "A" and "B" were tested under axial tensile load. Piles with the designation "A" were all embedded 5 feet below the ground surface, and piles with the designation "B" were embedded to 8 feet below the ground surface.

The "pull-out" load reaction was supported using Terracon's proprietary 20-kip tripod frame supported at an appropriate lateral distance from the post. A hydraulic jack and pump were used to apply the test loads using chains and other accessories all rated for at least a 10-ton safe working capacity. Deflections were measured with digital dial gauges with magnetic bases. Loads were measured with a electronic dynamometer.

The axial tension load was applied in load increments of 500 lbs. to a maximum of 10,000 lbs. or until the pile reached ¾-inch deflection. Deflection measurements were taken at the end of application of each load increment. Each load increment was sustained for about 60 seconds and the stabilized deflection readings of both indicator gauges were recorded.

5.5 Testing Under Lateral Load

After testing under axial tensile load, the piles at each location were then tested under lateral load as described below.

A total of 30 piles, two piles at 15 PLT locations, were tested under lateral load. Please note that test piles with the designations "A" and "B" were tested under lateral load. Piles with the

designation “A” were all embedded 5 feet below the ground surface, and piles with the designation “B” were embedded to 8 feet below the ground surface. As the test piles were installed in-line with each other, the piles were connected together to provide a reaction for the opposite pile and tested simultaneously in the strong axis direction.

For lateral testing, the pair of piles were pulled toward each other, and deflections of each pile were measured. The load for the lateral tests was applied at about 3½ feet above the ground surface against the strong axis of the posts. The loads were applied in 500 lbs. increments in 5 cycles from 0 pounds to the ultimate lateral load of 7,000 lbs. or the limits of the soil capacity, whichever occurred first for each test pile. The limit of soil capacity during the lateral test is defined as movement in excess of 1-inch at 6 inches above the ground surface. Each load increment was held for at least 60 seconds and the stabilized deflection readings of both indicator gauges were recorded.

Deflections were measured with digital dial gauges and loads were measured with a electronic dynamometer. The gauges were read, and the data was recorded manually by Terracon field personnel.

5.6 Summary of Pile Load Test Results

In general, the axial compressive, tensile, and lateral loads were applied at approximately 500-pound increments. The maximum applied load during the axial compression test was 13,000 lbs. or until the deflection exceeded ¾ of an inch. The maximum applied load during the axial tension test was 10,000 lbs. or until the deflection exceeded ¾ of an inch. The maximum applied load during the lateral load test was 7,000 lbs. or until the deflection exceeded 1- inch when measured at 6 inches above the ground surface.

The following table provides a summary of the tension loads for vertical pile displacement of about ¼-inch.

Pile Load Test Location	Embedment Depth	Tension Load at ¼” Disp.	Pile Load Test Location	Embedment Depth	Tension Load at ¼” Disp.
	ft.	lbs.		ft.	lbs.
PLT-001A[1]	5	10,000+	PLT-001B[1]	8	10,000+
PLT-002A[1]	5	10,000+	PLT-002B[1]	8	10,000+
PLT-003A[1]	5	10,000+	PLT-003B[1]	8	10,000+
PLT-004A[1]	5	10,000+	PLT-004B[1]	8	10,000+
PLT-005A[1]	5	4,530	PLT-005B[1]	8	5,350
PLT-006A[1]	5	10,000+	PLT-006B[1]	8	10,000+

Pile Load Test Location	Embedment Depth	Tension Load at ¼" Disp.	Pile Load Test Location	Embedment Depth	Tension Load at ¼" Disp.
	ft.	lbs.		ft.	lbs.
PLT-101A	5	10,000+	PLT-101B	8	10,000+
PLT-102A	5	10,000+	PLT-102B	8	10,000+
PLT-103A	5	3,630	PLT-103B	8	6,080
PLT-104A	5	4,290	PLT-104B	8	10,000+
PLT-105A	5	10,000+	PLT-105B	8	10,000+
PLT-106A	5	10,000+	PLT-106B[2]	9	10,000+
PLT-107A	5	10,000+	PLT-107B	8	10,000+
PLT-108A	5	3,590	PLT-108B	8	4,360
PLT-109A	5	10,000+	PLT-109B	8	10,000+
PLT-110A	5	4,750	PLT-110B	8	10,000+

1. Pile test location was performed as part of the preliminary phase.
2. Pile accidentally driven an extra foot deep

The following table provides a summary of the pile embedment depth and lateral load at ½-inch lateral displacement at 6 inches above ground surface.

Pile Load Test Location	Embedment Depth	Lateral Load at ½" Disp.	Pile Load Test Location	Embedment Depth	Lateral Load at ½" Disp.
	ft.	lbs.		ft.	lbs.
PLT-01A[1]	5	3,970	PLT-01B[1]	8	3,820
PLT-02A[1]	5	3,690	PLT-02B[1]	8	3,780
PLT-03A[1]	5	5,190	PLT-03B[1]	8	4,980
PLT-04A[1]	5	3,670	PLT-04B[1]	8	4,580
PLT-05A[1]	5	3,190	PLT-05B[1]	8	4,790
PLT-06A[1]	5	3,100	PLT-06B[1]	8	3,790
PLT-101A	5	4,590	PLT-101B	8	4,320
PLT-102A	5	5,000	PLT-102B	8	4,500
PLT-103A	5	3,370	PLT-103B	8	4,570
PLT-104A	5	2,450	PLT-104B	8	3,300
PLT-105A	5	3,930	PLT-105B	8	4,110

Pile Load Test Location	Embedment Depth	Lateral Load at ½" Disp.	Pile Load Test Location	Embedment Depth	Lateral Load at ½" Disp.
	ft.	lbs.		ft.	lbs.
PLT-106A	5	5,120	PLT-106B	8	5,170
PLT-107A	5	3,840	PLT-107B	8	4,370
PLT-108A	5	2,820	PLT-108B	8	3,260
PLT-109A	5	3,740	PLT-109B	8	4,690
PLT-110A	5	4,000	PLT-110B	8	5,000

1. Pile test location was performed as part of the preliminary phase.
2. Test ended before reaching ½" lateral deflection due to excessive movement from "B" pile.

The following table provides a summary of the compression loads for vertical pile displacement of about ¼-inch.

Pile Load Test Location	Embedment Depth	Compression Load at ¼" Disp.
	ft.	lbs.
PLT-01C[1]	5	13,000+
PLT-02C[1]	5	7,410
PLT-03C[1]	5	13,000+
PLT-04C[1]	5	13,000+
PLT-05C[1]	5	8,930
PLT-06C[1]	5	13,000+
PLT-102C[2]	4.42	10,000+
PLT-110C[3]	3.83	7,000+

1. Pile test location was performed as part of the preliminary phase.
2. Field staff stopped test at 10,000.
3. Test stopped at 7000 due to lateral deflection of the pile.

The compression test load vs. deflection graphs are shown as Exhibits F-1 through F-7 in Appendix F.

The tension test load vs. deflection graphs are shown as Exhibits G-1 through G-29 in Appendix G.

The lateral test load vs. deflection graphs are shown as Exhibits H-1 through H-29 in Appendix H.

6.0 PV Solar Array Field – Recommendations For Design And Construction

6.1 Geotechnical Considerations

We would expect the PV panels to be supported by driven piles, while inverters could be supported on mat foundations and/or driven piles. The proposed structure types and loading information was not available at the time of this report. Settlement and strength parameters were analyzed using soil compressibility properties derived from the SPT borings along with the results of pile load testing program.

Results of the pile load tests indicate that driven steel piles should be suitable for support of the planned solar panels. Piles with embedment depths between 5 and 8 feet or greater should be suitable for support of PV array panels. We have provided geotechnical engineering parameters in this report to assist the designers of production piles. Subsurface conditions that could hinder pile driving were generally not encountered within the borings and test pits, and no pile refusals occurred during the pile load testing to a maximum depth of 8 feet.

Based on the results of the axial and lateral pile load testing program, we have partitioned the site into two (2) zones for axial parameters and two (2) zones for lateral parameters. Each pile load test (PLT) location was assigned into either Zone 1, or 2 based on the axial test performance/results, and into either Zone A or B based on the lateral test performance/results. The project site was then zoned by matching test locations by their axial and lateral group. The resulting zones are then designated as A1, A2, B1, and B2 where the zone numbers correspond to the axial parameter zone and the zone letter corresponds to the lateral parameter zone. The following table presents the results of the designated zones determined on the site:

	Zone A1	Zone A2	Zone B1	Zone B2
Preliminary Phase PTL	PLT-005	PLT-006		PLT-001, PLT-002, PLT-003. PLT-004
Design Phase PLT	PLT-104, PLT-108	--	PLT-103, PLT-110	PLT-101, PLT-102, PLT-105, PLT-106, PLT-107, PLT-109

A map of these zones is provided on the attached Pile Load Test Zoning Plan (Exhibit E-1) in Appendix E.

It should be noted that the axial tension performance varied significantly across the site, and while an attempt has been made to quantify this variability, isolated areas of lower strength soils within zones of relatively high strength soils may exist, and vice versa. When carrying out the quality control program of testing production piles across the site, some of these relatively weaker soil areas may be encountered.

As part of the overall quality control program, the time rate of installation (seconds per foot of embedment) should be recorded during production post driving. As a direct extension of the design process, additional "proof" testing should be performed on a representative number of production posts that do not meet the minimum installation rate criteria outlined in this report.

Geotechnical engineering recommendations for foundation systems and other earth connected phases of the project are outlined in this report. The recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and our current understanding of the proposed project.

6.2 Solar Panel Support Pile Design Recommendations

6.2.1 Adfreeze Stress and Depth To Which Adfreeze Applies

In cold weather climates, design to resist frost heave forces exerted on foundations is often a significant factor in the foundation design. Specifically, pile lengths will need to be long enough to counteract potential heave forces in the seasonal frost zone. As the frost penetrates deeper into the soil and the ground swells due to freezing, a portion of the soil profile and ground surface will rise due to frost heaving. The upward displacement is due to freezing water contained in the soil voids along with the formation of ice lenses in the soil. The freezing material grips the steel pile and exerts an uplift force due to the adfreeze stress developed around the surface area of the pile. The amount of upward force depends on the following:

- the thickness of ice lenses formed in the seasonal frozen ground
- the bond between the steel pile surface and the frozen ground
- the surface area of the steel pile in the seasonally frozen ground

Adfreeze on pile foundations may be significant. If the anchorage of the foundations and the deadweight of the pile are not sufficient to resist these upward forces, adfreeze load can cause uplift to structures.

Based on the soil type and laboratory data, it is Terracon's professional opinion that the near-surface soils encountered in the borings drilled at this site are frost susceptible to a depth of 24 inches below ground surface. However, due to the lack of shallow groundwater, we believe the risk of frost heave due to adfreeze stress is negligible.

6.2.2 Axial Capacity Recommendations

The axial uplift capacity of driven piles may be estimated based on skin friction developed along the perimeter of the pile, while the compression capacity may be estimated using the skin friction and end bearing. When determining embedment depths, the perimeter of a wide flange beam should be taken as twice the sum of the flange width and section depth. Terracon assumes the Ultimate End Bearing values provided below are appliable for comparable W6 and W8 piles. The upper 12 inches of soil for each pile should be neglected in the axial capacity analyses due to considerations of strength losses that can occur due to soil moisture variations, shrinkage, and other potential surface disturbances.

The ultimate axial capacity of driven steel piles may be calculated using skin friction and end bearing values as presented in the following table. Based on the results of the axial pile load testing program, we recommend the site be broken into two zones as follows:

Axial Design Parameters

Axial Zone	Minimum Embedment Depth (feet-bgs)	Ultimate Uplift and Compression Unit Skin Friction (psf)	Ultimate End Bearing (lbs.)[4]
1	5 [1]	450[2]	1,000[2]
	5.1 to 8		
	8.1 to 20	450[3]	1,000[3]
2	5 [1]	1,150[2]	2,000[2]
	5.1 to 8		
	8.1 to 20	1,150[3]	2,000[3]

1. The minimum embedment depth for the pile is 5 feet, and the uppermost 1 foot of pile embedment should be ignored when considering the axial capacity of driven steel piles.
2. The minimum factor of safety to be applied for embedment depths up to 8 ft. should be 1.5.
3. The minimum factor of safety to be applied for embedment depths greater than 8 ft. should be 2.0.
4. Ultimate end bearing was determined by taking the difference between compression values at ¼ inch deflection and axial tension values at ¼ inch deflection.

The above values are to be used in the following equations to obtain the allowable uplift or compression load capacity of a pile:

$$Q_{all\ (compressive)} = ((Q_{ult\ (end)}) / FS) + ((H \times P \times q_s) / FS)^*$$

$$Q_{all\ (uplift)} = (H \times P \times q_s) / FS^*$$

Q_{ult} = Ultimate uplift or compression capacity of pile (lbs.)
$Q_{ult\ (end)}$ = Ultimate end bearing per table above (lbs.)
H = Depth of embedment of pile (ft)
P = Box perimeter of pile. (ex., W6x9 = 1.64 ft.)
q_s = Ultimate skin friction per table above (psf)
*Note, the upper 1 foot should be subtracted from the layer thickness (H) for the first layer.

An example calculation to determine the allowable capacity for a W6x9 pile in tension and founded at a depth of 9 feet in the area of Axial Zone 2 would be as follows:

$$Q_{all\ (up)} = (5-1)\ x\ 1.64\ x \frac{450}{1.5} + (8-5) x\ 1.64\ x \frac{1,150}{1.5} + (9-8) x\ 1.64\ x \frac{1,150}{2.0} = 6,683$$

The above ultimate skin friction and end bearing values are applicable for piles that are driven for a minimum of 2 seconds per foot for a 5-foot embedment using equipment similar to a GAYK Model HRE 4000 equipped with a hydraulic hammer. If a smaller or larger drive hammer is used, we recommend Terracon be consulted to determine the minimum drive time based on the proposed equipment to be used for driving of the piles.

Piles should have a minimum center-to-center spacing of at least 5 times their largest cross-sectional dimension to prevent reduction in the axial capacities due to group effects.

6.2.3 Lateral Capacity Recommendations

Lateral load response of pile foundations was calculated using the computer program LPILE 2022, by Ensoft, Inc. The stiffness of the pile and the stress-strain properties of the surrounding soils determine the lateral resistance of the foundation. We modeled the lateral response of the tested piles to evaluate L-Pile input parameters for each zone. Recommended L-Pile input parameters lateral load analysis for driven pile foundations are shown in the following table:

LPILE Parameters					
Depth Range of Layer (feet)	Soil Type [1]	Effective Unit Weight (pcf)	Friction Angle (°)	Cohesion (psf)	K or ϵ50 [2]
0 – 4	Sand (Reese)	115	36	---	Allow LPILE to choose this value
4 – 20	Sand (Reese)	120	40	---	

1. See Subsurface Profile in Geotechnical Characterization for more details on Stratigraphy.
2. LPILE estimates values of static lateral subgrade modulus (K) and strain modulus (ε50) based on soil properties. We recommend using LPILE spring stiffness default values for both K and ε50 because the p-multiplier presented in the table below was determined with the software default values.

The lateral load test results were varied between the different locations and embedment depths at the site. Therefore, we are providing the following table of p-multiplier values that should be used for the corresponding zone and embedment depth:

P-Multipliers

Lateral Group	Minimum Embedment Depth	P-Multiplier[1, 2, 3]
A	5	2.7
	8	3.8
B	5	5.0
	8	5.0

1. For embedment depths between 5 and 8 feet, linearly interpolate between the values provided. The calculated value should then be applied to the entire pile depth.
2. The *p*-multiplier values provided in this table are only applicable to piles installed to a depth of at least 5 feet.
3. The *p*-multiplier value for the 8-foot-deep piles may be used for piles installed deeper than 8 feet.

Lateral analyses were performed using LPILE to generate a load versus deflection curve that generally matched the results of the field load tests for each group and each embedment depth. The shear load was applied at approximately 3.5 feet above the ground surface. The effective unit weights, cohesions, and friction angles were based on the subsurface conditions observed from the borings. The cohesions, friction angles, effective unit weights, and p-multipliers were then adjusted (by trial-and-error method) such that the applied load resulted in a deflection value that matched the load test results. Please note that this procedure was based on only one discrete set of data determined at about six inches from the ground surface during the field load testing. These results should be used for LPILE analysis only using the 2022 version of LPILE. These parameters are only applicable to piles installed a minimum of 5 feet below grade. In our evaluation, the piles were modeled as a Steel AISC Section Strong Axis with a yield stress of 50 ksi.

The structural engineer should evaluate the moment capacity of the pile as part of their structural evaluation. Piles should have a minimum center-to-center spacing of at least five times their largest cross-sectional dimension in the direction of the lateral loads, or the lateral capacities should be reduced due to group effects. If piles will be spaced closer than five

times their largest cross-sectional dimension, we should be notified to provide supplemental recommendations regarding resistance to lateral loads.

6.2.4 Construction Considerations

Based on the field exploration and laboratory testing, it is our opinion that the soils on the site are suitable for pile installation. Possible obstructions (very dense soils, gravel, and cobbles) that could impede the installation of the piles were generally not observed within typical pile driving depths within the borings, and no pile driving refusal was encountered during pile installation.

6.3 Pile Design Recommendations for Other Structures

Some structures may require piles to be driven to greater depths than 8 feet in order to achieve the required axial capacities.

For allowable strength design, we recommend the allowable skin friction and end bearing be determined by applying a factor of safety of at least 2 to the ultimate values provided in this section for piles embedded greater than 8 feet. Recommended ultimate skin friction, end bearing, and factor of safety are presented below:

Pile Embedment Depth (ft)	Ultimate Skin Friction q_s (psf)	Ultimate End Bearing $Q_{ult\text{-}(end)}$ (lbs)	Factor of Safety
Zone 1			
0 to 1	---	---	---
1 to 5	450	---	1.5
5 to 8	450	1,000	1.5
8+	450	1,000	2.0
Zone 2			
0 to 1	---	---	---
1 to 5	1,150	2,000	1.5
5 to 8	1,150	2,000	1.5
8+	1,150	2,000	2.0

For piles embedded between depths of 8 and 16½ feet throughout the site: When determining embedment depths, the perimeter of a wide flange beam should be taken as twice the sum of the flange width and web depth, and the upper 12 inches of soil for each pile should be neglected.

For W6x9 piles or larger pile sections with embedment depths between 8 and 16½ feet: The ultimate unit end bearing for alternate pile sections should be assumed to be the same as the W6x9 piles tested for this project.

We recommend Terracon be consulted to determine the minimum drive time based on the proposed equipment to be used for driving of the piles.

Piles should have a minimum center-to-center spacing of at least five times their largest cross-sectional dimension to prevent reduction in the axial capacities due to group effects.

6.4 Mat Slab Foundations

If the site has been prepared in accordance with the requirements noted in Section 9.0, the following design parameters are applicable for mat foundations for inverters throughout the Array area.

6.4.1 Frost Susceptible Soils

The frost depth for local building code for the design of shallow spread footing and mat foundations for unheated structures is 24 inches (2 feet). If frost action needs to be accommodated for local building code, the use of non-frost susceptible (NFS) fill extending to the building code frost depth requirement of 2 feet could be implemented. Material commonly used as NFS fill consists of granular soils that are free draining and have a relatively high in-place permeability. It has been our experience that using NFS fill consisting of granular materials on sites with low permeable collapsible soils can create zones where water collects, and the underlying collapsible soils become wetted and settle rapidly. This can result in undesirable downward movement for foundations constructed on these materials. An alternative to a free draining NFS material, while not commonly used, is an appropriate low permeable Controlled Low Strength Material (CLSM).

If a low permeable NFS fill material cannot be obtained or is cost prohibitive, structural slabs (for instance, structural stoops in front of building doors), supported on frost-depth footings, should be used. Placement of low permeable NFS material in large areas may not be economically feasible; however, the following recommendations are provided to help reduce potential frost heave for grade supported structures:

- Provide surface drainage away from the structures and slabs, and toward the site storm drainage system.
- Install drains around the perimeter of the structures as well as below exterior slabs and access roadways and connect them to the storm drainage system.
- Grade clayey subgrades, so groundwater potentially perched in overlying more permeable subgrades, such as sand or aggregate base, slopes toward a site drainage system.

- Place low permeable CLSM fill as backfill beneath slabs and access roadways critical to the project.
- Consider structural slabs supported on frost-depth footings.
- Consider placing another type of Frost Protected Shallow Foundation (FPSF) system

6.4.2 Mat Foundations Design Recommendations

Reinforced mat foundations are considered suitable for the support of the proposed inverters on the project. Mat foundations should be designed based on the criteria outlined below:

Design Item	Description/Recommendations
Foundation Type	Mat foundations
Maximum Design Contact Stress[1,2]	Any practical value up to a maximum of 1,500 psf
Minimum Embedment Depth Below finished grade [3]	24 inches for frost protection 6 inches if underlain by 18 feet of NFS fill (mat/slab foundations)[2]
Bearing Material	A minimum of 4 feet engineered fill placed within the geometric configurations and depths below mat foundations as outlined in Section 9.0 of this report.
Design Modulus of Subgrade Reaction, k	125 pci
Minimum Width	4 feet
Maximum Width	10 feet
Modulus Correction Factor[4]	$k_c = k((b+1)/2b)^2$
Total Estimated Settlement[5,6]	1 inch or less
Differential Settlement	¾-inch over 40 feet
Coefficient of Base Friction	0.35[7]
Passive Pressure	300 pcf[8]

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The allowable bearing pressure may be increased by one-third when considering the alternative load combinations of Section 1605.3.2 of the 2015 International Building Code, however, it should not be increased when loads are determined by the basic allowable stress design load combinations of Section 1605.3.1. A factor of safety of 3 was utilized for bearing capacity and 1 inch service limit was utilized to determine capacity for settlement.

Design Item	Description/Recommendations

2. Finished grade is defined as the lowest adjacent grade within 5 feet of the foundation for perimeter (or exterior) footings and finished floor level for interior footings. The minimum embedment depth is recommended for frost protection. Shallower embedment depths can be considered with no changes to the allowable bearing capacity or estimated settlements outlined above. There is an inherent risk that scour and erosion of the soils beneath the slabs could lead to a partially unsupported mat and/or an increase in the settlements outlined above.
3. Embedment necessary to minimize the effects of frost and seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
4. It is common to reduce the k-value to account for dimensional effects of large loaded areas. Where k_c is the corrected or design modulus value and b is the mat width (short dimension) or tributary loaded area.
5. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. Footings should be proportioned to relatively constant dead-load pressure in order to reduce differential movement between adjacent footings.
6. These design recommendations are applicable for maximum foundation dimensions of 20 feet.
7. Value should be reduced to 0.30 when used in conjunction with the passive pressure.
8. No factor of safety applied.

Additional foundation movements could occur if water from any source infiltrates the foundation soils; therefore, proper drainage should be provided in the final design and during construction. Drainage design is the responsibility of the Civil Designer.

Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

6.4.3 Foundation Construction Considerations

As noted in Section 9.0, the foundation excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the foundation excavations should be removed/reconditioned before foundation concrete is placed.

7.0 Substation, BESS, Switching Station, And Overhead Transmission Line – Recommendations For Design And Construction

7.1 Geotechnical Considerations

We expect several small structures to house equipment and provide storage to be constructed as part of the substation portion of the project. The proposed structure types and loading information were not available at the time of this report. Settlement potential was analyzed using soil compressibility properties derived from the borings drilled in the planned substation and BESS areas and assumed structural loads. We estimate total settlements will be less than 1-inch provided column loads are less than 150 kips and the applied bearing pressure of small, isolated slabs or mats is less than about 2,000 psf. Shallow foundation systems for support of lightly-loaded buildings and equipment pads will be acceptable provided these maximum loads are not exceeded. Once loading for these ancillary structures is better known, detailed settlement analyses can be performed to confirm shallow foundation acceptability. As an alternative to shallow foundations, driven pile foundations may be utilized. Please refer to sections Section 6.2 for capacity.

Proposed substation structures may also be supported as direct embed poles or poles supported on drilled shaft foundations designed using the soil properties presented in this report. Drilled shafts and direct embed poles should be designed and constructed in accordance with Section 7.3 of this report.

The on-site soils exhibited low to moderate compressibility and hydro-collapse potential under typical foundation loads in their existing conditions; therefore, all building structure foundations should bear on a minimum of 4 feet of properly placed and compacted engineered fill material.

7.2 Spread Footing and Isolated Slab Foundations

7.2.1 General

We understand within the substation that some equipment may be supported on mat/slab foundations, while other building(s) may be supported on shallow footing foundations.

If the site has been prepared in accordance with the requirements noted in Section 9.0, the following design parameters are applicable for mat foundations for inverters throughout the Array area.
The following sections present design recommendations and construction considerations for the shallow foundations for proposed lightly loaded structures and related structural elements.

7.2.2 Spread Footing and Mat /Slab Foundation Design Recommendations

Description	Columns	Walls	Mat/Slab
Net allowable bearing pressure[1,2]	2,000 psf	2,000 psf	1,500 psf
Modulus of subgrade reaction for slab-on-grade design	200 pounds per square inch per in (psi/in) for point loading conditions		
Bearing material	Shallow footings and mat/slab foundations should be supported on a minimum of 4 feet engineered fill consisting of on-site soils as outlined in Section 9.0		
Minimum dimensions	30 inches	18 inches	4 feet
Minimum embedment below finished grade[3]	24 inches for frost protection 6 inches if underlain by 18 feet of NFS fill (mat/slab foundations)[2]		
Approximate total settlement[4,5]	<1 inch	<1 inch	<1 inch
Estimated differential settlement	< ½ inch between columns	< ½ inch over 40 feet	< ½ inch over 40 feet
Coefficient of Base Friction	0.35[6]		
Passive Pressure	300 pcf[7]		

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. It assumes any unsuitable soils, if encountered, will be replaced with compacted structural fill.
2. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The allowable bearing pressure may be increased by one-third when considering the alternative load combinations of Section 1605.3.2 of the 2012 International Building Code, however, it should not be increased when loads are determined by the basic allowable stress design load combinations of Section 1605.3.1.
3. Embedment necessary to minimize the effects of frost and seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
4. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. Footings should be proportioned

Description	Columns	Walls	Mat/Slab

to relatively constant dead-load pressure in order to reduce differential movement between adjacent footings.

5. These design recommendations are applicable for maximum foundation dimensions of 20 feet.
6. Value should be reduced to 0.30 when used in conjunction with the passive pressure.
7. No factor of safety applied.

Footings, foundations, and walls should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in walls is recommended.

Foundation excavations should be observed by the Geotechnical Engineer. If the soil conditions encountered differ significantly from those presented in this report, Terracon should be contacted to provide additional evaluation and supplemental recommendations.

7.2.3 Spread Footing and Mat/Slab Construction Considerations

The foundation excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the foundation excavations should be removed/reconditioned before foundation concrete is placed.

7.3 Drilled Shaft Foundation Design

7.3.1 Drilled Shaft Design Parameters

Straight sided drilled shaft foundations drilled into natural soils are also considered suitable for support of the proposed substation, switching station, and transmission line structures. Soil design parameters are provided below in the Drilled Shaft Design Summary table for the design of drilled shaft foundations. The values presented for allowable side friction and end bearing include a factor of safety.

Drilled Shaft Design Summary[1]

Location	Depth (feet-bgs)	Stratigraphy [2]	Allowable Skin Friction (ksf) [3,4]	Allowable End Bearing Pressure (ksf) [4,5]
	0 to 3[6]	IGNORE	---	---

Drilled Shaft Design Summary[1]

Location	Depth (feet-bgs)	Stratigraphy [2]	Allowable Skin Friction (ksf) [3,4]	Allowable End Bearing Pressure (ksf) [4,5]
Substation /Bess Area	3 to 7	Silty Sand; Loose	0.20	2.0
	7 to 14	Clayey Sand; Loose	0.40	10.0
	14 to 29	Well Graded Sand; Dense	0.75	13.0
	29 to 39	Clayey Sand; Medium Dense	0.90	7.0
	39 to 41.5	Silty Sand; Very Dense	1.05	40.0
T-01	0 to 3[6]	IGNORE	---	---
	3 to 7	Lean Clay; Very Stiff to Hard	0.75	12.0
	7 to 14	Clayey Sand; Medium Dense	0.35	5.0
	14 to 24	Lean Clay; Stiff	0.35	6.0
	24 to 29	Silty Sand; Dense	0.75	12.5
	29 to 31.5	Lean Clay; Very Stiff	0.55	9.0
T-02	0 to 3[6]	IGNORE	---	---
	3 to 7	Sandy Silt; Hard	0.20	24.0
	7 to 14	Sandy Silt; Very Stiff	0.35	11.0
	14 to 24	Lean Clay; Very Stiff	0.55	9.0
	24 to 29	Silty Sand; Medium Dense	0.55	9.0
	29 to 31.5	Silty Sand; Dense	0.75	12.5
T-03	0 to 3[6]	IGNORE	---	---
	3 to 9	Lean Clay; Medium Stiff	0.20	3.0
	9 to 14	Silty Sand; Medium Dense	0.40	5.0
	14 to 19	Silty Clayey Sand; Loose	0.50	3.5
	19 to 24	Silty Sand; Loose	0.60	1.5

Drilled Shaft Design Summary[1]

Location	Depth (feet-bgs)	Stratigraphy [2]	Allowable Skin Friction (ksf) [3,4]	Allowable End Bearing Pressure (ksf) [4,5]
	24 to 31.5	Silty Sand; Dense	0.75	10.5
T-04, Switching Station Area	0 to 3[6]	IGNORE	---	---
	3 to 9	Silty Sand; Medium Dense	0.25	4.5
	9 to 15	Sandy Silt; Stiff	0.45	9.0
	15 to 20	Sandy Silt; Very Stiff	0.60	8.5
	20 to 25	Sandy Silt; Hard	0.70	14.5
	25 to 31.5	Clayey Sand; Medium Dense	0.85	10.5

1. Design capacities are dependent upon the method of installation and quality control parameters. The values provided are estimates and should be verified when installation protocol have been finalized.
2. See Subsurface Profile in Typical Subsurface Profile for more details on stratigraphy.
3. The effective weight of the shaft can be added to uplift load resistance to the extent permitted by IBC.
4. Values presented include a factor of safety of 2.0 for skin friction and 3.0 for end-bearing. Skin frictions should be neglected for direct embed poles.
5. The full end bearing pressure is applicable for drilled shafts embedded a minimum of one shaft diameter into the bearing stratum. For example, to use the full end bearing pressure below a depth of 10 feet, the bottom of a 3-foot diameter shaft must be founded at 13 ft. or greater.
6. Not recommended to be used due to potential ground disturbance and frost depth.

7.3.2 Drilled Shaft Lateral Loading

LPILE: The following table lists input values for use in LPILE analyses. Recommended geotechnical parameters for lateral load analysis of the drilled shaft foundations have been developed for use in the computer program LPILE that utilizes P-y curve analyses, and they are presented in the following table. Modern versions of LPILE provide estimated default values of k_h and E_{50} based on strength and are recommended for the project. Since deflection or a service limit criterion will most likely control lateral capacity design, no safety/resistance factor is included with the parameters.

Stratigraphy		LPILE Soil Model	Total Unit Weight (pcf)	Friction Angle °	Cohesion (psf)	ε_{50}	Soil Modulus, k (pci)
Boring No.	Depth						
Substation, BESS Area	3 to 7	Sand (Reese)	100	28	---	Allow LPILE to use Default Values based on other parameters listed in this table.	
	7 to 14	Sand (Reese)	125	35	---		
	14 to 29	Sand (Reese)	125	37	---		
	29 to 39	Sand (Reese)	120	32	---		
	39 to 41.5	Sand (Reese)	125	40	---		
T-01	3 to 7	Stiff Clay w/o Free Water	110	---	6000		
	7 to 14	Sand (Reese)	100	37	---		
	14 to 24	Stiff Clay w/o Free Water	100	---	3500		
	24 to 29	Sand (Reese)	110	33	---		
	29 to 31.5	Stiff Clay w/o Free Water	110	---	4000		
T-02	3 to 7	Sand (Reese)	95	28	---		
	7 to 14	Sand (Reese)	100	31	---		
	14 to 19	Stiff Clay w/o Free Water	100	---	3000		
	19 to 24	Stiff Clay w/o Free Water	100	---	3000		
	24 to 31.5	Sand (Reese)	110	34	---		
T-03	3 to 7	Stiff Clay w/o Free Water	95	---	1500		
	7 to 14	Stiff Clay w/o Free Water	95	---	2500		
	14 to 19	Sand (Reese)	100	35	---		
	19 to 24	Sand (Reese)	100	28	---		
	24 to 31.5	Sand (Reese)	105	34	---		
T-04, Switching Station Area	3 to 9	Sand (Reese)	105	30.5	---		
	9 to 15	Sand (Reese)	125	32	---		
	15 to 20	Sand (Reese)	125	35	---		

Stratigraphy		LPILE Soil Model	Total Unit Weight (pcf)	Friction Angle °	Cohesion (psf)	ε_{50}	Soil Modulus, k (pci)
Boring No.	Depth						
	20 to 25	Sand (Reese)	115	36	---		
	25 to 31.5	Sand (Reese)	120	35	---		

MFAD: The following table lists input values for use in Moment Foundation Analysis and Design (MFAD). Since deflection or a service limit criterion will most likely control lateral capacity design, no safety/resistance factor is included with the parameters.

Stratigraphy		Soil Type	Total Unit Weight (pcf)	Friction Angle °	Cohesion (psf)	Modulus of Deformation, E_p (ksi)
Boring No.	Depth					
Substation, BESS Area	3 to 7	Granular	100	28	---	0.5
	7 to 14	Granular	125	35	---	1.5
	14 to 29	Granular	125	37	---	3.2
	29 to 39	Granular	120	32	---	1.0
	39 to 41.5	Granular	125	40	---	10
T-01	3 to 7	Cohesive	110	---	6000	4.9
	7 to 14	Granular	100	37	---	0.6
	14 to 24	Cohesive	100	---	3500	0.9
	24 to 29	Granular	110	33	---	3.1
	29 to 31.5	Cohesive	110	---	4000	1.9
T-02	3 to 7	Granular	95	28	---	3.5
	7 to 14	Granular	100	31	---	1.7
	14 to 19	Cohesive	100	---	3000	2.1
	19 to 24	Cohesive	100	---	3000	1.7
	24 to 31.5	Granular	110	34	---	3.1
T-03	3 to 7	Cohesive	95	---	1500	0.3

Stratigraphy		Soil Type	Total Unit Weight (pcf)	Friction Angle °	Cohesion (psf)	Modulus of Deformation, E_p (ksi)
Boring No.	Depth					
	7 to 14	Cohesive	95	---	2500	1.2
	14 to 19	Granular	100	35	---	0.9
	19 to 24	Granular	100	28	---	0.2
	24 to 31.5	Granular	105	34	---	2.6
T-04, Switching Station Area	3 to 9	Granular	105	30.5	---	1.1
	9 to 15	Granular	125	32	---	1.3
	15 to 20	Granular	125	35	---	1.2
	20 to 25	Granular	115	36	---	2.0
	25 to 31.5	Granular	120	35	---	1.7

Lateral load design parameters are valid for maximum soil strain of 5 percent acting over a distance of one shaft diameter. All shafts should be reinforced full-depth for the applied axial and lateral stresses imposed.

7.3.3 Drilled Shaft Construction Considerations

Based on the subsurface conditions encountered during the field exploration, drilled shaft excavations for the proposed structures will be advanced into loose to very dense sand soils and soft to hard clay soils with various amounts of gravel and cementation.

Caving materials (particularly within the upper 5 feet) could be encountered during drilled shaft excavation requiring the use of temporary casing. If temporary casing is used for drilled shaft construction, it should be withdrawn in a slow continuous manner maintaining a sufficient head of concrete to prevent the creation of voids in pier concrete. Drilled shaft concrete should have a relatively high fluidity when placed in cased pier holes or through a tremie. Concrete with a slump in the range of 6 to 8 inches is recommended.

Drilled shaft concrete should be placed upon completion of drilling and cleaning. Free-fall concrete placement in drilled shaft excavations will only be acceptable if provisions are taken to prevent aggregate segregation and avoid striking the concrete on the sides of the hole or reinforcing steel. The use of a bottom-dump hopper, or an elephant's trunk discharging near the bottom of the hole where concrete segregation will be minimized, is recommended.
Shaft bearing surfaces should be cleaned prior to concrete placement. A representative of the geotechnical engineer should inspect the bearing surface and shaft configuration. If the soil

conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

8.0 Access Roadways

8.1.1 Aggregate Surface Roadway Design Recommendations

We understand that new roadways for postconstruction traffic within the proposed substation area site will consist of aggregate-surfaced roadways. Design truck load frequencies postconstruction have not been provided. Therefore, we have assumed one pickup truck per day and one fully loaded truck per week with a maximum weight of 80,000 pounds for fire truck loading. Aggregate sections based on a more detailed design could be provided.

Subgrade soils beneath aggregate surfaced roadways should be prepared and constructed as outlined in Section 9.0 of this report. An analysis of the proposed pavement section was performed as outlined in the 1993 AASHTO Design of Pavement Structures for aggregate-surfaced roads (Section 4.1.2). The design analysis evaluates the allowable rutting depth, traffic loading, and subgrade strength as design considerations. The unpaved road sections for postconstruction use have been developed under the following assumptions:

Gravel-Surfaced Roadway Design Parameters		
Parameter	Design Value	Comments
Traffic Loading	up to 10,000 ESALs[1]	Provided by AES
Design Life	35 years	Assumed
Design R-Value	7	Based on lab testing
Resilient Modulus	2,000 psi (saturated)	Based on correlations to R-Value
	5,250 psi (wet)	
	8,000 psi (dry)	
Chemically Treated Subgrade Resilient Modulus	10,000 psi (wet/saturated)	Assumed
	12,000 psi (dry)	
	20,000 psi (frozen)	
Aggregate Base Elastic Modulus	30,000 psi	Assumed
Allowable Rut Depth	2 inches	Assumed
Design Serviceability Loss	2.0	Assumed
Vehicle Tire Pressure	80 psi	Assumed

1. ESAL = 18 kips Equivalent Single Axle Load

As a minimum, we recommend the following for gravel-surfaced access roads:

Typical Gravel-Surfaced Road Section (Non Cement Treated) – Post Construction Traffic			
Traffic Area	Base Course Thickness (in)[1]	Subbase Type	Geogrid Stabilization
Up to 500 ESALs	4	10 inches of compacted on-site soil	No
Up to 1,000 ESALs	4.5		
Up to 5,000 ESALs	7		
Up to 10,000 ESALs	10		

1. Base materials should meet NMDOT specifications

Typical Gravel-Surfaced Road Section (Treated) – Post Construction Traffic			
Traffic Area	Base Course Thickness (in)[1]	Treated Subbase Type	Geogrid Stabilization
Up to 500 ESALs	4	6 inches of compacted treated on-site soil (5% cement)[2]	No
Up to 1,000 ESALs	4.5		
Up to 5,000 ESALs	5		
Up to 10,000 ESALs	6		

1. Base materials should meet NMDOT specifications.
2. Preliminary based on design experience.

Note that whichever type of road is chosen, there will be a need for an ongoing maintenance program. Ruts or potholes that develop should be filled with additional aggregate base rather than by re-grading.

A concern regarding the use of permeable aggregate materials in large pavement areas is that surface water cannot be drained over the surface before it permeates through the aggregate surfacing, which would create a condition where the subgrade soils in moisture content. If the subgrade soils do become elevated in moisture content, the overall performance of the aggregate surfaced pavement areas will be reduced and could result in excessive rutting and may require maintenance or reconstruction of the gravel surface pavement. To help direct surface water over the aggregate surface, we suggest minimum surface slopes of 2% to 3% be constructed and maintained. Surface drainage should be directed away from the pavement areas, and no ponding of water should be allowed on the paved surface or adjacent to the edges of the pavement areas. Drainage design should

be completed by the Civil Designer. If site stripping lowers site grades, equivalent fill volumes should be utilized to bring roadway back up to original grade.

8.1.2 Compacted Native Soils Access Road Design Recommendations

It is our understanding that AES is considering using compacted native soils for the surface of some interior roadways on the project.

Due to the relatively infrequent rain and minimal traffic in the vicinity of the project, it is our opinion that such unsurfaced roadways are anticipated to perform with periodic maintenance under the anticipated light and temporary traffic loading provided the roadways are compacted and prepared in conformance with the compaction requirements in Section 9.0 to a minimum depth of 10 inches.

Compacted native soils roads could pump and yield, increase in rut depth, and unstable conditions could develop during construction operations particularly if the soils increase in moisture content and/or are subjected to repetitive construction traffic. If pumping and rut depths become excessive as construction work progresses, re-grading and re-compaction should be performed as necessary. Care should be taken to reduce or eliminate trafficking of the unpaved access roads when the subgrade is relatively high in moisture content as this will result in accelerated rutting conditions. Scarification, moisture treatment as necessary, and re-compaction of the roadways will likely be necessary as the roadways deteriorate. To help direct surface water over the aggregate surface, we suggest minimum surface slopes of 2% be constructed and maintained. Surface drainage should be directed away from the access road areas, and ponding of water should not be allowed on the access road surfaces or adjacent to the edges of the roadways areas. Drainage design is the responsibility of the Civil Engineer. If site stripping lowers site grades, equivalent fill volumes should be utilized to bring roadway back up to original grade.

8.1.3 Access Roadway Design and Construction Considerations

The roadway subgrade, if prepared early in the project, should be carefully evaluated as the time for construction approaches. We recommend the roadway area be stripped of existing topsoil/organic subsoil, or otherwise unsuitable material, rough graded, and compacted with a heavy roller compactor with vibration, before being proof-rolled with a loaded tandem-axle dump truck. To reduce the potential of development of low spots, an equivalent volume of material to what was removed during stripping should be replaced. Particular attention should be paid to high traffic areas that were rutted and disturbed during construction, and areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by replacing the materials with properly compacted fill.

Aggregate and native surfaced drives, regardless of the section thickness or subgrade preparation measures, will require on-going maintenance and repairs to keep them in a serviceable condition. It is not practical to design a gravel section of sufficient thickness that on-going maintenance will not be required. This is due to the porous nature of the gravel that will allow precipitation and surface water to infiltrate and soften the subgrade soils, and the limited near surface strength of unconfined gravel that makes it susceptible to rutting. When potholes, ruts, depressions or yielding subgrades develop, they must be addressed as soon as possible in order to avoid major repairs.

Maintenance should consist of periodic grading with a road grader. Typical repairs could consist of placing additional gravel in ruts or depressed areas. Potholes and depressions should not be filled by blading adjacent ridges or high areas into the depression areas. New material should be added to the depressed areas as they develop.

Adequate drainage should be provided at the site to reduce the likelihood of an increase in moisture content of the foundation soils. The site should be graded to shed water and avoid ponding over the subgrade. Water should not be allowed to pool against foundations (including driven piles) or within roadways. Drainage design is the responsibility of the Civil Designer.

9.0 Earthwork

9.1.1 General

The site work conditions will be largely dependent on the weather conditions and the contractor's means and methods in controlling surface drainage and protecting the subgrade. The near surface soils encountered across the majority of the project site are anticipated to remain relatively stable; however, they may become unstable with increases in moisture content or due to repetitive traffic. Site preparation where inverter mat foundations will be installed should include clearing and grubbing, installation of a site drainage system (if necessary), and subgrade preparation. Site preparation is not necessary in the PV Array field or where inverters will be supported on driven piles except to improve site drainage where necessary. The following paragraphs present our considerations and recommendations for the PV Array Field portion of the site and subgrade preparation.

The following presents recommendations for site preparation, excavation, subgrade preparation and placement of engineered fills on the project. The recommendations presented for design and construction of earth supported elements including foundations and roadways are contingent upon following the recommendations outlined in this section.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

9.1.2 Site Preparation

Strip and remove existing vegetation, debris, and other deleterious materials from proposed access road areas, and any proposed mat foundations supporting invertors. Native trees, tree stumps and large vegetation should be cleared from the site at the location of mat foundations supporting invertors and roadway areas. Exposed surfaces should be free of mounds and depressions which could prevent uniform compaction in proposed array panel, invertor and access road areas.

Stripped materials consisting of vegetation and organic materials should be wasted from the site. If it is necessary to dispose of organic materials on-site, they should be placed in non-structural areas. This does not mention anything about invasive plants and containing them.

Where proposed inverters will be located, the area should be initially graded to create a relatively level surface to receive fill or be constructed upon, and to provide for a relatively uniform thickness of fill beneath structures (if applicable).

9.1.3 Subgrade Preparation

To mitigate hydro collapse potential in proposed mat/slab foundation areas, the upper 4 feet of subgrade soils beneath existing grade should be removed and recompacted as engineered fill material to mitigate the collapse and compression potential of the native soils. The lateral extents should be 2/3 the depth of replacement. The moisture content and compaction of subgrade soils should be maintained until slab construction. If new mat/slab foundations are in close proximity of each other, the subgrade preparation for the entire footprint that covers the new mat/slab foundations should be completed at the same time.

Subgrade soils beneath roadways should be scarified, moisture conditioned and compacted to a minimum depth of 10 inches. The moisture content and compaction of subgrade soils should be maintained until pavement construction.

Subgrade soils beneath any new interior floor slabs should be scarified, moisture conditioned and compacted to a minimum depth of 12 inches. On-site medium and high plasticity clay soils should be excluded from within the upper 16 inches of subgrade soils beneath any proposed interior floor slabs. The moisture content and compaction of subgrade soils should be maintained until floor slab construction.

Exposed areas which will receive fill, once properly cleared and benched where necessary, including at the base of the recommended over-excavation below foundations, should be scarified to a minimum depth of 10 inches, moisture conditioned, and compacted. Exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.

9.1.4 Fill Material Type

All fill materials should be inorganic soils free of vegetation, debris, and fragments larger than 4 inches in size. Pea gravel or other similar non-cementitious, poorly-graded materials should not be used as fill or backfill without the prior approval of the geotechnical engineer.

Clean on-site soils or approved imported materials may be used as fill material for the following:

Fill Type[1]	USCS Classification	Acceptable Location for Placement
On-Site Medium Plasticity Clay Soils	CL	The near-surface on-site clay soils with Plasticity Index (PI) greater than 15 are not considered suitable for use as engineered fill beneath lightly loaded structures such as mat slabs supporting inverters and BESS structures. These soils may be utilized in non structural areas and as landscaping fill.
On-Site Sand Soils	SM, SC-SM, SC, CL	The on-site low plasticity and non-plastic sand soils with Plasticity Index (PI) less than 15 are considered suitable for use as engineered fill at all locations and elevations.
Imported Material	Varies	All locations and elevations
Non-Frost Susceptible (NFS)	GW, GP, SW and SP	Maximum particle size of 2 inches Maximum of 3 percent passing the No. 200 US sieve size. Below foundations to a depth of at least 24 inches.

1. Controlled, compacted fill should consist of approved materials that are free of organic matter, debris, and oversized materials. A sample of each material type should be submitted to the geotechnical engineer for evaluation.

Imported soils (if required) for use as fill material in foundation and slab areas should conform to low volume change materials as indicated in the following specifications:

Gradation	Percent Finer by Weight (ASTM C 136)
4"	100
No. 4 Sieve	50-100
No. 200 Sieve	15 (min) to 45 (max)
■ Liquid Limit	30 (max)
■ Plasticity Index	10 (max)
■ Maximum expansive potential (%)*	1.5

*Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 2 percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged/inundated.

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Fill lifts should not exceed 10 inches loose thickness. The EPC is responsible for selecting appropriate compaction equipment, and loose lift thickness (up to a maximum of 10 inches), to ensure the recommendations in this report are achieved and verifiable. Corrosion properties of all imported soils should be determined and verified to be in agreement with construction material design.

9.1.5 Compaction Requirements

Engineered fill should meet the following compaction and moisture requirements:

Material Type and Location	Per the Standard Proctor Test (ASTM D698)		
	Minimum Compaction Requirement (%)[1]	Range of Moisture Contents for Compaction (referenced from optimum moisture content)[1]	
		Minimum	Maximum
On-site and imported soils:			
Beneath foundations	95	-2%	+3%
PV Array Pile Areas	96	-2%	+2%
Compacted Native and Aggregate Surfaced Roadways (subgrade)	92	-2%	+2%
Aggregate base[2]	95	-2%	+3%
Cable Trench Backfill (non-structural areas)	85	-2%	+2%
Cable Trench Backfill (structural areas and roadways)	95	-2%	+2%

Material Type and Location	Per the Standard Proctor Test (ASTM D698)		
	Minimum Compaction Requirement (%)[1]	Range of Moisture Contents for Compaction (referenced from optimum moisture content)[1]	
		Minimum	Maximum
Miscellaneous backfill	95	-2%	+3%

1. The moisture content and compaction should be measured for each lift of engineered fill during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Moisture percentage is not a pass/fail criteria for aggregate base course.

9.1.6 Earthwork Factors

The earthwork factors are based on a comparison of the in-situ dry densities from ring samples to the density of bulk samples compacted to 98, 95, 90, and 85 percent of the maximum dry density as determined by ASTM D698. The estimated shrinkage of the upper roughly 2 feet of the site soils when used as compacted fill is presented in the table below:

Percent Compaction (%)	Shrink/Swell (%)[1]		
	Minimum	Maximum	Average
98	-4	34	18
95	-7	32	15
90	-13	28	10
85	-20	24	5

1. Positive numbers are shrink, while negative numbers are swell. All values are in percent.

These estimates are general in nature, and are based on our experience, limited data from our field exploration, and the soil conditions we encountered at the site. Earthwork factors may vary dependent upon the actual subsurface conditions, which may include variations in soil gradations and gravel contents.

9.1.7 Grading and Drainage

Adequate drainage should be provided at the site to reduce the likelihood of an increase in moisture content of the foundation soils. The site should be graded to shed water and avoid ponding over the subgrade.

9.1.8 Earthwork Construction Considerations

Shallow excavations up to 10 feet for the proposed construction are anticipated to be accomplished with conventional construction equipment. However, if excavations penetrate into very dense soils, some additional effort may be need for excavation of these materials. Consideration should be given to obtaining a unit price for difficult excavation in the contract documents for the project.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of the access roads. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed, or these materials should be scarified, moisture conditioned, and re-compacted prior to access road construction.

The individual contractors are responsible for designing and constructing stable, temporary excavations (including utility trenches) as required to maintain stability of both the excavation sides and bottom. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations to the completed subgrade.

9.1.9 Construction Observation and Testing

The exposed subgrade and the full extend of each lift of compacted fill should be tested, evaluated and reworked, as necessary, until approved by the geotechnical engineer's representative prior to placement of additional lifts of fill. We recommend each lift of fill be tested for density and moisture content at a minimum frequency of at least one test for every 15,000 square feet of compacted fill in the structure areas. We recommend at a minimum at least one density and moisture content test for every 500 linear feet of compacted roadway and utility trench backfill. If engineered fill is placed beneath individual structures, we recommend at least one density and moisture content test per each vertical lift per structure.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; and backfilling of excavations into the completed subgrade.

10.0 General Comments

Terracon should be retained to review the final design plans and specifications, so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings, test pits, and pile load testing performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The results of the test pile program should be interpreted in consideration of the subsurface conditions at the time when and locations where testing was performed. Inherent variations within near surface soil layers, seasonal groundwater fluctuations, seasonal wet and dry season effects, and site disturbance (due to construction activities including clearing, grubbing, grading, or modifications to site drainage) can significantly affect the geotechnical capacity of short pile foundations. The results of the test pile program should also be interpreted in consideration of the test pile connection method and test pile characteristics including the section properties, surface texture, and installation methods.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

Appendix A – Field Exploration Exhibit No.

Site Location A-1
Exploration Plan – Borings.....A-2 through A-5

Exploration Plan – Test Pits ..... A-6 through A-7
General Notes A-8
Unified Soil Classification System A-9
Boring Logs ..... A-10 through A-65
Test Pit Pictures ..... A-66 through A-81

Appendix B – Laboratory Testing
Atterberg Limits Results ..... B-1 and B-4
Grain Size Distribution ..... B-5 through B-17
Moisture-Density Relationship Results ..... B-18 through B-31
R-Value Test Results ..... B-32 through B-33
Consolidation Test Results ..... B-34 through B-42
Corrosion Testing Results ..... B-42 through B-48
Summary of Laboratory Results ..... B-49 through B-64

Appendix C – Thermal Resistivity Test Results
Thermal Resistivity Test Location Plan ..... C-1 through C-2
Thermal Resistivity Test Results ..... C-3 thru C-20

Appendix D – Field Soil Electrical Resistivity Test Data
Field Soil Electrical Resistivity Test Location Plan ..... D-1 through D-3
Field Soil Electrical Resistivity Test Data ..... D-4 through D-29

Appendix E – Test Pile Driving Data
Pile Load Test Zoning Plan E-1
Test Pile Driving Records ..... E-2 thru E-6

Appendix F – Pile Load Testing Results – Axial Compression Load
Compression Load Test Results ..... F-1 thru F-7

Appendix G – Pile Load Testing Results – Axial Tensile Load
Tension Load Test Results ..... G-1 thru G-29

Appendix H – Pile Load Testing Results – Lateral Load
Lateral Load Test Results ..... H-1 thru H-29

Appendix I – Double Ring Infiltration Test Results
Double Ring Infiltration Test Location Plan I-1
Double Ring Infiltration Test Results ..... I-2 through I-3

Appendix J – JDH Corrosion Analysis ..... J-1 through J-14

APPENDIX A

FIELD EXPLORATION

Site Location

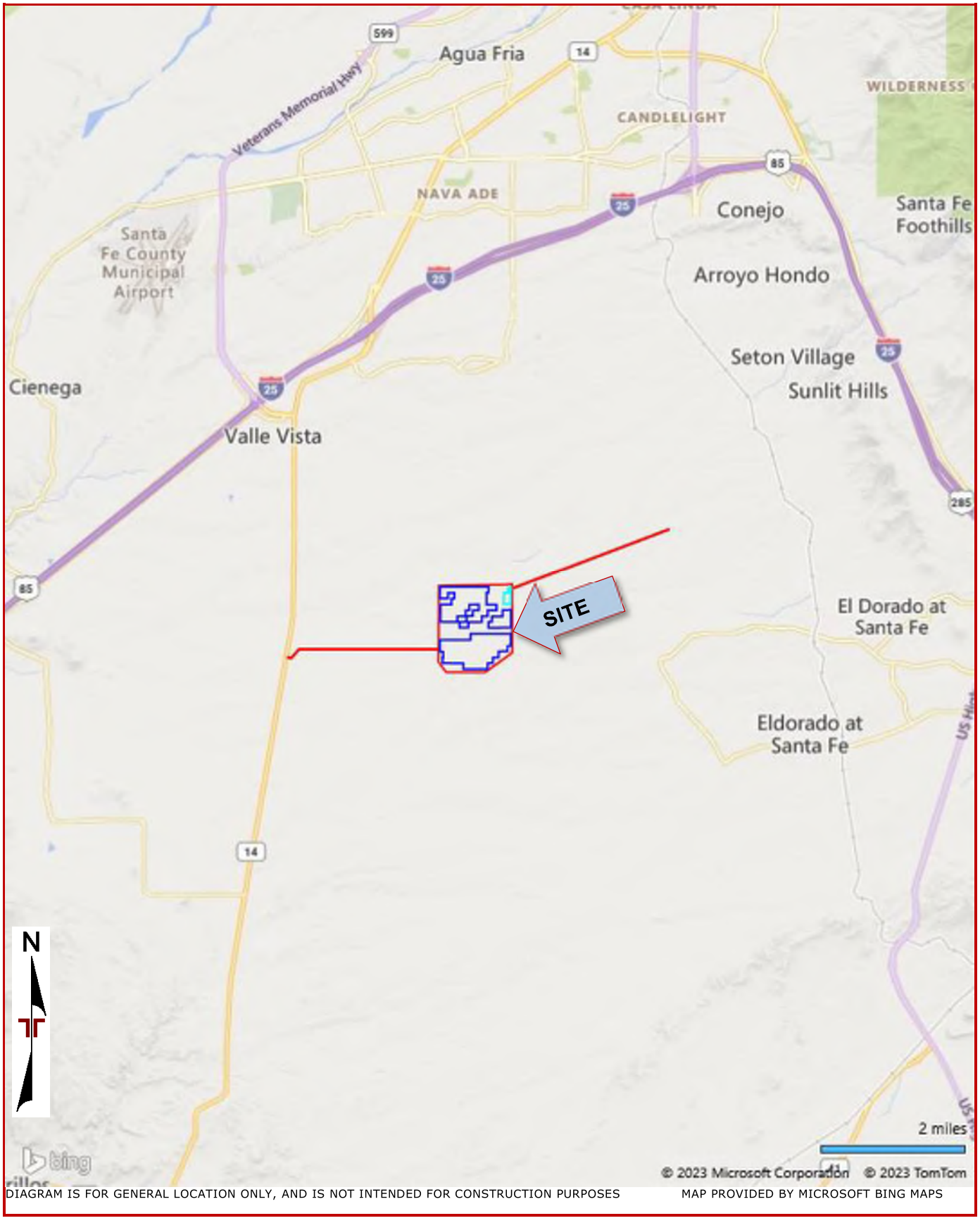


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exhibit A-1

Exploration Plan – Solar Array, BESS, and Substation Borings

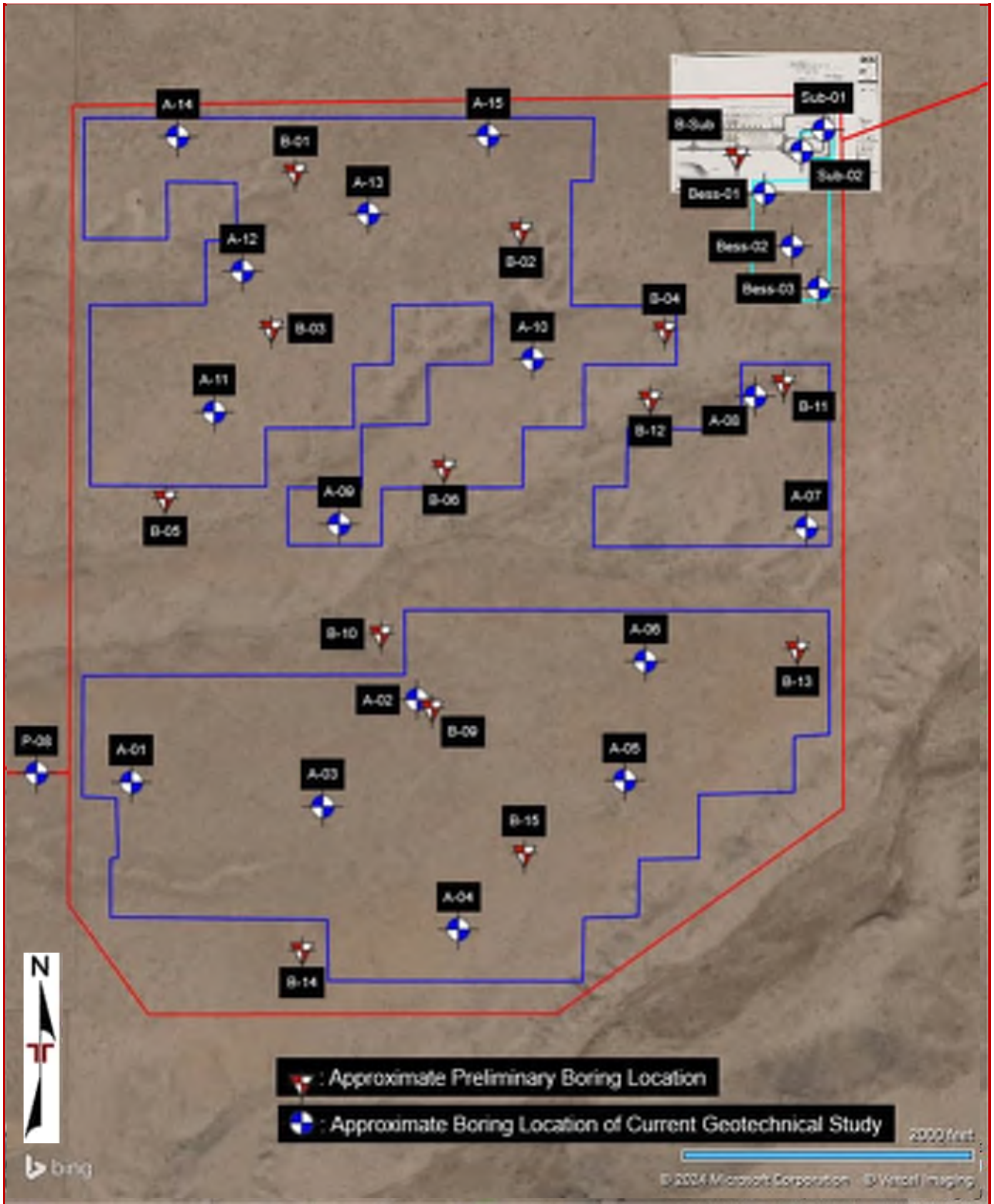


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exhibit A-2

Exploration Plan – Access Road Borings



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exhibit A-3

Exploration Plan – Transmission Line Borings

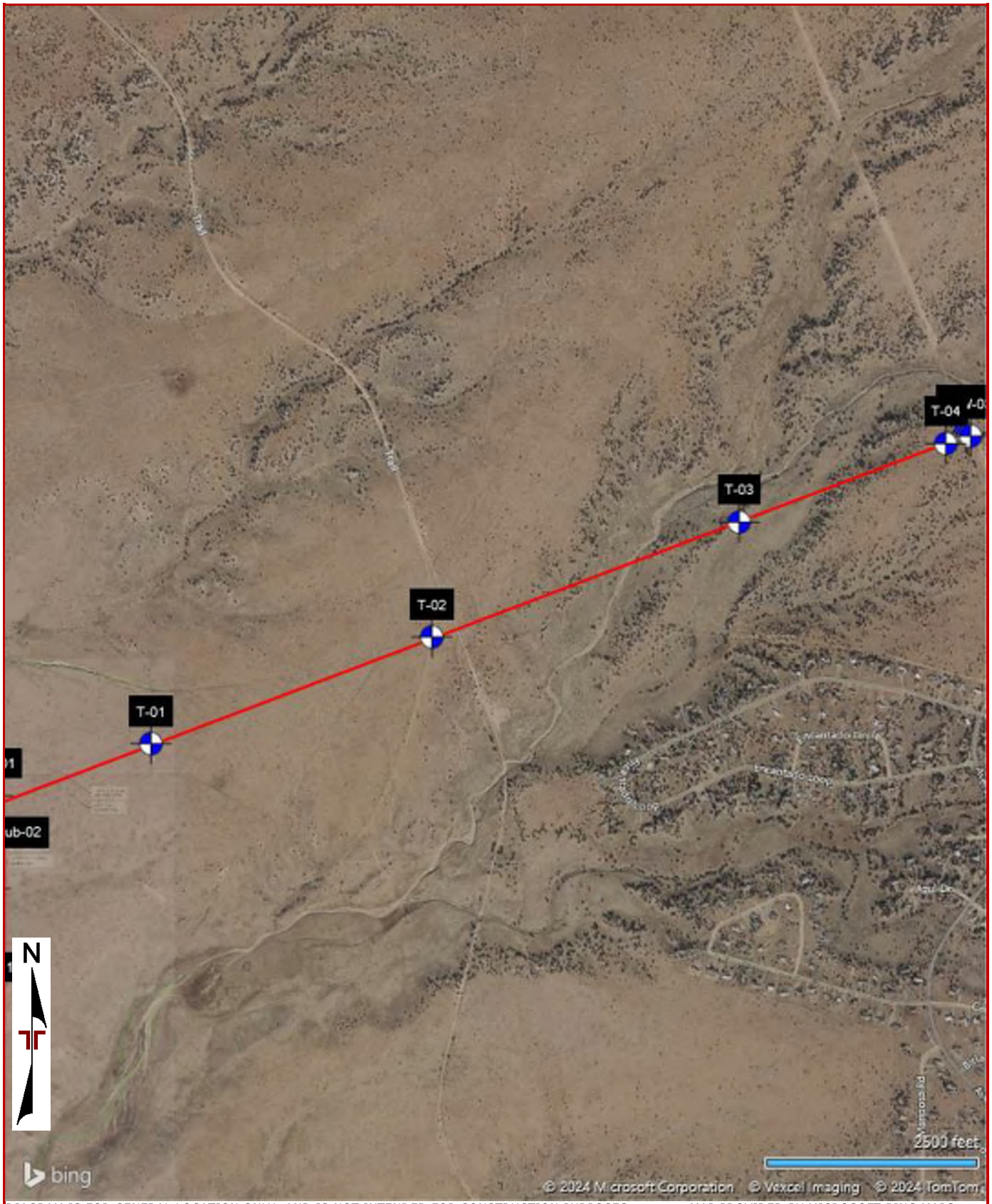


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exhibit A-4

Exploration Plan – Switching Station Borings



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exhibit A-5

Exploration Plan – Test Pits

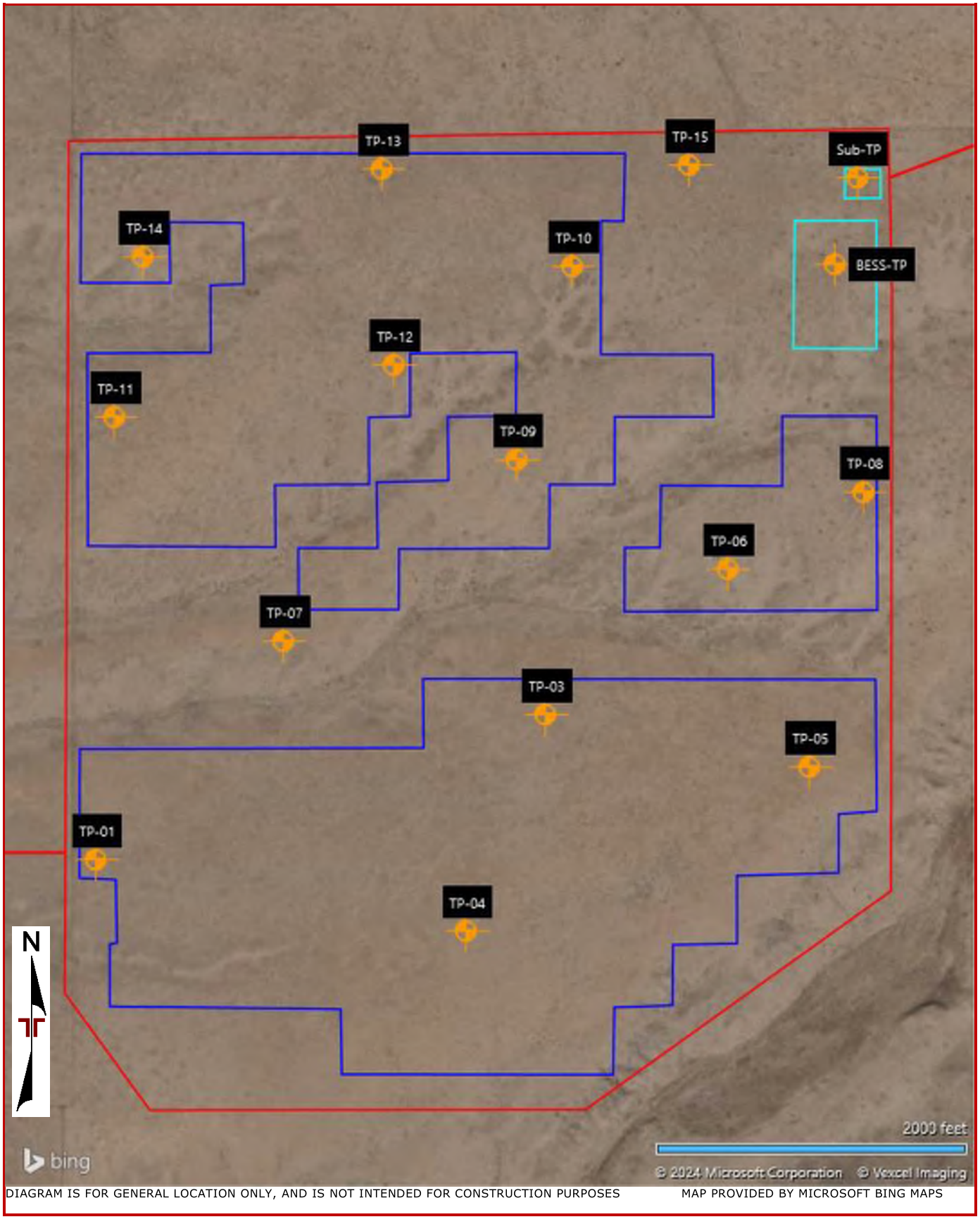


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exhibit A-6

Exploration Plan – Test Pits



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

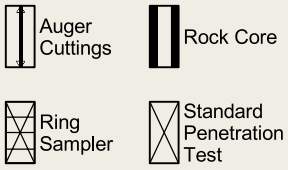
MAP PROVIDED BY MICROSOFT BING MAPS

Exhibit A-7

Terracon
4685 S Ash Ave, Ste H-4
Tempe, AZ

General Notes

Sampling



Water Level



Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

Field Tests

N	Standard Penetration Test Resistance (Blows/Ft.)
(HP)	Hand Penetrometer
(T)	Torvane
(DCP)	Dynamic Cone Penetrometer
UC	Unconfined Compressive Strength
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance				Bedrock		
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**	**Standard Penetration or N-Value (Blows/Ft.)**	**Consistency**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3	< 30	< 20	Weathered
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4	30 - 49	20 - 29	Firm
Medium Dense	10 - 29	19 - 58	Medium Stiff	0.50 to 1.00	4 - 8	5 - 9	50 - 89	30 - 49	Medium Hard
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18	90 - 119	50 - 79	Hard
Very Dense	> 50	> 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42	> 119	>79	Very Hard
			Hard	> 4.00	> 30	> 42			

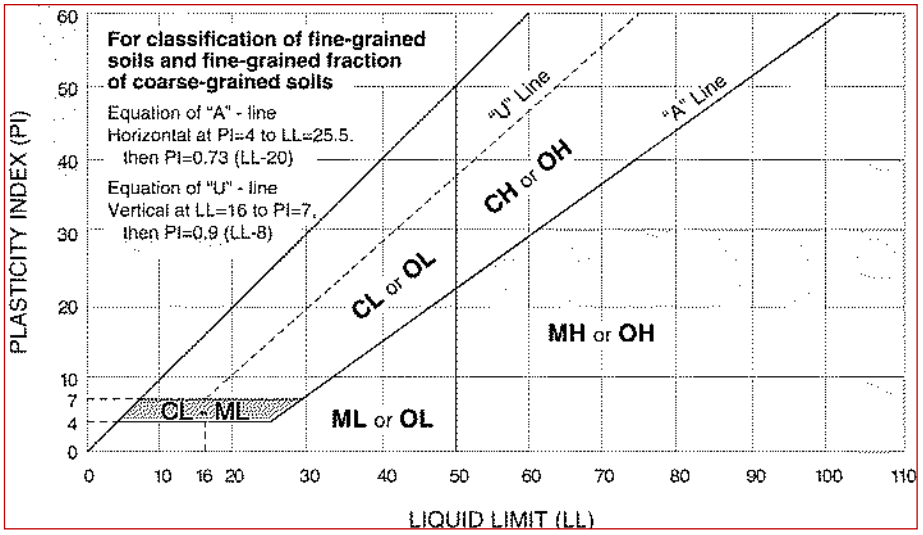
Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-01

Location: See Exploration Plan

Latitude: 35.5416° Longitude: -106.0171°

Depth (Ft.) Elevation.: 6411 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		0.2 **TOPSOIL**, approximately 2" thick 6410.83								
		SILTY SAND (SM), fine to coarse grained, brown, medium dense			4-8-6 N=14		6.6			
		2.0 6409								
3		**SANDY LEAN CLAY (CL)**, light brown, very stiff to hard			6-10-11 N=21		8.5		39-19-20	62
					17-29/0"		6.7	104		
		8.0 6403								
2		**SILTY SAND (SM)**, fine to coarse grained, brown, very loose			6-8-8 N=16		7.9			
					2-2-1 N=3		7.3			
		12.0 6399								
		POORLY GRADED SAND (SP), fine to coarse grained, brown, medium dense			5-6-5 N=11		1.2			
		14.0 6397								
4		**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine to coarse grained, brown, medium dense to dense			5-11-13 N=24		1.4			
		20.9 6390.08			16-50/5"					
		Boring Terminated at 20.92 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
08-01-2023

Boring Completed
08-01-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-02

Location: See Exploration Plan

Latitude: 35.5432° Longitude: -106.0105°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6434 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		0.3	**TOPSOIL**, approximately 3" thick 6433.75									
		2.0	**CLAYEY SAND (SC)**, fine to coarse grained, brown to light brown, medium dense 6432				3-4-9 N=13		6.7			
3		7.0	**SANDY LEAN CLAY (CL)**, trace gravel, brown, hard, moderate cementation 6427	5			12-17-22 N=39		9.4			
							24-43/0"		8.3	100	38-18-20	56
2		12.0	**SILTY CLAYEY SAND (SC-SM)**, fine to coarse grained, reddish brown, medium dense 6422	10			6-5-5 N=10		7.2			
							5-7-7 N=14		4.7			
		21.5	**SILTY SAND (SM)**, trace gravel, fine to coarse grained, brown, medium dense 6412.5	15			6-5-6 N=11		1.7			
							6-7-7 N=14		2.4			
				20			6-9-18 N=27		1.9			
			Boring Terminated at 21.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
SS

Boring Started
08-24-2023

Boring Completed
08-24-2023

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-03

Location: See Exploration Plan

Latitude: 35.5412° Longitude: -106.0127°

Depth (Ft.) Elevation.: 6426 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick 6425.67								
2		**SILTY SAND (SM)**, fine to coarse grained, brown, medium dense			5-6-8 N=14		6.6			
		2.0 6424								
3		**SANDY LEAN CLAY (CL)**, trace gravel, light brown, stiff to hard			6-7/0"		10.2	88		
					16-17-15 N=32		7.4			
					6-6-10 N=16		6.8		30-16-14	65
4		**SILTY SAND (SM)**, fine to coarse grained, brown, medium dense to very dense			16-50/5"		8.1			
					6-15-16 N=31		5.9			
					3-6-8 N=14		4.0			
					9-9-12 N=21		6.2			
		21.5 6404.5								
		Boring Terminated at 21.5 Feet								

Depth (Ft.): 5, 10, 15, 20

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
08-01-2023

Boring Completed
08-01-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-04

Location: See Exploration Plan

Latitude: 35.5388° Longitude: -106.0095°

Depth (Ft.) Elevation.: 6427 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick 6426.67								
4		**SILTY SAND (SM)**, trace calcareous nodules, trace gravel, fine to coarse grained, brown to light brown, medium dense to very dense, moderate cementation			4-8-8 N=16		5.8			
					3-6-11 N=17		9.3			
					30-37/0"		6.0	101	NP	39
		7.0 6420								
2		**SILTY CLAYEY SAND (SC-SM)**, trace gravel, fine to coarse grained, brown, medium dense			6-11-15 N=26		1.7			
		9.0 6418								
		POORLY GRADED SAND (SP), trace gravel, fine to coarse grained, brown to brown, medium dense			10-13/0"		1.7	113		
		12.0 6415								
		WELL GRADED SAND (SW), trace gravel, fine to coarse grained, brown, medium dense			5-7-10 N=17		0.9			
		14.0 6413								
		POORLY GRADED SAND (SP), trace gravel, fine to coarse grained, brown, medium dense			7-11-11 N=22		1.0			
		19.0 6408								
4		**CLAYEY SAND (SC)**, fine to coarse grained, brown, dense			4-14-22 N=36		5.5			
		21.5 6405.5								
		Boring Terminated at 21.5 Feet								

5 10 15 20

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
08-01-2023

Boring Completed
08-01-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-05

Location: See Exploration Plan

Latitude: 35.5417° Longitude: -106.0057°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6449 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
1		0.2	**TOPSOIL**, approximately 2" thick 6448.83									
		2.0	**SANDY SILT (SM)**, brown, stiff 6447				3-6-6 N=12		5.4			
3			**SANDY LEAN CLAY (CL)**, trace gravel, brown to dark brown, very stiff to hard				29		12.3	94		
				5			7-16-29 N=45		6.0			
							7-17-14 N=31		5.4		31-15-16	56
				10			7-10-15 N=25		3.4			
2		14.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to coarse grained, brown, medium dense 6435				5-11-15 N=26		1.7			
4		19.0	**WELL GRADED SAND WITH SILT (SW-SM)**, trace gravel, fine to coarse grained, tan to light brown, dense 6430	15			6-17-16 N=33		1.1			
2		21.5	**SILTY SAND (SM)**, fine to coarse grained, brown, medium dense 6427.5	20			8-11-11 N=22		3.0			
			Boring Terminated at 21.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
08-01-2023

Boring Completed
08-01-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-06

Location: See Exploration Plan

Latitude: 35.5439° Longitude: -106.0052°

Depth (Ft.) Elevation.: 6456 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		0.3 **TOPSOIL**, approximately 3" thick 6455.75								
		SILTY SAND (SM), fine to coarse grained, brown, medium dense			3-4-7 N=11		5.4			
		2.0 6454								
3		**SILT WITH SAND (ML)**, trace caliche, trace gravel, tan to white, very stiff to hard, moderate cementation			4-16-24 N=40		4.8			
					10-9-10 N=19		6.2		NP	71
					9-11/0"		6.5	92		
		10.0 6446								
4		**CLAYEY SAND (SC)**, fine to coarse grained, brown to dark brown, very dense			14-28-36 N=64		6.2			
		14.0 6442								
3		**LEAN CLAY WITH SAND (CL)**, brown to dark brown, hard			9-22-30 N=52		6.6			
					12-14-16 N=30		9.0			
		21.5 6434.5								
		Boring Terminated at 21.5 Feet								

5 10 15 20

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
08-01-2023

Boring Completed
08-01-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-07

Location: See Exploration Plan

Latitude: 35.5464° Longitude: -106.0014°

Model Layer	Depth (Ft.)	Elevation.: 6470 (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
	0.3	**TOPSOIL**, approximately 3" thick — 6469.75			3-5-7 N=12					
		LEAN CLAY WITH SAND (CL), trace gravel, brown, stiff to very stiff			4-7-7 N=14		6.9		32-17-15	80
					4-3-6 N=9		7.2			
					10-15/0"		7.6	90		
3					8-13-12 N=25		8.8			
					4-3-5 N=8		8.9			
					4-4-7 N=11		8.4			
	19.0	6451								
		SILT (ML), tan, hard			10-32-50/4"		8.5			
	21.5	6448.5								
		Boring Terminated at 21.5 Feet								

Depth (Ft.) 5 10 15 20

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
08-02-2023

Boring Completed
08-02-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-08

Location: See Exploration Plan

Latitude: 35.5489° Longitude: -106.0026°

Model Layer	Graphic Log	Depth (Ft.) / Elevation.: 6477 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.2 **TOPSOIL**, approximately 2" thick — 6476.83									
1		**LEAN CLAY (CL)**, fine to coarse grained, light brown to brown, stiff — 2.0 — 6475				3-5-6 N=11		7.7			
		SILT (ML), tan, stiff				3-3-6 N=9		6.2			
3		**SILTY CLAY (CL-ML)**, tan, very stiff	5			8-14/0"		6.4	95		
		7.0 — 6470									
1		**SANDY SILT (ML)**, trace gravel, light tan, stiff — 9.0 — 6468				4-4-5 N=9		4.8		NP	57
3		**LEAN CLAY (CL)**, tan to light brown, hard	10			9-15-22 N=37		6.6			
		14.0 — 6463									
2		**CLAYEY SAND (CL)**, fine to coarse grained, brown, medium dense	15			15-19-15 N=34		10.3			
		19.0 — 6458									
3		**LEAN CLAY (CL)**, brown, hard	20			6-18-19 N=37		8.2			
		21.5 — 6455.5									
		Boring Terminated at 21.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
08-02-2023

Boring Completed
08-02-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-09

Location: See Exploration Plan

Latitude: 35.5465° Longitude: -106.0123°

Depth (Ft.) Elevation.: 6430 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick 6429.67								
3		**LEAN CLAY (CL)**, trace calcareous nodules, brown to light brown, stiff to hard			5-7-6 N=13		6.1			
					10-12-14 N=26		6.9			
		5			9-18/0"					
		6.0 6424								
4		**SILTY SAND (SM)**, trace gravel, brown, very dense			31-43-24 N=67		4.7		NP	45
		9.0 6421								
3		**SANDY LEAN CLAY (CL)**, brown to dark brown, hard								
		10			12-21-26 N=47		6.5			
		12.0 6418								
		LEAN CLAY (CL), brown, very stiff			8-9-11 N=20		9.0			
		14.0 6416								
4		**SILTY SAND (SM)**, brown to light brown, medium dense to very dense			4-7-12 N=19		5.2			
		15								
		20			8-25-28 N=53		6.0			
		21.5 6408.5								
		Boring Terminated at 21.5 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
08-02-2023

Boring Completed
08-02-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-10

Location: See Exploration Plan

Latitude: 35.5496° Longitude: -106.0078°

Depth (Ft.) Elevation.: 6464 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick 6463.67								
3		**SANDY LEAN CLAY (CL)**, trace calcareous nodules, trace gravels, brown to light brown, soft to very stiff			3-5-7 N=12		5.4			
					3-6-11 N=17		9.8			
		5			6-6-7 N=13		7.7		34-16-18	57
					5-4		6.8	92		
		10			3-2-2 N=4		4.7			
					3-8-8 N=16		8.8			
		15			5-9-8 N=17		9.9			
		20			8-12-13 N=25		9.9			
		21.5 6442.5								
		Boring Terminated at 21.5 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
08-02-2023

Boring Completed
08-02-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-11

Location: See Exploration Plan

Latitude: 35.5486° Longitude: -106.0152°

Depth (Ft.) Elevation.: 6431 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick 6430.67								
1		**SANDY LEAN CLAY (CL)**, trace calcareous nodules, trace gravel, brown to light brown, soft to very stiff			4-9-8 N=17		6.5			
					7-11-16 N=27		6.6			
		5			17-16/0"		7.0	81	32-18-14	66
					4-2-2 N=4		8.3			
		10			4-8-9 N=17		6.3			
2		12.0 6419 **SILTY SAND (SM)**, trace gravel, fine to coarse grained, light brown, medium dense			5-6-15 N=21		7.4			
		15			7-7-6 N=13		5.1			
		20			10-9-10 N=19		4.6			
		21.5 6409.5 ***Boring Terminated at 21.5 Feet***								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
08-02-2023

Boring Completed
08-02-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-12

Location: See Exploration Plan

Latitude: 35.5513° Longitude: -106.0145°

Depth (Ft.) Elevation.: 6443 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 3" thick 6442.75								
3		**LEAN CLAY (CL)**, brown, very stiff			3-6-13 N=19		3.5			
					9-15-12 N=27		5.0			
4		4.0 6439 **SILTY SAND (SM)**, trace gravel, fine to coarse grained, tan to brown, medium dense to dense			13-12		2.8	100		
					10-12-18 N=30		4.3		NP	42
					9-10-11 N=21		7.3			
3		12.0 6431 **LEAN CLAY (CL)**, brown to dark brown, hard			15-25-30 N=55		7.8			
					14-17-19 N=36		9.7			
					12-18-20 N=38		9.2			
		21.5 6421.5 ***Boring Terminated at 21.5 Feet***								

Depth (Ft.): 5, 10, 15, 20

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
08-02-2023

Boring Completed
08-02-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-13

Location: See Exploration Plan

Latitude: 35.5523° Longitude: -106.0116°

Depth (Ft.) Elevation.: 6461 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		0.2 **TOPSOIL**, approximately 2" thick 6460.83								
		CLAYEY SAND (SC), fine to coarse grained, brown, medium dense			5-7-3 N=10		6.4			
		2.0 6459								
4		**SILTY CLAYEY SAND (SC-SM)**, fine to coarse grained, brown to white, medium dense			13-17		5.7	84		
		4.0 6457								
3		**SANDY LEAN CLAY (CL)**, trace gravel, brown to beige, very stiff to hard			19-21-15 N=36		8.4		35-16-19	59
					5-31-15 N=46		6.8			
					4-7-11 N=18		7.4			
		12.0 6449								
4		**CLAYEY SAND (SC)**, fine to coarse grained, brown to tan, medium dense to very dense			7-11-17 N=28		7.2			
					33-50/5"		6.9			
					19-19-13 N=32		6.9			
		21.5 6439.5								
		Boring Terminated at 21.5 Feet								

Depth (Ft.): 5, 10, 15, 20

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-18-2023

Boring Completed
08-18-2023

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-14

Location: See Exploration Plan

Latitude: 35.5538° Longitude: -106.0160°

Depth (Ft.) Elevation.: 6438 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		0.3 **TOPSOIL**, approximately 3" thick 6437.75								
		CLAYEY SAND (SC), fine to coarse grained, brown, medium dense			7-7-6 N=13		7.5			
		2.0 6436								
3		**SANDY SILT (ML)**, trace clay, sandy silt, white to light brown, stiff to hard			18-32		10.7	83		
					7-7-5 N=12		9.0		NP	60
					11-12-10 N=22		10.0			
					15-24-39 N=63		39.0			
					13-16-16 N=32		8.9			
					16-21-24 N=45		7.8			
		19.0 6419								
4		**SILTY SAND (SM)**, fine to coarse grained, beige, dense			21-16-15 N=31		4.0			
		21.5 6416.5								
		Boring Terminated at 21.5 Feet								

Depth (Ft.): 5, 10, 15, 20

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-16-2023

Boring Completed
08-16-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. A-15

Location: See Exploration Plan

Latitude: 35.5538° Longitude: -106.0088°

Depth (Ft.) Elevation.: 6474 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		0.3 **TOPSOIL**, approximately 3" thick 6473.75								
		SILTY SAND (SM), trace clay, silty sand, fine to coarse grained, light brown to brown, loose to medium dense			2-2-2 N=4					
					8-9-12 N=21		6.7		NP	48
					5-6					
					5-10-14 N=24		5.9			
					5-14-13 N=27		7.2			
4		13.0 6461								
		CLAYEY SAND (SC), fine to coarse grained, light brown, medium dense to dense			12-12-10 N=22		10.0			
					29-20-23 N=43		8.1			
		21.5 6452.5			4-9-8 N=17		4.8			
		Boring Terminated at 21.5 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-16-2023

Boring Completed
08-16-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. Bess-01

Location: See Exploration Plan

Latitude: 35.5527° Longitude: -106.0024°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6493 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3	**TOPSOIL**, approximately 4" thick 6492.67									
2		2.0	**CLAYEY SAND (SC)**, fine to coarse grained, brown, medium dense 6491				4-5-7 N=12					
3		7.0	**LEAN CLAY WITH SAND (CL)**, trace gravel, brown, hard 6486	5			10-19-28 N=47		7.4		30-14-16	77
							25-50/4"		7.9	105		
		12.0	**SANDY SILT (ML)**, trace gravel, beige, stiff to very stiff 6481	10			4-5-8 N=13		8.0			
							6-6-11 N=17		6.6		NP	67
2		14.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to coarse grained, beige, medium dense 6479				5-10-11 N=21		4.7			
4		24.0	**SILTY SAND (SM)**, fine to coarse grained, beige, medium dense to dense 6469	15			15-17-14 N=31		5.3			
				20			10-12-13 N=25		4.4			
				25			13-14-14 N=28		1.3			
			POORLY GRADED SAND WITH SILT (SP-SM), trace gravel, fine to coarse grained, beige, medium dense to very dense	30			7-11-19 N=30		2.5			

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-18-2023

Boring Completed
08-18-2023

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. Bess-01

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.5527° Longitude: -106.0024° Depth (Ft.) Elevation.: 6493 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
4		**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine to coarse grained, beige, medium dense to very dense *(continued)*	35								
						21-25-50/5"		8.0			
			40								
		41.5 6451.5				25-50/4"		8.3			
		Boring Terminated at 41.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-18-2023

Boring Completed
08-18-2023

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. Bess-02

Location: See Exploration Plan

Latitude: 35.5517° Longitude: -106.0018°

Depth (Ft.) Elevation.: 6492 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick 6491.67								
2		**CLAYEY SAND (SC)**, fine to coarse grained, brown, loose 2.0 6490			6-5-3 N=8					
		SILTY SAND (SM), trace clay, trace gravel, fine to coarse grained, light brown to white, loose to very dense, weak to moderate cementation			3-15		12.7	76		
					28-29-23 N=52		9.8			
					2-3-2 N=5		6.8		NP	46
					6-5-1 N=6		7.7			
					6-3-4 N=7		6.4			
3		**SANDY LEAN CLAY (CL)**, trace gravel, very stiff 14.0 6478			16-13-9 N=22		7.7		26-16-10	62
					8-9-8 N=17		9.0			
2		**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine to coarse grained, beige to brown, loose to dense 23.0 6469			12-11-10 N=21		9.3			
					7-4-4 N=8					

5 10 15 20 25 30

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-18-2023

Boring Completed
08-18-2023

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. Bess-02

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.5517° Longitude: -106.0018° Depth (Ft.) Elevation.: 6492 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, fine to coarse grained, beige to brown, loose to dense *(continued)* 36.5 6455.5	35			11-17-18 N=35		3.0			
		Boring Terminated at 36.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-18-2023

Boring Completed
08-18-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. Bess-03

Location: See Exploration Plan

Latitude: 35.5509° Longitude: -106.0012°

Model Layer	Depth (Ft.)	Elevation.: 6480 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2	0.3	**TOPSOIL**, approximately 3" thick 6479.75									
		CLAYEY SAND (SC), fine to coarse grained, brown, medium dense				11-7-10 N=17		5.9			
						18-10		5.4	102		
	4.0	6476									
		SILTY SAND (SC), fine to coarse grained, brown, loose	5			4-4-4 N=8		5.1			
	7.0	6473									
		CLAYEY SAND (SC), fine to coarse grained, brown, medium dense				7-10-8 N=18		11.5			
			10			10-14-13 N=27		11.8			
	14.0	6466				10-13-16 N=29		6.8			
4		**WELL GRADED SAND WITH SILT (SW-SM)**, trace gravel, fine to coarse grained, brown to tan, medium dense to dense	15			17-18-14 N=32		6.8			
			20			10-14-24 N=38		1.6		NP	8
			25			6-13-13 N=26		2.5			
	29.0	6451									
2		**CLAYEY SAND (SC)**, fine to coarse grained, brown, medium dense	30			4-8-7 N=15		8.5			

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-18-2023

Boring Completed
08-18-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. Bess-03

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.5509° Longitude: -106.0012° Depth (Ft.) Elevation.: 6480 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		**CLAYEY SAND (SC)**, fine to coarse grained, brown, medium dense *(continued)*	35								
						2-6-5 N=11		9.2			
		39.0 6441									
4		**SILTY SAND (SM)**, fine to coarse grained, brown, very dense	40								
						12-29-50/5"		5.9			
		41.5 6438.5									
		Boring Terminated at 41.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-18-2023

Boring Completed
08-18-2023

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. BW-01

Location: See Exploration Plan

Latitude: 35.5656° Longitude: -105.9625°

Depth (Ft.) | Elevation.: 6662 (Ft.)

Model Layer	Depth (Ft.)	Elevation (Ft.)	Description	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
	0.4	6661.58	**TOPSOIL**, approximately 5" thick					
2	15.0	6647	**SILTY SAND (SM)**, trace gravel, fine grained, brown, loose to medium dense	2-2-6 N=8	4.5		NP	50
				18-21	7.4	100		
				10-12-14 N=26	7.0			
				11-9-13 N=22	6.9			
3	23.0	6639	**SANDY SILT (ML)**, trace gravel, brown, very stiff	15-14-11 N=25	7.3			
				16-9-10 N=19	6.1		NP	60
	29.0	6633	**LEAN CLAY WITH SAND (CL)**, brown, medium stiff to hard, moderate cementation	16-14-19 N=33	6.1			
4	31.5	6630.5	**CLAYEY SAND (SC)**, fine to coarse grained, brown, dense	11-14-16 N=30	3.2			
			Boring Terminated at 31.5 Feet					

Depth (Ft.): 5, 10, 15, 20, 25, 30

Water Level Observations | Sample Type | SWELL (%)

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
SS

Boring Started
08-25-2023

Boring Completed
08-25-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. BW-02

Location: See Exploration Plan

Latitude: 35.5656° Longitude: -105.9624°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6661 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3	**TOPSOIL**, approximately 4" thick 6660.67									
3			**LEAN CLAY WITH SAND (CL)**, brown, very stiff				9-14		2.5	90		
		4.0	6657									
2			**SILTY SAND (SM)**, trace gravel, fine to coarse grained, brown, medium dense	5			6-12-16 N=28		4.0		NP	35
		7.0	6654									
4			**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to coarse grained, brown to gray, medium dense to dense				16-18-20 N=38		2.2			
				10			10-13-15 N=28		2.3			
		14.0	6647									
2			**SILTY SAND (SM)**, trace gravel, fine to coarse grained, brown to gray, medium dense	15			6-7-10 N=17		4.5			
				20			6-9-9 N=18		1.7			
				25			7-8-10 N=18		4.8		NP	40
		29.0	6632									
3			**LEAN CLAY WITH SAND (CL)**, fine to coarse grained, brown, very stiff	30			7-9-11 N=20		8.8			
		31.5	6629.5									
			Boring Terminated at 31.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
SS

Boring Started
08-25-2023

Boring Completed
08-25-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. BW-03

Location: See Exploration Plan

Latitude: 35.5655° Longitude: -105.9622°

Depth (Ft.) | Elevation.: 6660 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick (6659.67)								
		LEAN CLAY WITH SAND (CL), brown, very stiff, moderate cementation								
		4.0 (6656)		X	10-11-12 N=23					
3		**SANDY SILT (ML)**, trace gravel, brown, very stiff								
		5		X	7-11		4.2	97	NP	56
		9.0 (6651)		X	3-7-10 N=17		6.8			
4		**SILTY SAND (SM)**, trace gravel, fine to coarse grained, light brown to brown, loose to medium dense								
		10		X	5-8-12 N=20		5.4			
		15		X	6-6-9 N=15		2.3		NP	20
		20		X	6-12-17 N=29		2.9			
		24.0 (6636)								
3		**LEAN CLAY WITH SAND (CL)**, light brown, very stiff								
		25		X	13-12-14 N=26		3.5			
		30		X	11-11-14 N=25		8.5			
		31.5 (6628.5)								
		Boring Terminated at 31.5 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
SS

Boring Started
08-25-2023

Boring Completed
08-25-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. P-01

Location: See Exploration Plan

Latitude: 35.5400° Longitude: -106.0543°

Depth (Ft.) Elevation.: 6303 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 3" thick 6302.75								
2		**CLAYEY SAND (SC)**, fine to coarse grained, brown, loose to very dense, moderate cementation			4-4-4 N=8		7.3			
					4-10		7.3	90		
		5			10-15-15 N=30		6.9			
		6.5 6296.5								
		Boring Terminated at 6.5 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-23-2023

Boring Completed
08-23-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. P-02

Location: See Exploration Plan

Latitude: 35.5418° Longitude: -106.0524°

Depth (Ft.) Elevation.: 6313 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		0.3 **TOPSOIL**, approximately 3" thick 6312.75								
		CLAYEY SAND (SC), fine to coarse grained, brown, medium dense			4-5-5 N=10		5.5			
		2.0 6311								
3		**SANDY LEAN CLAY (CL)**, trace gravel, light brown, very stiff to hard, moderate cementation			8-9-23 N=32		10.2		39-24-15	61
		5								
		6.0 6307			9-27		7.8	95		
		Boring Terminated at 6 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-23-2023

Boring Completed
08-23-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. P-03

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.5418° Longitude: -106.0477° Depth (Ft.) / Elevation.: 6326 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		0.3 **TOPSOIL**, approximately 3" thick (6325.75) **CLAYEY SAND (SC)**, fine to coarse grained, brown, medium dense, weak cementation				4-5-6 N=11		6.6			
						7-16		6.6	95		
			5								
						16-10-10 N=20		6.6		NP	
		6.5 (6319.5) ***Boring Terminated at 6.5 Feet***									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-23-2023

Boring Completed
08-23-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. P-04

Location: See Exploration Plan

Latitude: 35.5418° Longitude: -106.0427°

Depth (Ft.) Elevation.: 6336 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick 6335.67								
2		**CLAYEY SAND (SC)**, fine to coarse grained, brown, medium dense			3-4-7 N=11		6.9			
		2.0 6334								
3		**SANDY SILT (ML)**, trace clay, trace gravel, brown to beige, medium stiff to hard, moderate cementation			2-3-4 N=7		7.4		NP	65
		5								
		6.0 6330			8-50/3"		8.3	92		
		Boring Terminated at 6 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-23-2023

Boring Completed
08-23-2023

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. P-05

Location: See Exploration Plan

Latitude: 35.5418° Longitude: -106.0370°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6354 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3	**TOPSOIL**, approximately 4" thick 6353.67									
2			**CLAYEY SAND (SC)**, fine grained, brown, medium dense				3-6-10 N=16		7.4			
							3-19		8.3	81		
		4.0	6350									
1			**SANDY LEAN CLAY (CL)**, beige, medium stiff	5								
							2-3-3 N=6		20.6		28-17-11	62
		6.5	6347.5									
			Boring Terminated at 6.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-23-2023

Boring Completed
08-23-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. P-06

Location: See Exploration Plan

Latitude: 35.5418° Longitude: -106.0316°

Depth (Ft.) Elevation.: 6367 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		0.3 **TOPSOIL**, approximately 3" thick 6366.75								
		CLAYEY SAND (SC), fine to coarse grained, brown, medium dense			4-6-9 N=15		7.4			
		2.0 6365								
4		**SILTY SAND (SM)**, trace clay and gravel, fine to coarse grained, brown to beige, loose to very dense			6-35-29 N=64		5.9			
		5								
		6.0 6361			5-9		5.5	91	NP	41
		Boring Terminated at 6 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
7" Hollow Stem Auger

Logged by
MBG

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Boring Started
08-23-2023

Boring Completed
08-23-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. P-07

Location: See Exploration Plan

Latitude: 35.5418° Longitude: -106.0252°

Depth (Ft.) Elevation.: 6385 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 3" thick 6384.75								
2		**SILTY SAND (SM)**, trace gravel, fine to coarse grained, brown, loose to medium dense, moderate cementation			3-8-8 N=16		6.6			
					3-5		6.1	76	NP	36
		5			2-7-9 N=16		6.1			
		6.5 6378.5								
		Boring Terminated at 6.5 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
SS

Boring Started
08-24-2023

Boring Completed
08-24-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. P-08

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.5418° Longitude: -106.0193° Depth (Ft.) / Elevation.: 6402 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick — 6401.67									
3		**SANDY LEAN CLAY (CL)**, trace gravel, brown, stiff to hard				5-6-7 N=13		5.6			
						8-19-19 N=38		7.2		35-24-11	64
			5								
		6.0 — 6396				8-16		7.8	83		
		Boring Terminated at 6 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
SS

Boring Started
08-24-2023

Boring Completed
08-24-2023

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. Sub-01

Location: See Exploration Plan

Latitude: 35.5539° Longitude: -106.0010°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6500 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2		0.3	**TOPSOIL**, approximately 3" thick 6499.75									
		2.0	**CLAYEY SAND (SC)**, fine to coarse grained, brown, medium dense 6498				8-11-9 N=20					
3		4.0	**SANDY LEAN CLAY (CL)**, beige to white, very stiff 6496				20		9.1	93	30-17-13	58
2		12.0	**CLAYEY SAND (SC)**, with silt, fine to coarse grained, brown to beige, loose 6488	5			7-5-4 N=9		8.4			
							3-2-4 N=6		8.2			
				10			4-3-4 N=7		7.6			
		17.0	**SILTY SAND (SM)**, trace clay, fine to coarse grained, brown to beige, medium dense 6483				4-5-6 N=11		8.7			
				15			5-6-9 N=15		7.1			
3			**SANDY LEAN CLAY (CL)**, brown to beige, hard, moderate cementation	20			17-27-50/1"		8.3		29-16-13	69
		29.0	6471	25			6-8-50/1"		7.6			
			SILTY SAND (SM), fine to coarse grained, beige to brown, medium dense to dense	30			27-15-10 N=25		6.0			

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-16-2023

Boring Completed
08-16-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. Sub-01

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.5539° Longitude: -106.0010° Depth (Ft.) Elevation.: 6500 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
3		**SILTY SAND (SM)**, fine to coarse grained, beige to brown, medium dense to dense *(continued)*	35								
						9-13-19 N=32		5.9			
			40								
		41.5 6458.5				10-14-17 N=31		5.9			
		Boring Terminated at 41.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-16-2023

Boring Completed
08-16-2023

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. Sub-02

Location: See Exploration Plan

Latitude: 35.5535° Longitude: -106.0016°

Depth (Ft.) Elevation.: 6499 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 3" thick 6498.75								
2		**CLAYEY SAND (SC)**, fine to coarse grained, brown to beige, medium dense 2.0 6497			6-7-4 N=11		7.3			
3		**SANDY LEAN CLAY (CL)**, brown to beige, very stiff to hard			11-18-22 N=40		8.9		30-22-8	62
					8-12		9.6	90		
2		7.0 6492 **CLAYEY SAND (SC)**, fine to coarse grained, brown to beige, medium dense			8-8-5 N=13		8.8			
4		10.0 6489 **SILTY SAND (SM)**, trace clay, trace gravel, fine to coarse grained, brown to beige, medium dense to very dense			6-6-8 N=14		8.6			
					6-6-7 N=13		7.5			
					11-6-5 N=11		5.2			
					19-14-16 N=30		3.2		NP	22
					17-18-15 N=33		6.7			
					17-19-50/2"		6.4			

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-16-2023

Boring Completed
08-16-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. Sub-02

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.5535° Longitude: -106.0016° Depth (Ft.) Elevation.: 6499 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
4		**SILTY SAND (SM)**, trace clay, trace gravel, fine to coarse grained, brown to beige, medium dense to very dense *(continued)*	35								
						10-11-17 N=28		6.7			
			40								
		41.5 6457.5				19-24-19 N=43		5.6			
		Boring Terminated at 41.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
CME 75

Hammer Type
Automatic

Driller
EDI

Notes

Advancement Method
8" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
MBG

Boring Started
08-16-2023

Boring Completed
08-16-2023

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. T-01

Location: See Exploration Plan

Latitude: 35.5556° Longitude: -105.9948°

Depth (Ft.) Elevation.: 6521 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Elevation (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
3		0.3	6520.75	**TOPSOIL**, approximately 3" thick									
				SANDY LEAN CLAY (CL), brown, very stiff to hard				3-5-14 N=19		10.2			
					5			30-50/4"		6.6	103	31-12-19	64
		7.0	6514										
2				**CLAYEY SAND (SC)**, fine to coarse grained, tan to red brown, medium dense				5-7-6 N=13		5.8			
					10			3-6-7 N=13		6.6			
		14.0	6507										
1				**SANDY LEAN CLAY (CL)**, brown, stiff				6-7-8 N=15		6.7			
					15								
					20			13-6-5 N=11		5.0			
		24.0	6497										
4				**SILTY SAND (SM)**, trace gravel, fine to coarse grained, brown, dense									
					25			26-16-15 N=31		4.2		NP	38
		29.0	6492										
3				**SANDY LEAN CLAY (CL)**, brown to red brown, very stiff, moderate cementation									
					30			26-12-14 N=26		7.9			
		31.5	6489.5										
				Boring Terminated at 31.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
SS

Boring Started
08-24-2023

Boring Completed
08-24-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. T-02

Location: See Exploration Plan

Latitude: 35.5590° Longitude: -105.9836°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6553 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
4		0.2	**TOPSOIL**, approximately 2" thick — 6552.83									
			CLAYEY SAND (SC), with silt, fine grained, brown to beige, very dense, moderate cementation				7-20-33 N=53					
		5.0	6548	5			50/4"		6.3	91		
3			**SANDY SILT (ML)**, brown, very stiff to hard				7-10-19 N=29		5.5		NP	63
				10			10-14-13 N=27		7.8			
		14.0	6539									
			SANDY LEAN CLAY (CL), brown, very stiff	15			10-12-15 N=27		5.7			
				20			8-9-11 N=20		7.5		26-16-10	58
		24.0	6529									
4			**SILTY SAND (SM)**, fine to coarse grained, tan to beige, medium dense to dense	25			10-8-8 N=16		6.9			
		31.5	6521.5	30			6-24-22 N=46		7.4			
			Boring Terminated at 31.5 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
SS

Boring Started
08-24-2023

Boring Completed
08-24-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. T-03

Location: See Exploration Plan

Latitude: 35.5627° Longitude: -105.9714°

Depth (Ft.) Elevation.: 6580 (Ft.)

Model Layer	Depth (Ft.)	Material Description	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
1	0.3 (6579.75)	**TOPSOIL**, approximately 3" thick					
		LEAN CLAY WITH SAND (CL), brown, soft to medium stiff	5-3-3 N=6	4.6			
			6-3	4.5	89		
			3-2-1 N=3	3.3			
	9.0 (6571)						
2		**SILTY SAND (SM)**, trace gravel, fine to coarse grained, brown, loose to medium dense	3-5-7 N=12	2.1		NP	23
			3-4-5 N=9	5.4			
	19.0 (6561)						
		SILTY CLAYEY SAND (SC-SM), trace gravel, fine to coarse grained, brown, loose	3-2-2 N=4	3.9			
	24.0 (6556)						
4		**SILTY SAND (SM)**, fine to coarse grained, brown, medium dense to very dense	6-4-6 N=10	2.7			
			8-24-18 N=42	1.6			
	31.5 (6548.5)						
		Boring Terminated at 31.5 Feet					

Depth (Ft.): 5, 10, 15, 20, 25, 30

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Logged by
SS

Boring Started
08-25-2023

Boring Completed
08-25-2023

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. T-04

Location: See Exploration Plan

Latitude: 35.5653° Longitude: -105.9632°

Model Layer	Depth (Ft.)	Elevation.: 6654 (Ft.)	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
	0.3	**TOPSOIL**, approximately 4" thick — 6653.67					
	2.0	**CLAYEY SAND (SC)**, fine grained, brown, medium dense, moderate cementation — 6652					
		SILTY SAND (SM), fine grained, brown, medium dense	8-13	3.7	101		
			7-9-10 N=19	1.3			
	7.0	— 6647					
		SILTY CLAYEY SAND (SC-SM), fine grained, brown, medium dense	2-6-7 N=13	3.4			
	9.0	— 6645					
2		**SANDY SILT (ML)**, brown, medium dense	6-9-13 N=22	3.8			
			6-8-13 N=21	5.8		NP	61
			8-13-23 N=36	4.0			
	24.0	— 6630					
4		**CLAYEY SAND (SC)**, fine grained, brown, medium dense to dense	29-14-16 N=30	11.3			
			10-12-11 N=23	4.3			
	31.5	— 6622.5					
		Boring Terminated at 31.5 Feet					

Depth (Ft.): 5, 10, 15, 20, 25, 30

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
D-50

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
7" Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
SS

Boring Started
08-25-2023

Boring Completed
08-25-2023

BORING LOG NO. B-01

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5531° Longitude: -106.0133°

Surface Elev.: 6455 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		0	6455									
							1-5-7 N=12		5.2		NP	57
							11-17		7.6	86		
				5			5-6-8 N=14		4.9			
							1-2-4 N=6		4.7			
				10			4-9-17 N=26		7.6			
							14-16-13 N=29		4.8			
				15			7-9-11 N=20		7.7			
		16.5	6438.5									

SANDY SILT (ML), brown, medium stiff to very stiff

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-25-2022 | Boring Completed: 07-25-2022

Drill Rig: CME 55 | Driller: Terracon

Project No.: 66225093

Exhibit A-50

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-02

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5520° Longitude: -106.0081°

Surface Elev.: 6478 (Ft.)

DEPTH ELEVATION (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		0								
					1-2-4 N=6		5.1			
					6-3-4 N=7		5.8			
		5			3-3		8.7	86	NP	75
					1-2-2 N=4		8.0			
		10			2-4-4 N=8		7.0			
					4-10-11 N=21		9.7			
		15			5-9-12 N=21		7.0			

SILT WITH SAND (ML), brown, soft to very stiff

16.5 6461.5

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-25-2022 Boring Completed: 07-25-2022

Drill Rig: CME 55 Driller: Terracon

Project No.: 66225093

Exhibit A-51

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-03

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5502° Longitude: -106.0139°

Surface Elev.: 6441 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
3			**SANDY SILT (ML)**, brown, very stiff to hard				4-11-16 N=27		9.4			
							10-19-27 N=46		8.8			
		5.0	6436	5								
2			**SILTY SAND (SM)**, light brown, loose				8-6		7.6	93		
							2-4-5 N=9		6.7			
		10.0	6431	10								
3			**SANDY SILT (ML)**, light brown, very stiff to hard, none to moderate cementation				3-7-8 N=15		7.0		NP	61
							11-15-16 N=31		11.2			
		16.5	6424.5	15			16-25-19 N=44		6.8			
			Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-21-2022 | Boring Completed: 07-21-2022

Drill Rig: CME 55 | Driller: Terracon

Project No.: 66225093

Exhibit A-52

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-04

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5502° Longitude: -106.0047°

Surface Elev.: 6474 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1			**SANDY SILT (ML)**, brown, medium stiff to very stiff				2-2-7 N=9		4.1			
							13-19		6.9	99	NP	75
				5			3-3-4 N=7		6.8			
							1-2-3 N=5		6.0			
				10			4-9-11 N=20		6.6			
4		13.5	6460.5				7-10-12 N=22		6.0			
1			**SANDY SILT (ML)**, brown, stiff	15			6-4-7 N=11		10.0			
		16.5	6457.5									
			Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-25-2022 | Boring Completed: 07-25-2022

Drill Rig: CME 55 | Driller: Terracon

Project No.: 66225093

Exhibit A-53

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-05

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5470° Longitude: -106.0163°

Surface Elev.: 6421 (Ft.)

DEPTH ELEVATION (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
3		0			4-11		10.7	82		
					16-36-39 N=75		6.9			
		5			20-25-30 N=55		6.5		NP	61
					13-16-16 N=32		7.4			
		10			4-6-6 N=12		5.9			
					5-8-9 N=17		3.8			
		15			4-6-10 N=16		3.0			

SANDY SILT (ML), light brown, stiff to hard, none to strong cementation

16.5 6404.5

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-21-2022 Boring Completed: 07-21-2022

Drill Rig: CME 55 Driller: Terracon

Project No.: 66225093

Exhibit A-54

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-06

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5476° Longitude: -106.0099°

Surface Elev.: 6438 (Ft.)

DEPTH ELEVATION (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
3										
					2-6-9 N=15		6.9			
					9-11-11 N=22		6.2			
		5			17-26		6.8	98		
					13-16-20 N=36		9.6			
		10			10-13-16 N=29		6.5		NP	59
					4-8-10 N=18		8.5			
		15			7-7-6 N=13		7.1			

SANDY SILT (ML), brown, stiff to hard

16.5 6421.5

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-25-2022 Boring Completed: 07-25-2022

Drill Rig: CME 55 Driller: Terracon

Project No.: 66225093

Exhibit A-55

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-07

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5429° Longitude: -106.0302°

Surface Elev.: 6361 (Ft.)

DEPTH ELEVATION (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
3										
					2-4-5 N=9		6.6			
					10-11		9.3	84	NP	70
		5			12-35-50 N=85		7.8			
					21-37-50 N=87		8.4			
		10			16-18-19 N=37		11.2			
					13-14-15 N=29		11.0			
		15			6-10-13 N=23		7.7			

SANDY SILT (ML), brown with black and white streaks, stiff to hard, none to strong cementation

16.5 6344.5

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-21-2022 Boring Completed: 07-21-2022

Drill Rig: CME 55 Driller: Terracon

Project No.: 66225093

Exhibit A-56

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-08

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5417° Longitude: -106.0235°

Surface Elev.: 6389 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
3		0.0	6389	**SANDY SILT (ML)**, tan, stiff to hard				4-7-5 N=12		9.1			
								3-5-10 N=15		8.9			
					5			36-12		7.1	96	NP	59
4		11.0	6378	**SILTY SAND (SM)**, light brown, medium dense				4-5-5 N=10		5.6			
					10			5-6-10 N=16		8.6			
3		16.5	6372.5	**SANDY SILT (ML)**, brown, stiff to hard, none to moderate cementation				2-6-6 N=12		10.7			
					15			18-30-53 N=83		9.3			
				Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-21-2022 | Boring Completed: 07-21-2022

Drill Rig: CME 55 | Driller: Terracon

Project No.: 66225093

Exhibit A-57

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-09

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5430° Longitude: -106.0101°

Surface Elev.: 6414 (Ft.)

DEPTH ELEVATION (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
3		0			3-5-13 N=18		9.5			
					23-24		5.8	97		
		5			14-21-36 N=57		7.9			
					50/4"		6.4			
		10			35-15-11 N=26		6.4			
					3-5-10 N=15		6.5			
		15			10-10-9 N=19		6.6			

SANDY SILT (ML), light brown and white, tan, stiff to hard, none to strong cementation

16.5 6397.5

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-21-2022 Boring Completed: 07-21-2022

Drill Rig: CME 55 Driller: Terracon

Project No.: 66225093

Exhibit A-58

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-10

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5444° Longitude: -106.0113°

Surface Elev.: 6419 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		1.0	6418									
			SANDY SILT (ML), brown, stiff				4-3-9 N=12		6.1			
2			**SILTY SAND (SM)**, light brown, loose to medium dense				10-14		6.8	90		
		6.0	6413	5			2-3-1 N=4		7.4			
3			**SILT (ML)**, brown, stiff to hard, none to moderate cementation				12-28-34 N=62		7.3			
				10			10-15-12 N=27		16.5		NP	86
							5-9-6 N=15		9.5			
				15			5-14-37 N=51		7.3			
		16.5	6402.5									
			Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-21-2022 | Boring Completed: 07-21-2022

Drill Rig: CME 55 | Driller: Terracon

Project No.: 66225093

Exhibit A-59

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-11

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5492° Longitude: -106.0020°

Surface Elev.: 6478 (Ft.)

DEPTH ELEVATION (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1										
					2-2-3 N=5		4.7			
					2-3-3 N=6		5.2		NP	61
		5			4-15		7.3	90		
					1-2-2 N=4		7.7			
		10			9-11-12 N=23		7.5			
					6-7-8 N=15		7.3			
		15			7-11-15 N=26		8.4			

SANDY SILT (ML), brown, soft to very stiff

16.5 6461.5

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-25-2022 Boring Completed: 07-25-2022

Drill Rig: CME 55 Driller: Terracon

Project No.: 66225093

Exhibit A-60

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-12

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5489° Longitude: -106.0051°

Surface Elev.: 6462 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		0	6462				-1					
							1-2-1 N=3		7.5			
							1-2		7.7	84		
				5			2-2-2 N=4		8.1		NP	58
							5-14-50 N=64		6.7			
				10			11-10-8 N=18		4.1			
							3-5-7 N=12		4.9			
				15			4-7-8 N=15		6.0			
		16.5	6445.5									

SANDY SILT (ML), brown, very soft to hard, none to moderate cementation

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-25-2022 | Boring Completed: 07-25-2022

Drill Rig: CME 55 | Driller: Terracon

Project No.: 66225093

Exhibit A-61

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-13

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5441° Longitude: -106.0017°

Surface Elev.: 6475 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1			**SANDY SILT (ML)**, brown, very soft to very stiff				4-6-9 N=15		4.9			
							7-8-8 N=16		5.1			
				5			1-1		5.5			
		8.0	6467				2-3-5 N=8		4.5			
2			**SILTY SAND (SM)**, trace gravel, brown, loose to medium dense	10			8-6-12 N=18		3.1		NP	23
							10-10-12 N=22		2.0			
				15			8-9-15 N=24		3.5			
		16.5	6458.5									
			Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-25-2022 | Boring Completed: 07-25-2022

Drill Rig: CME 55 | Driller: Terracon

Project No.: 66225093

Exhibit A-62

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-14

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5385° Longitude: -106.0131°

Surface Elev.: 6421 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		0	6421									
							3-7-10 N=17		3.4			
							10-22		4.8	93	NP	51
				5			4-5-8 N=13		5.0			
							4-5-6 N=11		3.9			
4				10			11-13-19 N=32		1.4			
							10-16-15 N=31		1.4			
				15			12-13-14 N=27		1.7			
		16.5	6404.5									

SANDY SILT (ML), brown, stiff to very stiff

SILTY SAND (SM), brown, medium dense to dense

Boring Terminated at 16.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-25-2022 | Boring Completed: 07-25-2022

Drill Rig: CME 55 | Driller: Terracon

Project No.: 66225093

Exhibit A-63

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-15

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5403° Longitude: -106.0080°

Surface Elev.: 6435 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1			**SANDY SILT (ML)**, brown, medium stiff to very stiff				2-5-11 N=16		4.7			
						S						
							5-8-9 N=17		6.5			
		6.0	6429	5			3-4		4.0	94	NP	41
2			**SILTY SAND**, light brown, medium dense				3-4-9 N=13		2.9			
				10			7-14-15 N=29		1.5			
							7-13-14 N=27		1.3			
				15			9-13-12 N=25		2.8			
		16.5	6418.5									
			Boring Terminated at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-21-2022 | Boring Completed: 07-21-2022

Drill Rig: CME 55 | Driller: Terracon

Project No.: 66225093

Exhibit A-64

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

BORING LOG NO. B-Sub

PROJECT: Rancho Viejo Solar Facility

CLIENT: AES Clean Energy Development LLC
Boulder, CO

SITE: NM 599 and NM 14
Santa Fe, NM

LOCATION See Exploration Plan

Latitude: 35.5534° Longitude: -106.0031°

Surface Elev.: 6493 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	SWELL (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		1.5	6491.5				6-12	-0.39 @ 500psf	11.9	78		
2		3.0	6490				2-4-8 N=12		9.8		NP	59
3		6.5	6486.5	5			14-32-23 N=55		7.3			
2		21.5	6471.5	10			3-7-6 N=13		6.4			
							3-4-7 N=11		4.5		NP	33
							5-6-8 N=14		3.3			
				15			4-7-10 N=17		2.4			
							6-10-22 N=32		1.3			
				20			8-17-20 N=37		1.9			
3		31.5	6461.5				6-10-11 N=21					
				25			10-20-49 N=69		8.2		NP	71
							11-13-19 N=32		7.6			
				30			6-16-27 N=43		8.8			

SANDY SILT (ML), light brown, stiff

SILTY SAND (SM), light brown, medium dense

SANDY SILT (ML), tan, stiff to hard, none to moderate cementation

SILTY SAND (SM), light brown, medium dense

SILT (ML), trace gravel, light brown, very stiff to hard, none to moderate cementation

Boring Terminated at 31.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4.5" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations measured in the field

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Started: 07-21-2022 | Boring Completed: 07-21-2022

Drill Rig: CME 55 | Driller: Terracon

Project No.: 66225093

Exhibit A-65

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/28/22

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-01

Location: See Exploration Plan

Latitude: 35.5417° Longitude: -106.0178°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6408 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3	**TOPSOIL**, approximately 3" thick — 6407.75									
			SILTY SAND (SM), trace gravel, fine grained, brown, weak cementation									
		2.5	6405.5									
			SANDY LEAN CLAY (CL), fine grained, light brown to tan, moderate cementation	5								
		6.5	6401.5									
			CLAYEY SAND (SC), fine to coarse grained, brown									
		10.0	6398	10								
			Boring Terminated at 10 Feet									



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
JD Backhoe

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-06-2024

Boring Completed
10-06-2024

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-03

Location: See Exploration Plan

Latitude: 35.5442° Longitude: -106.0081°

Depth (Ft.) Elevation.: 6444 (Ft.)

Depth (Ft.)	Elevation	Description
0.3	6443.75	**TOPSOIL**, approximately 3" thick
		CLAYEY SAND (SC), trace gravel, fine grained, brown, weak cementation
3.0	6441	
		SANDY LEAN CLAY (CL), fine grained, light brown to tan, moderate cementation
8.0	6436	
		CLAYEY SAND (SC), fine to coarse grained, brown
10.0	6434	
		Boring Terminated at 10 Feet

Model Layer | Graphic Log | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | SWELL (%) | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
JD Backhoe

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-06-2024

Boring Completed
10-06-2024

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-04

Location: See Exploration Plan

Latitude: 35.5404° Longitude: -106.0098°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6434 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.2	**TOPSOIL**, approximately 2" thick 6433.83									
		1.0	**SILTY SAND (SM)**, trace gravel, fine grained, brown 6433									
			SANDY LEAN CLAY (CL), fine grained, light brown to tan, moderate cementation	5								
		7.0	6427									
			CLAYEY SAND (SC), fine to coarse grained, brown									
		10.0	6424	10								
			Boring Terminated at 10 Feet									



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
JD Backhoe

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-06-2024

Boring Completed
10-06-2024

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-05

Location: See Exploration Plan

Latitude: 35.5433° Longitude: -106.0023°

Depth (Ft.) Elevation.: 6465 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.2 **TOPSOIL**, approximately 2" thick 6464.83								
		1.5 **SILTY SAND (SM)**, trace gravel, fine grained, brown 6463.5								
		SANDY SILT (ML), trace clay, fine grained, light brown to tan, moderate cementation								
		6.5 6458.5								
		SANDY LEAN CLAY (CL), fine grained, light brown								
		10.0 6455								
		Boring Terminated at 10 Feet								



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
JD Backhoe

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-06-2024

Boring Completed
10-06-2024

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-06

Location: See Exploration Plan

Latitude: 35.5468° Longitude: -106.0041°

Depth (Ft.) | Elevation.: 6462 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 3" thick (6461.75)								
		CLAYEY SAND (SC), trace gravel, fine to coarse grained, brown, weak cementation								
		4.0 (6458)								
		SANDY LEAN CLAY (CL), fine grained, light brown to tan, moderate cementation								
		8.0 (6454)								
		SILTY SAND (SM), trace gravel, fine grained, brown, weak cementation								
		10.0 (6452)								
		Boring Terminated at 10 Feet								



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
JD Backhoe

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-07-2024

Boring Completed
10-07-2024

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-07

Location: See Exploration Plan

Latitude: 35.5455° Longitude: -106.0138°

Depth (Ft.) Elevation.: 6424 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 3" thick (6423.75)								
		CLAYEY SAND (SC), trace gravel, fine to coarse grained, brown, weak cementation								
		4.0 (6420)								
		SANDY LEAN CLAY (CL), fine grained, light brown to tan, moderate cementation								
		8.0 (6416)								
		SILTY SAND (SM), trace gravel, fine grained, brown, weak cementation								
		10.0 (6414)								
		Boring Terminated at 10 Feet								



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
JD Backhoe

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-09-2024

Boring Completed
10-09-2024

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-08

Location: See Exploration Plan

Latitude: 35.5482° Longitude: -106.0012°

Depth (Ft.)	Elevation.: 6482 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
0.3	**TOPSOIL**, approximately 4" thick — 6481.67									
2.0	**CLAYEY SAND (SC)**, trace gravel, fine to coarse grained, light brown — 6480									
7.0	**SANDY LEAN CLAY (CL)**, fine grained, tan, moderate cementation — 6475	5								
10.0	**SILTY SAND (SM)**, trace gravel, fine to coarse grained, brown, weak cementation — 6472	10								
	Boring Terminated at 10 Feet									



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
Komatsu PC170

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-08-2024

Boring Completed
10-08-2024

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

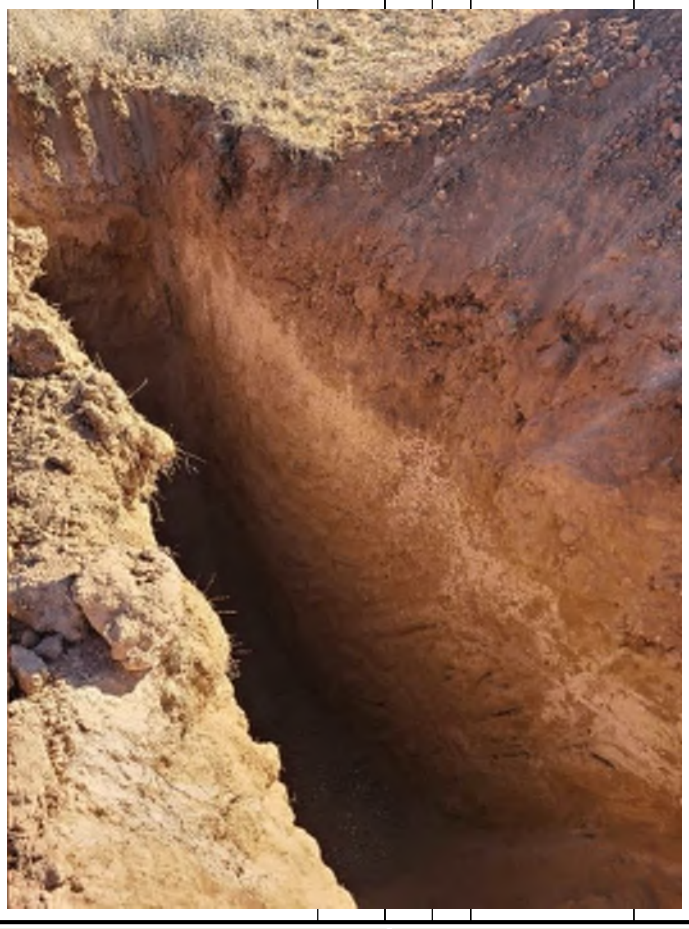
Boring Log No. TP-09

Location: See Exploration Plan

Latitude: 35.5487° Longitude: -106.0087°

Depth (Ft.) Elevation.: 6453 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 3" thick 6452.75								
		CLAYEY SAND (SC), trace gravel, fine to coarse grained, light brown								
		4.0 6449								
		5.0 **SANDY LEAN CLAY (CL)**, trace gravel, fine grained, tan to white brown, moderate cementation 6448								
		SILTY SAND (SM), trace gravel, fine grained, light brown								
		7.0 6446								
		CLAYEY SAND (SC), trace gravel, fine grained, brown								
		10.0 6443								
		Boring Terminated at 10 Feet								



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
Komatsu PC170

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-08-2024

Boring Completed
10-08-2024

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-10

Location: See Exploration Plan

Latitude: 35.5522° Longitude: -106.0075°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6471 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3	**TOPSOIL**, approximately 3" thick 6470.75									
		2.0	**CLAYEY SAND (SC)**, trace gravel, fine to coarse grained, brown 6469									
		10.0	**SANDY SILT (ML)**, trace gravel, fine grained, light brown to tan, moderate cementation 6461	5								
			Boring Terminated at 10 Feet	10								



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
Komatsu PC170

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-08-2024

Boring Completed
10-08-2024

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-11

Location: See Exploration Plan

Latitude: 35.5495° Longitude: -106.0174°

Depth (Ft.) | Elevation.: 6422 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick (6421.67)								
		CLAYEY SAND (SC), trace gravel, light brown								
		4.0 (6418)								
		SANDY SILT (ML), trace clay, tan to white brown, weak to moderate cementation								
		7.0 (6415)								
		CLAYEY SAND (SC), light brown								
		10.0 (6412)								
		Boring Terminated at 10 Feet								



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
Komatsu PC170

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-09-2024

Boring Completed
10-09-2024

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-12

Location: See Exploration Plan

Latitude: 35.5504° Longitude: -106.0114°

Depth (Ft.) Elevation.: 6452 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 3" thick (6451.75)								
		SANDY SILT (ML), tan, weak cementation								
		5.0 (6447)								
		SILTY SAND (SM), trace gravel, light brown								
		10.0 (6442)								
		Boring Terminated at 10 Feet								



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
Komatsu PC170

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-09-2024

Boring Completed
10-09-2024

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-13

Location: See Exploration Plan

Latitude: 35.5539° Longitude: -106.0116°

Depth (Ft.) | Elevation.: 6461 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.2 **TOPSOIL**, approximately 2" thick (6460.83)								
		1.5 **SANDY SILT (ML)**, fine grained, brown (6459.5)								
		SANDY LEAN CLAY (CL), fine grained, white brown to brown, moderate cementation								
		10.0 (6451)								
		Boring Terminated at 10 Feet								



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
Komatsu PC170

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-09-2024

Boring Completed
10-09-2024

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-14

Location: See Exploration Plan

Latitude: 35.5523° Longitude: -106.0168°

Depth (Ft.) Elevation.: 6431 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.2 **TOPSOIL**, approximately 2" thick (6430.83)								
		SILTY SAND (SM), fine to coarse grained, brown								
		5.0 (6426)								
		CLAYEY SAND (SC), fine grained, brown								
		10.0 (6421)								
		Boring Terminated at 10 Feet								



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
Komatsu PC170

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-09-2024

Boring Completed
10-09-2024

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-15

Location: See Exploration Plan

Latitude: 35.5539° Longitude: -106.0050°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6487 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3	**TOPSOIL**, approximately 3" thick — 6486.75									
		1.0	**SILTY SAND (SM)**, coarse grained, brown — 6486									
			SANDY SILT (ML), fine grained, tan, weak cementation									
		5.0	6482	5								
			CLAYEY SAND (SC), fine to coarse grained, light brown									
		10.0	6477	10								
			Boring Terminated at 10 Feet									



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
Komatsu PC170

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-08-2024

Boring Completed
10-08-2024

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-BESS

Location: See Exploration Plan

Latitude: 35.5522° Longitude: -106.0018°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 6495 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3	**TOPSOIL**, approximately 3" thick — 6494.75									
			SILTY SAND (SM), fine to coarse grained, brown									
		2.0	6493									
			CLAYEY SAND (SC), trace gravel, fine to coarse grained, light brown, weak cementation	5								
		10.0	6485	10								
			Boring Terminated at 10 Feet									



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
Komatsu PC170

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-06-2024

Boring Completed
10-06-2024

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-SUB

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.5537° Longitude: -106.0013° Depth (Ft.) / Elevation.: 6500 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick — 6499.67									
		SANDY SILT (ML), brown									
		2.0 — 6498									
		SILTY SAND (SM), trace gravel, light brown to tan, weak cementation	5								
		10.0 — 6490	10								
		Boring Terminated at 10 Feet									



See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
Komatsu PC170

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

Logged by
ED

Boring Started
10-06-2024

Boring Completed
10-06-2024

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Boring Log No. TP-SW

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.5655° Longitude: -105.9624° Depth (Ft.) — Elevation.: 6684 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	SWELL (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3 **TOPSOIL**, approximately 4" thick — 6683.67 **SANDY SILT (ML)**, fine grained, brown 2.0 — 6682 **SILTY SAND (SM)**, trace gravel, fine to coarse grained, light brown 6.0 — 6678 **CLAYEY SAND (SC)**, fine to coarse grained, light brown 10.0 — 6674	5 10									
		Boring Terminated at 10 Feet									

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were provided by Google Earth Pro (2023).

Water Level Observations
Groundwater not encountered

Drill Rig
Komatsu PC170

Hammer Type
Automatic

Driller
Terracon

Logged by
ED

Boring Started
10-08-2024

Boring Completed
10-08-2024

Notes

Advancement Method
36" Wide Bucket

Abandonment Method
Backfilled with soil cuttings upon completion.

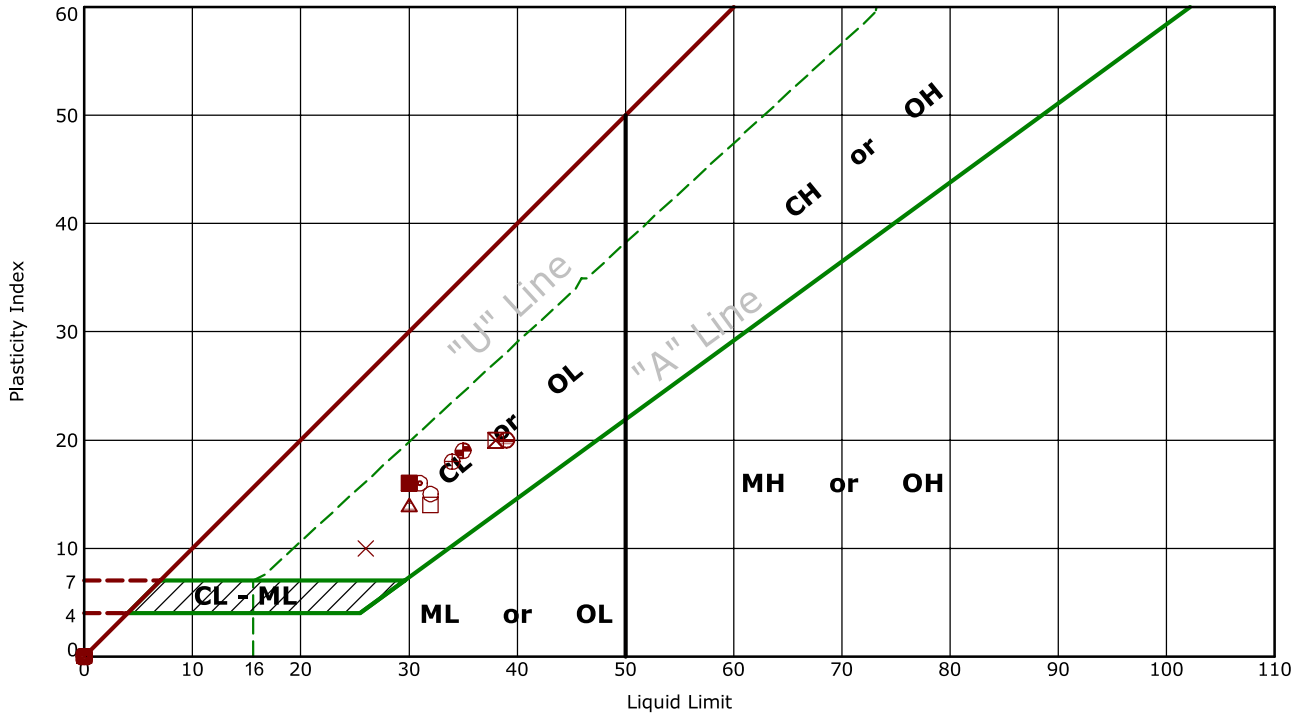
APPENDIX B

LABORATORY TESTING

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Atterberg Limit Results

ASTM D4318

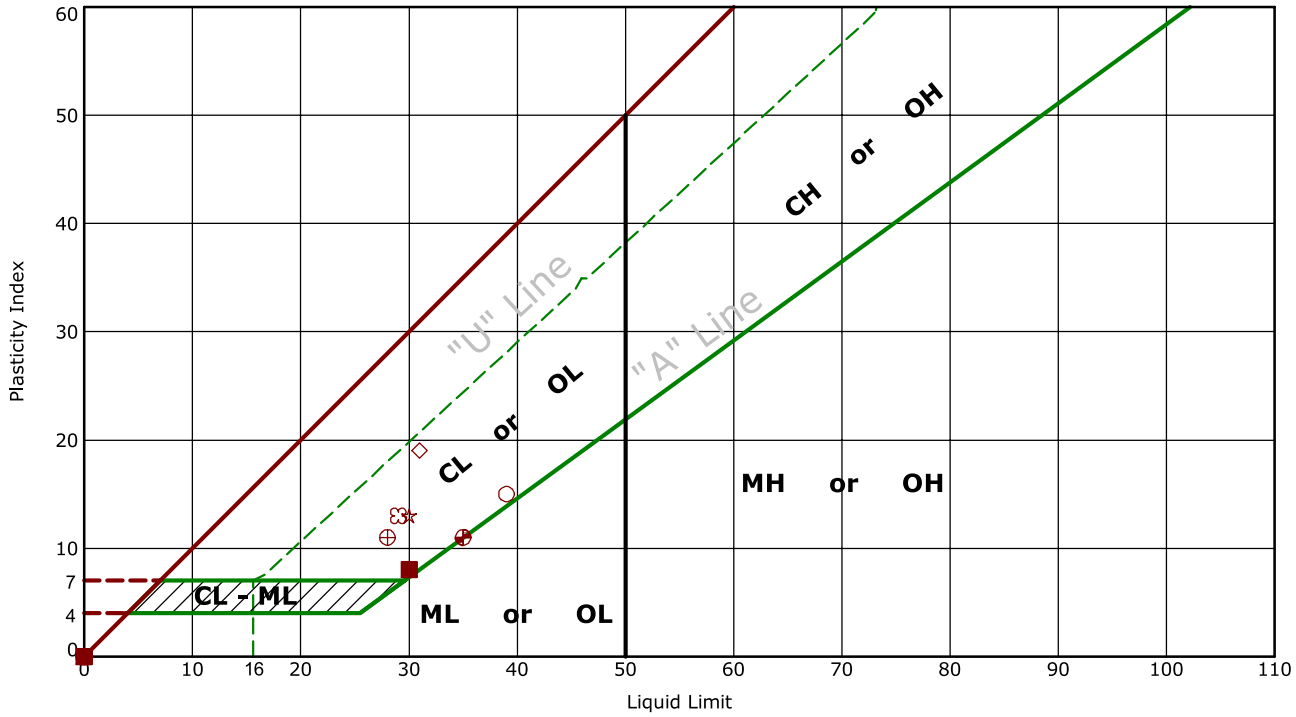


	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
⊖	A-01	2.5 - 4	39	19	20	61.9	CL	SANDY LEAN CLAY
⊠	A-02	5 - 5.5	38	18	20	55.6	CL	SANDY LEAN CLAY
△	A-03	7.5 - 9	30	16	14	64.8	CL	SANDY LEAN CLAY
☆	A-04	5 - 5.5	NP	NP	NP	39.3	SM	SILTY SAND
⊙	A-05	7.5 - 9	31	15	16	55.6	CL	SANDY LEAN CLAY
✿	A-06	5 - 6.5	NP	NP	NP	70.7	ML	SILT with SAND
○	A-07	2.5 - 4	32	17	15	79.5	CL	LEAN CLAY with SAND
△	A-08	7.5 - 9	NP	NP	NP	56.7	ML	SANDY SILT
⊗	A-09	7.5 - 9	NP	NP	NP	45.3	SM	SILTY SAND
⊕	A-10	5 - 6.5	34	16	18	56.6	CL	SANDY LEAN CLAY
□	A-11	5 - 5.5	32	18	14	66.2	CL	SANDY LEAN CLAY
⊗	A-12	7.5 - 9	NP	NP	NP	41.9	SM	SILTY SAND
◍	A-13	5 - 6.5	35	16	19	59.3	CL	SANDY LEAN CLAY
☆	A-14	5 - 6.5	NP	NP	NP	59.8	ML	SANDY SILT
⊠	A-15	2.5 - 4	NP	NP	NP	48.2	SM	SILTY SAND
■	Bess-01	2.5 - 4	30	14	16	77.3	CL	LEAN CLAY with SAND
◇	Bess-01	10 - 11.5	NP	NP	NP	67.0	ML	SANDY SILT
◇	Bess-02	7.5 - 9	NP	NP	NP	46.2	SM	SILTY SAND
×	Bess-02	15 - 16.5	26	16	10	62.3	CL	SANDY LEAN CLAY
⊠	Bess-03	20 - 21.5	NP	NP	NP	7.7	SW-SM	WELL-GRADED SAND with SILT

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Atterberg Limit Results

ASTM D4318

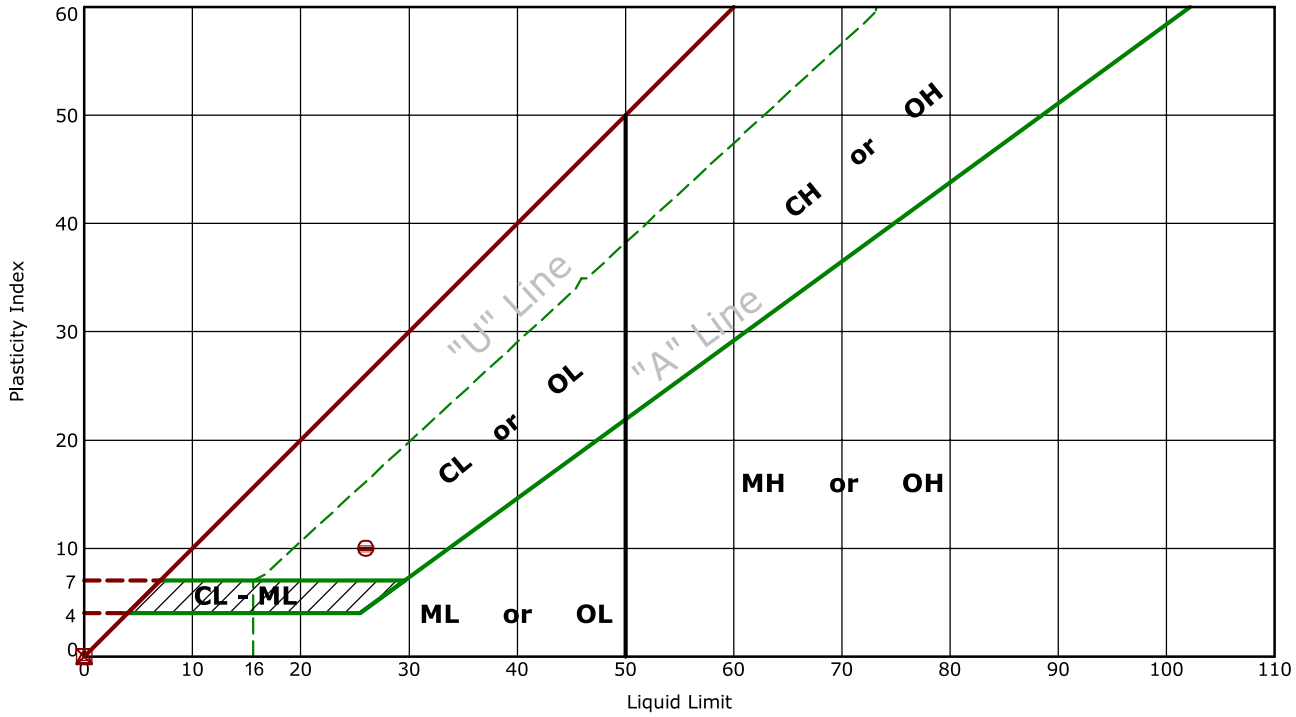


	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
⊖	BW-01	2.5 - 4	NP	NP	NP	50.0	SM	SILTY SAND
⊠	BW-01	20 - 21.5	NP	NP	NP	59.5	ML	SANDY SILT
△	BW-02	5 - 6.5	NP	NP	NP	35.2	SM	SILTY SAND
☆	BW-02	25 - 26.5	NP	NP	NP	40.3	SM	SILTY SAND
⊙	BW-03	5 - 6	NP	NP	NP	56.3	ML	SANDY SILT
✿	BW-03	15 - 16.5	NP	NP	NP	20.3	SM	SILTY SAND
○	P-02	2.5 - 4	39	24	15	61.2	CL	SANDY LEAN CLAY
△	P-03	5 - 6.5	NP	NP	NP			
⊗	P-04	2.5 - 4	NP	NP	NP	64.9	ML	SANDY SILT
⊕	P-05	5 - 6.5	28	17	11	62.5	CL	SANDY LEAN CLAY
□	P-06	5 - 6	NP	NP	NP	41.1	SM	SILTY SAND
⊗	P-07	2.5 - 3.5	NP	NP	NP	35.6	SM	SILTY SAND
◒	P-08	2.5 - 4	35	24	11	63.6	CL	SANDY LEAN CLAY
☆	Sub-01	2.5 - 3.5	30	17	13	58.5	CL	SANDY LEAN CLAY
✿	Sub-01	20 - 21.5	29	16	13	69.1	CL	SANDY LEAN CLAY
■	Sub-02	2.5 - 4	30	22	8	62.3	CL	SANDY LEAN CLAY
◇	Sub-02	20 - 21.5	NP	NP	NP	22.2	SM	SILTY SAND
◇	T-01	5 - 6	31	12	19	64.2	CL	SANDY LEAN CLAY
✕	T-01	25 - 26.5	NP	NP	NP	38.5	SM	SILTY SAND
✿	T-02	7.5 - 9	NP	NP	NP	62.9	ML	SANDY SILT

6805 Academy Pkwy West NE
Albuquerque, NM

Atterberg Limit Results

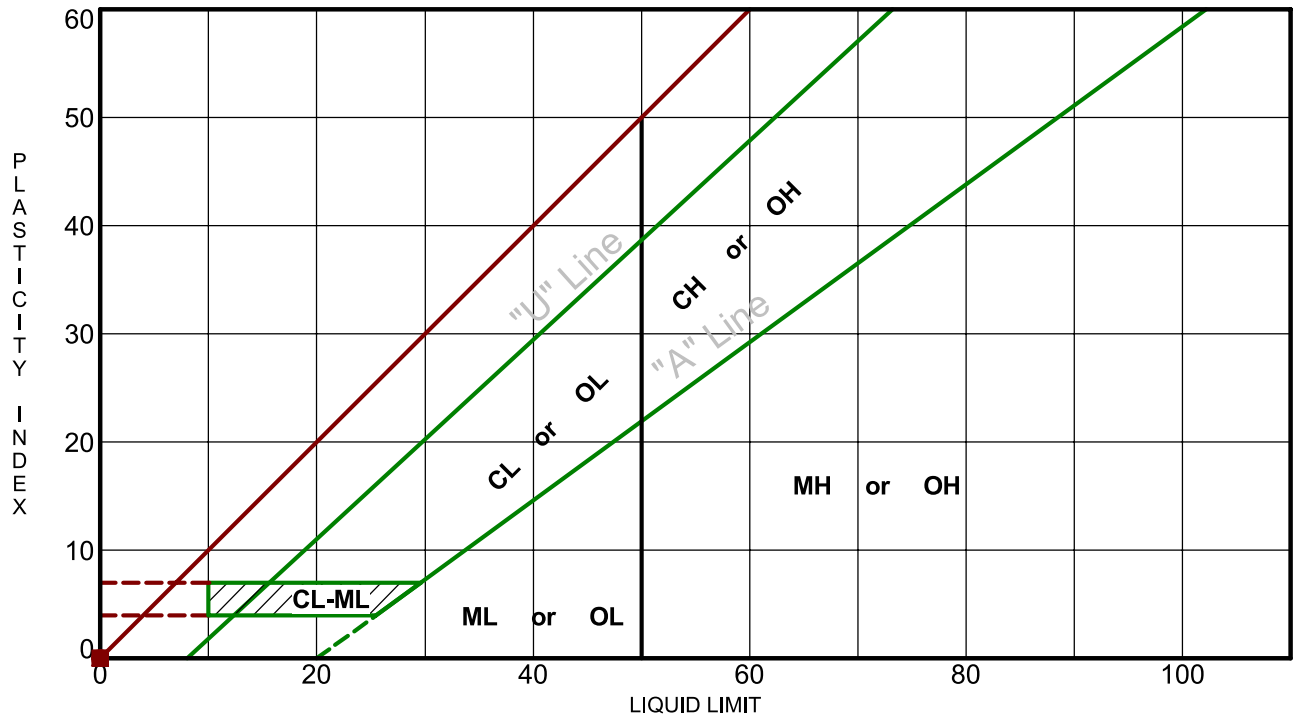
ASTM D4318



	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
⊖	T-02	20 - 21.5	26	16	10	58.3	CL	SANDY LEAN CLAY
⊠	T-03	10 - 11.5	NP	NP	NP	23.3	SM	SILTY SAND
△	T-04	15 - 16.5	NP	NP	NP	61.2	ML	SANDY SILT

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth (Ft)	LL	PL	PI	Fines	USCS	Description
⊖	B-01	0.5 - 2	NP	NP	NP	57.2	ML	SANDY SILT
⊠	B-02	5 - 6	NP	NP	NP	74.9	ML	SILT with SAND
△	B-03	10 - 11.5	NP	NP	NP	61.1	ML	SANDY SILT
☆	B-04	2.5 - 3.5	NP	NP	NP	74.8	ML	SILT with SAND
⊙	B-05	5 - 6.5	NP	NP	NP	61.0	ML	SANDY SILT
✿	B-06	10 - 11.5	NP	NP	NP	59.3	ML	SANDY SILT
○	B-07	2.5 - 3.5	NP	NP	NP	70.0	ML	SILT with SAND
△	B-08	5 - 6	NP	NP	NP	59.2	ML	SANDY SILT
⊗	B-10	10 - 11.5	NP	NP	NP	85.5	ML	SILT
⊕	B-11	2.5 - 4	NP	NP	NP	60.8	ML	SANDY SILT
□	B-12	5 - 6.5	NP	NP	NP	58.1	ML	SANDY SILT
⊗	B-13	10 - 11.5	NP	NP	NP	22.8	SM	SILTY SAND
◓	B-14	2.5 - 3.5	NP	NP	NP	50.7	ML	SANDY SILT
☆	B-15	5 - 6	NP	NP	NP	40.6	SM	SILTY SAND
✿	B-Sub	2.5 - 4	NP	NP	NP	59.1	ML	SANDY SILT
■	B-Sub	10 - 11.5	NP	NP	NP	32.7	SM	SILTY SAND
◇	B-Sub	25 - 26.5	NP	NP	NP	71.4	ML	SILT with SAND

PROJECT: Rancho Viejo Solar Facility

PROJECT NUMBER: 66225093

SITE: NM 599 and NM 14
Santa Fe, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

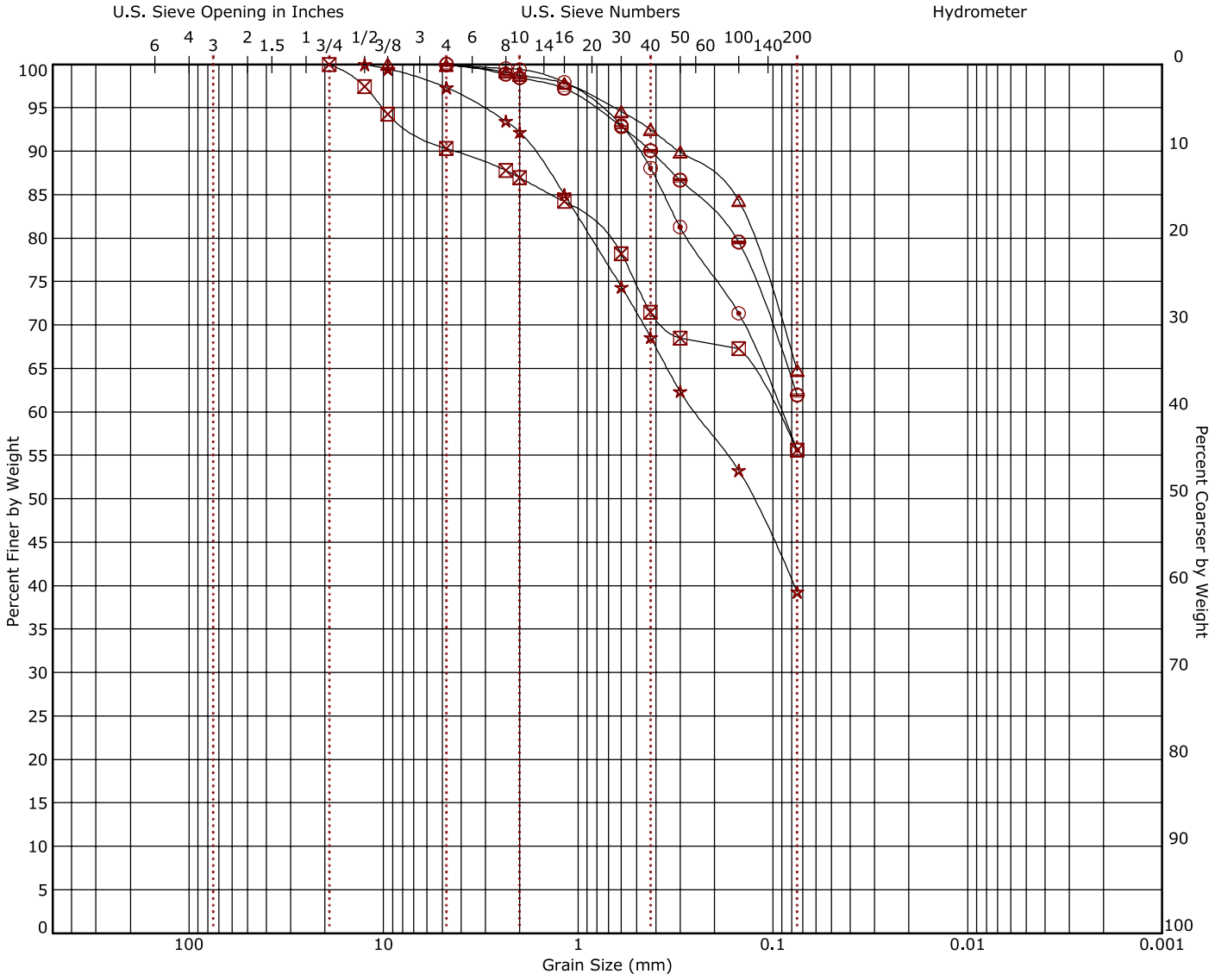
CLIENT: AES Clean Energy Development LLC
Boulder, CO

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/26/22

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Grain Size Distribution

ASTM D422 / ASTM C136



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

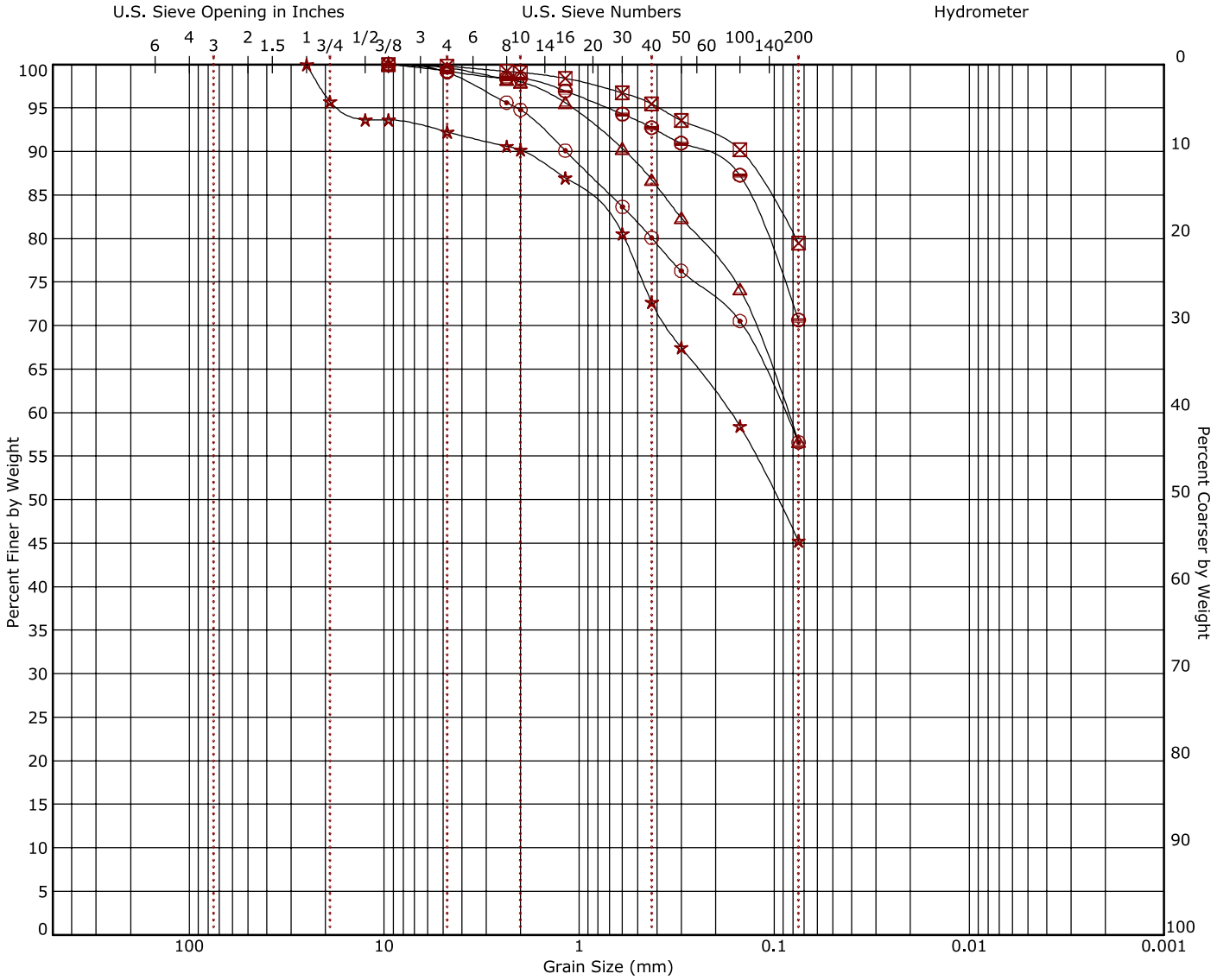
Boring ID		Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
⊖	A-01	2.5 - 4	SANDY LEAN CLAY	CL	39	19	20		
⊠	A-02	5 - 5.5	SANDY LEAN CLAY	CL	38	18	20		
△	A-03	7.5 - 9	SANDY LEAN CLAY	CL	30	16	14		
☆	A-04	5 - 5.5	SILTY SAND	SM	NP	NP	NP		
⊙	A-05	7.5 - 9	SANDY LEAN CLAY	CL	31	15	16		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
⊖	A-01	2.5 - 4	4.75				0.0	0.0	38.1	61.9		
⊠	A-02	5 - 5.5	19	0.097			0.0	9.7	34.7	55.6		
△	A-03	7.5 - 9	9.5				0.0	0.1	35.1	64.8		
☆	A-04	5 - 5.5	12.5	0.251			0.0	2.7	58.0	39.3		
⊙	A-05	7.5 - 9	4.75	0.091			0.0	0.0	44.4	55.6		

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Grain Size Distribution

ASTM D422 / ASTM C136



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

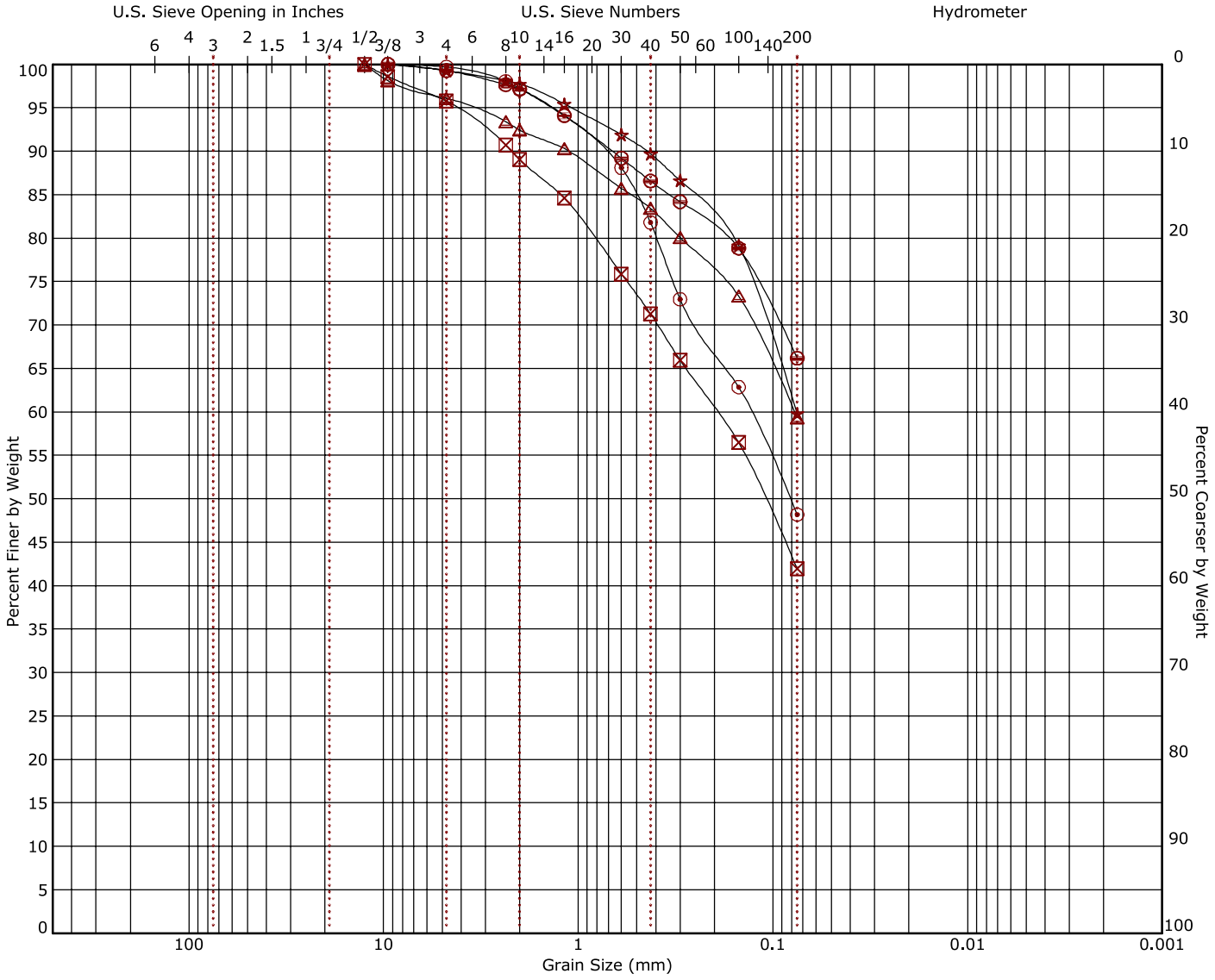
Boring ID		Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
⊖	A-06	5 - 6.5	SILT with SAND	ML	NP	NP	NP		
⊠	A-07	2.5 - 4	LEAN CLAY with SAND	CL	32	17	15		
△	A-08	7.5 - 9	SANDY SILT	ML	NP	NP	NP		
☆	A-09	7.5 - 9	SILTY SAND	SM	NP	NP	NP		
⊙	A-10	5 - 6.5	SANDY LEAN CLAY	CL	34	16	18		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
⊖	A-06	5 - 6.5	9.5				0.0	0.8	28.6	70.7		
⊠	A-07	2.5 - 4	9.5				0.0	0.2	20.3	79.5		
△	A-08	7.5 - 9	9.5	0.085			0.0	0.4	42.9	56.7		
☆	A-09	7.5 - 9	25	0.169			0.0	7.7	47.0	45.3		
⊙	A-10	5 - 6.5	9.5	0.089			0.0	0.9	42.5	56.6		

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Grain Size Distribution

ASTM D422 / ASTM C136



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

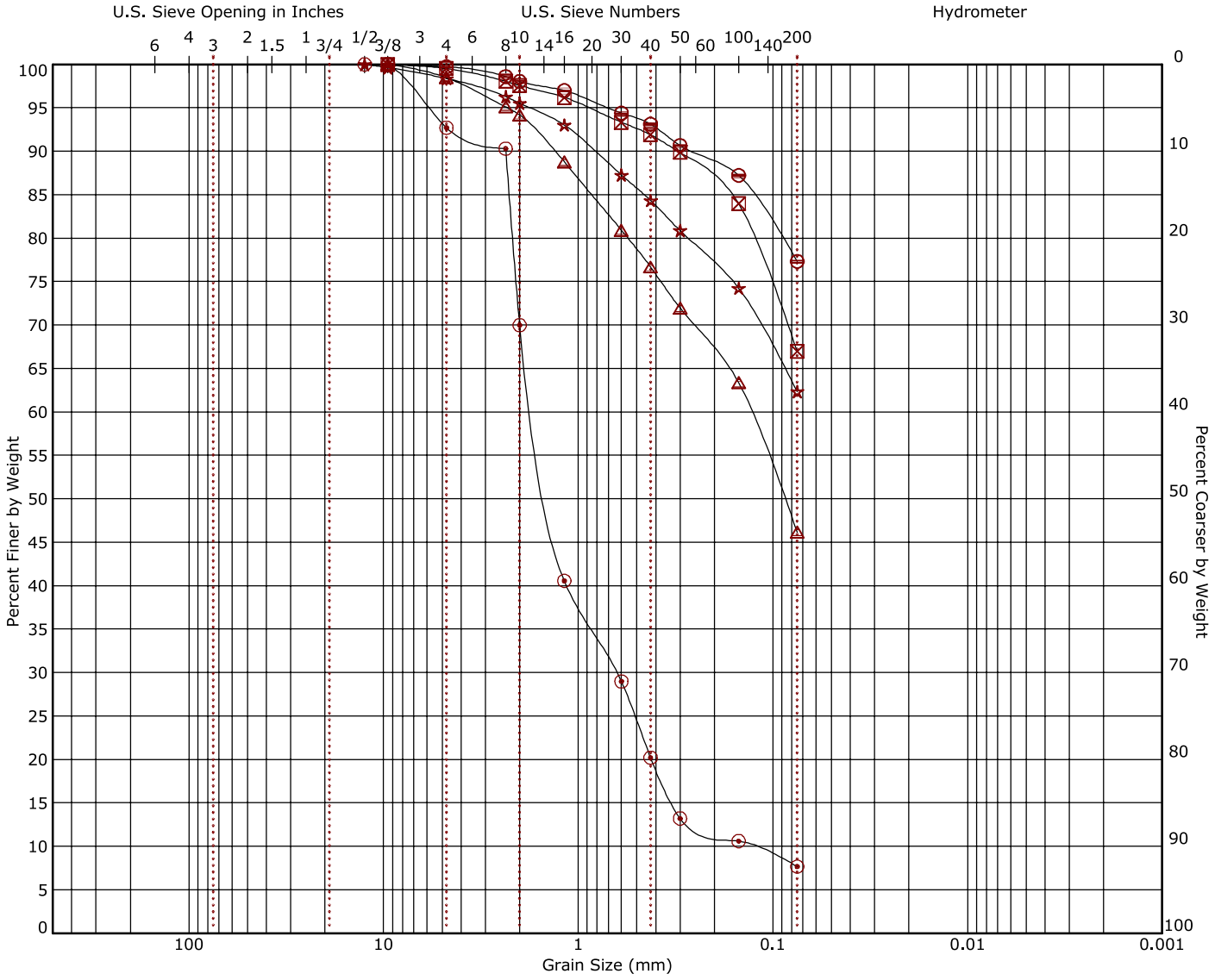
Boring ID		Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
⊖	A-11	5 - 5.5	SANDY LEAN CLAY	CL	32	18	14		
⊠	A-12	7.5 - 9	SILTY SAND	SM	NP	NP	NP		
△	A-13	5 - 6.5	SANDY LEAN CLAY	CL	35	16	19		
☆	A-14	5 - 6.5	SANDY SILT	ML	NP	NP	NP		
⊙	A-15	2.5 - 4	SILTY SAND	SM	NP	NP	NP		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
⊖	A-11	5 - 5.5	9.5				0.0	0.7	33.1	66.2		
⊠	A-12	7.5 - 9	12.5	0.194			0.0	4.2	53.8	41.9		
△	A-13	5 - 6.5	12.5	0.078			0.0	3.9	36.8	59.3		
☆	A-14	5 - 6.5	9.5	0.076			0.0	0.7	39.5	59.8		
⊙	A-15	2.5 - 4	9.5	0.131			0.0	0.3	51.5	48.2		

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Grain Size Distribution

ASTM D422 / ASTM C136



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

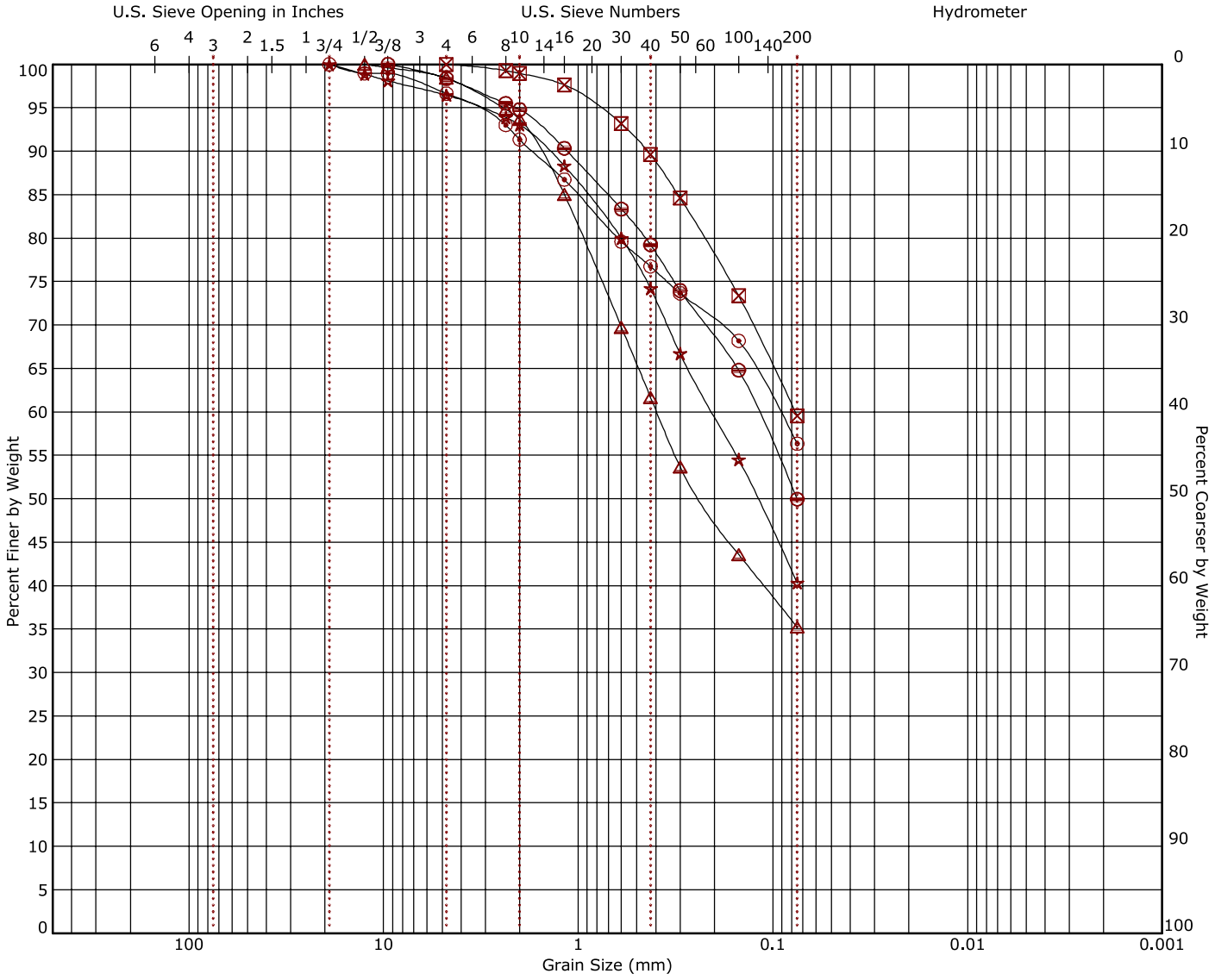
Boring ID	Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
Bess-01	2.5 - 4	LEAN CLAY with SAND	CL	30	14	16		
Bess-01	10 - 11.5	SANDY SILT	ML	NP	NP	NP		
Bess-02	7.5 - 9	SILTY SAND	SM	NP	NP	NP		
Bess-02	15 - 16.5	SANDY LEAN CLAY	CL	26	16	10		
Bess-03	20 - 21.5	WELL-GRADED SAND with SILT	SW-SM	NP	NP	NP	1.86	12.85

Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
Bess-01	2.5 - 4	9.5				0.0	0.3	22.4	77.3		
Bess-01	10 - 11.5	9.5				0.0	0.5	32.6	67.0		
Bess-02	7.5 - 9	9.5	0.131			0.0	1.5	52.3	46.2		
Bess-02	15 - 16.5	12.5				0.0	1.6	36.0	62.3		
Bess-03	20 - 21.5	12.5	1.672	0.637	0.13	0.0	7.3	85.0	7.7		

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Grain Size Distribution

ASTM D422 / ASTM C136



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Boring ID	Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
BW-01	2.5 - 4	SILTY SAND	SM	NP	NP	NP		
BW-01	20 - 21.5	SANDY SILT	ML	NP	NP	NP		
BW-02	5 - 6.5	SILTY SAND	SM	NP	NP	NP		
BW-02	25 - 26.5	SILTY SAND	SM	NP	NP	NP		
BW-03	5 - 6	SANDY SILT	ML	NP	NP	NP		

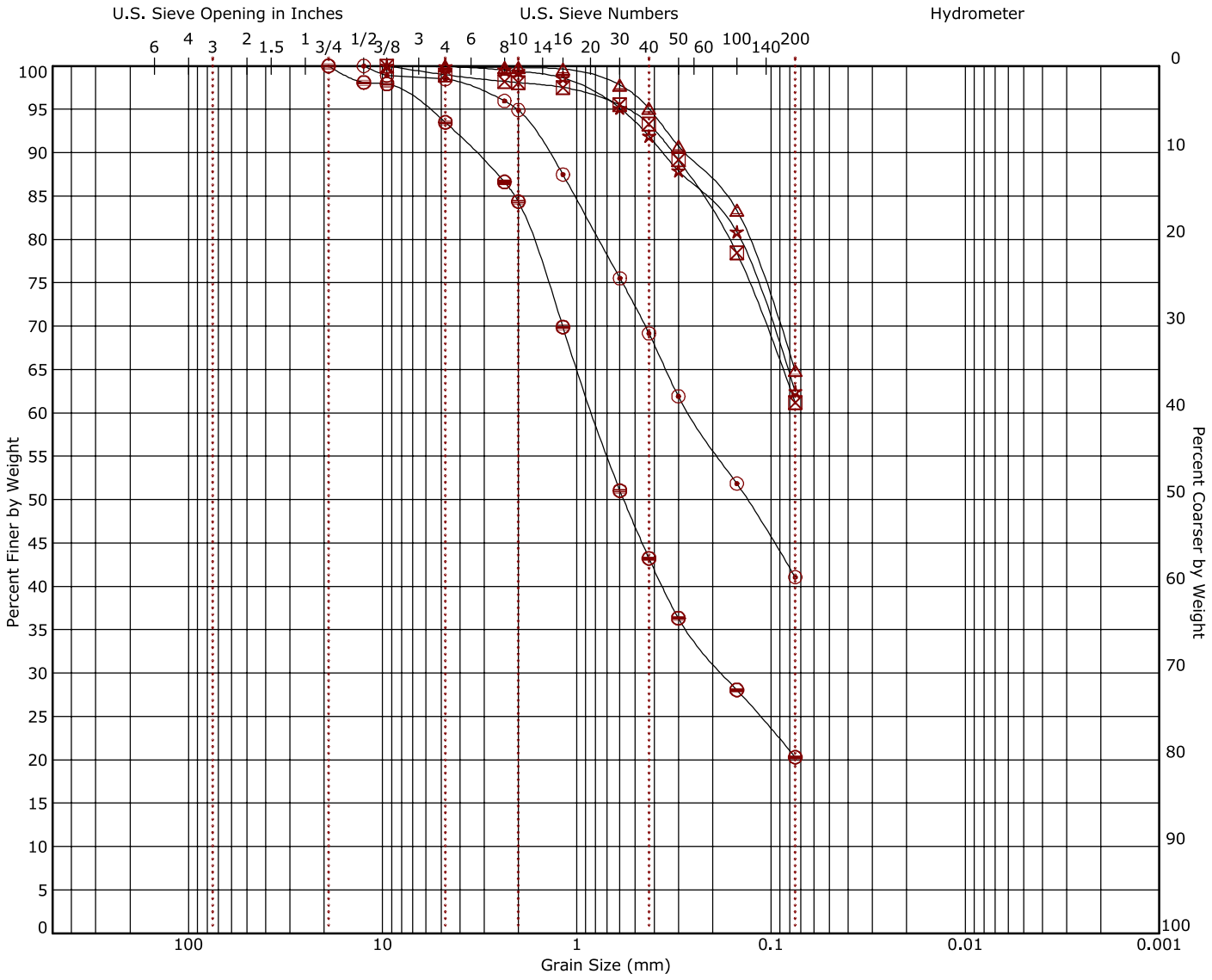
Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
BW-01	2.5 - 4	9.5	0.12			0.0	1.6	48.4	50.0		
BW-01	20 - 21.5	4.75	0.077			0.0	0.0	40.5	59.5		
BW-02	5 - 6.5	12.5	0.395			0.0	1.6	63.2	35.2		
BW-02	25 - 26.5	19	0.205			0.0	3.5	56.1	40.3		
BW-03	5 - 6	19	0.093			0.0	3.4	40.3	56.3		

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Grain Size Distribution

ASTM D422 / ASTM C136



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

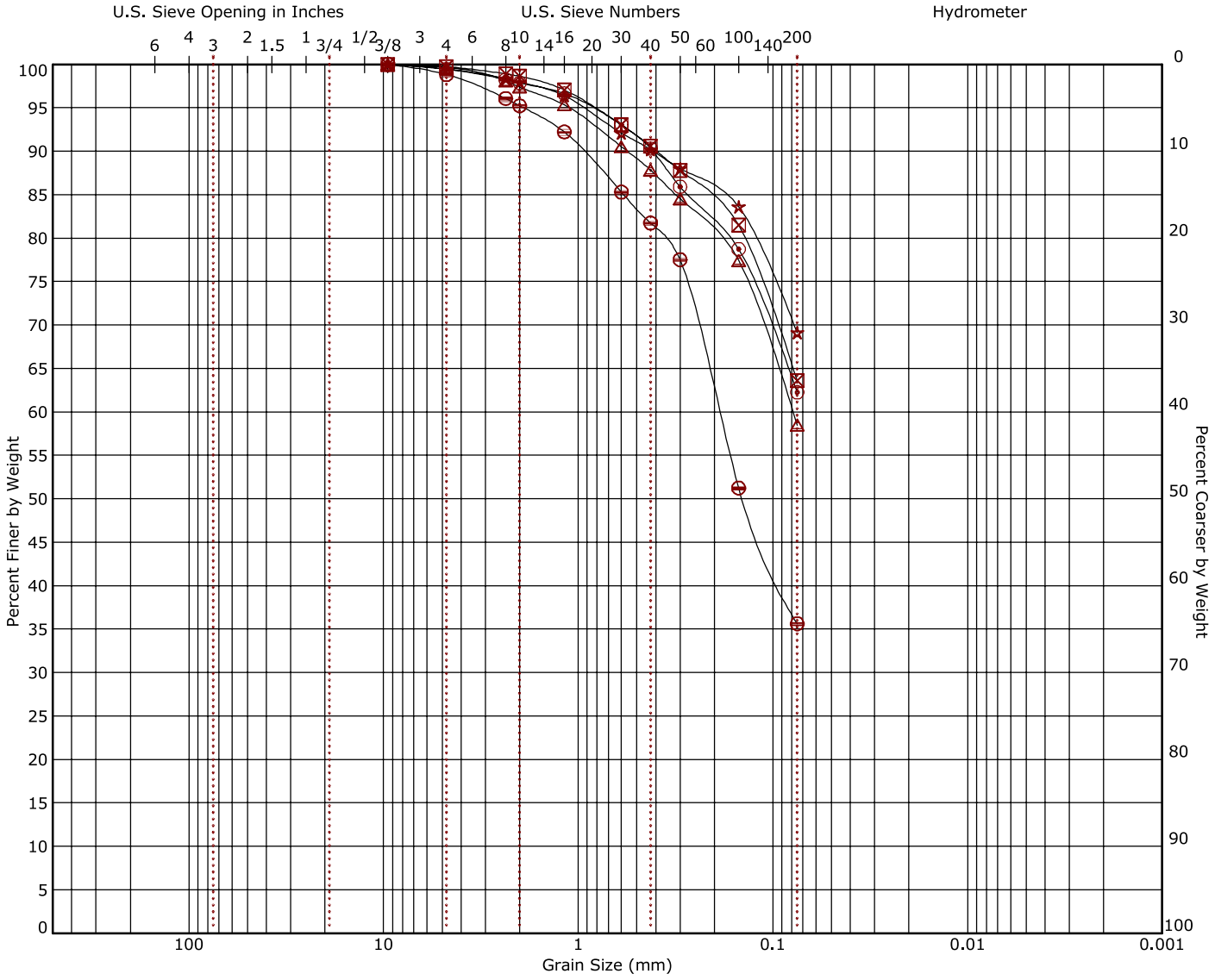
Boring ID	Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
BW-03	15 - 16.5	SILTY SAND	SM	NP	NP	NP		
P-02	2.5 - 4	SANDY LEAN CLAY	CL	39	24	15		
P-04	2.5 - 4	SANDY SILT	ML	NP	NP	NP		
P-05	5 - 6.5	SANDY LEAN CLAY	CL	28	17	11		
P-06	5 - 6	SILTY SAND	SM	NP	NP	NP		

Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
BW-03	15 - 16.5	19	0.827	0.176		0.0	6.5	73.2	20.3		
P-02	2.5 - 4	9.5				0.0	1.0	37.8	61.2		
P-04	2.5 - 4	4.75				0.0	0.0	35.1	64.9		
P-05	5 - 6.5	9.5				0.0	0.1	37.5	62.5		
P-06	5 - 6	12.5	0.263			0.0	1.5	57.4	41.1		

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Grain Size Distribution

ASTM D422 / ASTM C136



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

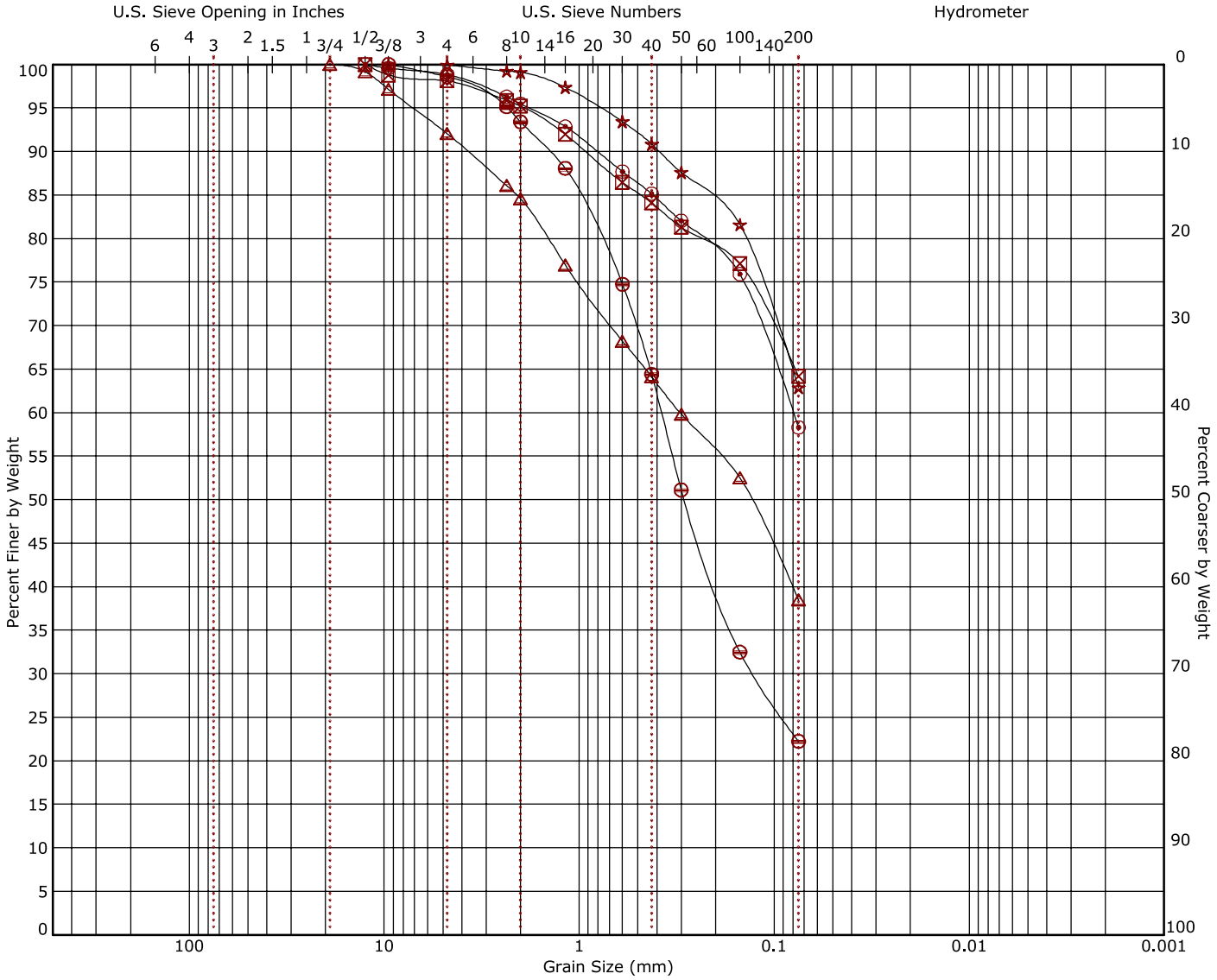
Boring ID		Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
⊖	P-07	2.5 - 3.5	SILTY SAND	SM	NP	NP	NP		
⊠	P-08	2.5 - 4	SANDY LEAN CLAY	CL	35	24	11		
△	Sub-01	2.5 - 3.5	SANDY LEAN CLAY	CL	30	17	13		
☆	Sub-01	20 - 21.5	SANDY LEAN CLAY	CL	29	16	13		
⊙	Sub-02	2.5 - 4	SANDY LEAN CLAY	CL	30	22	8		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
⊖	P-07	2.5 - 3.5	9.5	0.189			0.0	1.2	63.2	35.6		
⊠	P-08	2.5 - 4	9.5				0.0	0.3	36.2	63.6		
△	Sub-01	2.5 - 3.5	9.5	0.079			0.0	0.4	41.2	58.5		
☆	Sub-01	20 - 21.5	9.5				0.0	0.5	30.3	69.1		
⊙	Sub-02	2.5 - 4	9.5				0.0	0.5	37.2	62.3		

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Grain Size Distribution

ASTM D422 / ASTM C136



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

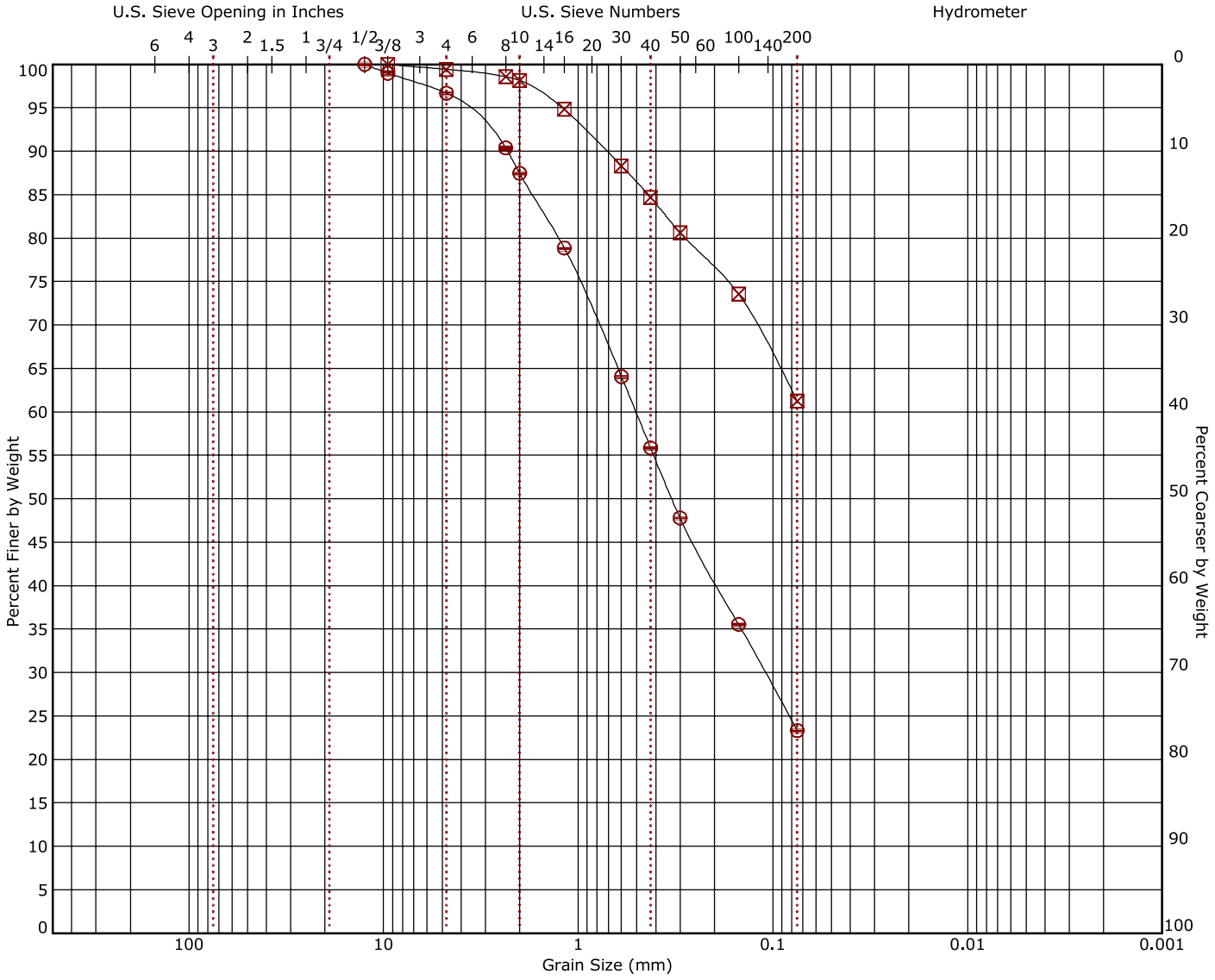
Boring ID		Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
⊖	Sub-02	20 - 21.5	SILTY SAND	SM	NP	NP	NP		
⊠	T-01	5 - 6	SANDY LEAN CLAY	CL	31	12	19		
△	T-01	25 - 26.5	SILTY SAND	SM	NP	NP	NP		
☆	T-02	7.5 - 9	SANDY SILT	ML	NP	NP	NP		
⊙	T-02	20 - 21.5	SANDY LEAN CLAY	CL	26	16	10		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
⊖	Sub-02	20 - 21.5	9.5	0.379	0.127		0.0	1.4	76.4	22.2		
⊠	T-01	5 - 6	12.5				0.0	1.9	34.0	64.2		
△	T-01	25 - 26.5	19	0.304			0.0	7.9	53.6	38.5		
☆	T-02	7.5 - 9	9.5				0.0	0.1	37.0	62.9		
⊙	T-02	20 - 21.5	12.5	0.08			0.0	1.2	40.5	58.3		

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Grain Size Distribution

ASTM D422 / ASTM C136



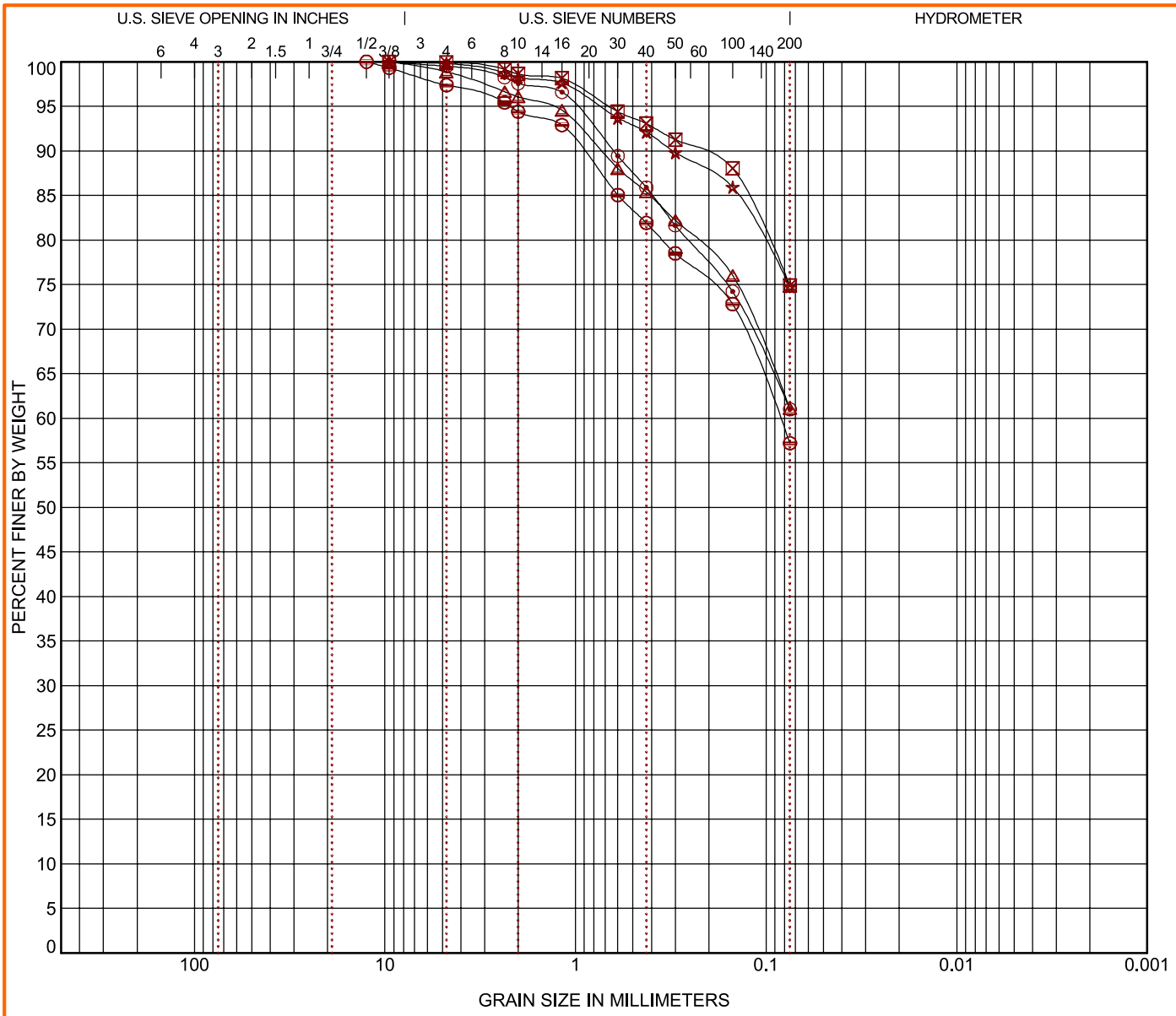
Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
⊖	T-03	10 - 11.5	SILTY SAND	SM	NP	NP	NP		
⊠	T-04	15 - 16.5	SANDY SILT	ML	NP	NP	NP		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
⊖	T-03	10 - 11.5	12.5	0.506	0.11		0.0	3.3	73.4	23.3		
⊠	T-04	15 - 16.5	9.5				0.0	0.6	38.2	61.2		

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
⊖	B-01	0.5 - 2	SANDY SILT (ML)	5.2	NP	NP	NP		
⊠	B-02	5 - 6	SILT with SAND (ML)	8.7	NP	NP	NP		
△	B-03	10 - 11.5	SANDY SILT (ML)	7.0	NP	NP	NP		
★	B-04	2.5 - 3.5	SILT with SAND (ML)	6.9	NP	NP	NP		
⊙	B-05	5 - 6.5	SANDY SILT (ML)	6.5	NP	NP	NP		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
⊖	B-01	0.5 - 2	12.5	0.085			0.0	2.6	40.2		57.2	
⊠	B-02	5 - 6	9.5				0.0	0.1	25.0		74.9	
△	B-03	10 - 11.5	9.5				0.0	1.1	37.8		61.1	
★	B-04	2.5 - 3.5	9.5				0.0	0.2	25.0		74.8	
⊙	B-05	5 - 6.5	9.5				0.0	0.5	38.5		61.0	

PROJECT: Rancho Viejo Solar Facility

PROJECT NUMBER: 66225093

SITE: NM 599 and NM 14
Santa Fe, NM

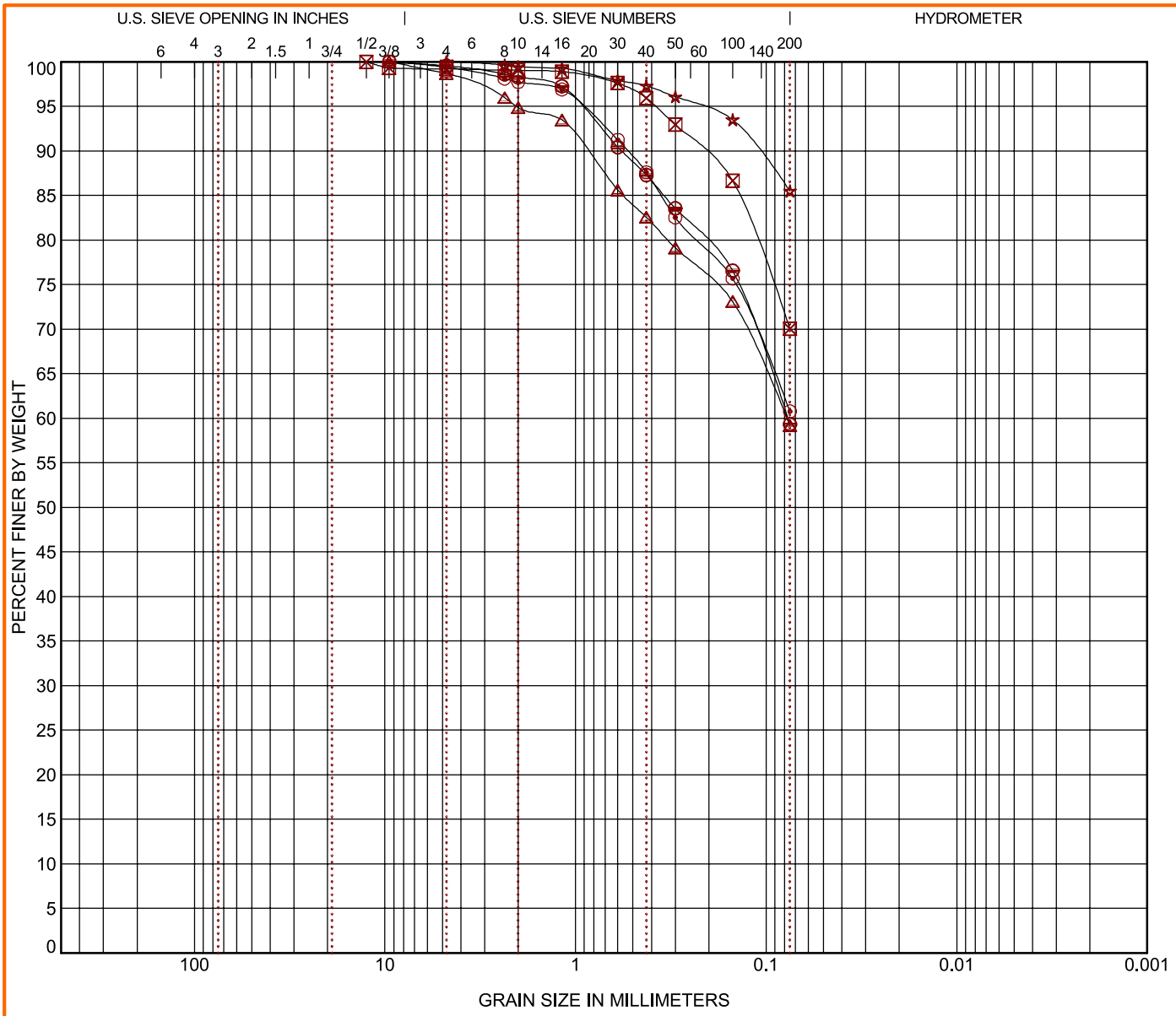
Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

CLIENT: AES Clean Energy Development LLC
Boulder, CO

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/26/22

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
⊖	B-06	10 - 11.5	SANDY SILT (ML)	6.5	NP	NP	NP		
⊠	B-07	2.5 - 3.5	SILT with SAND (ML)	9.3	NP	NP	NP		
△	B-08	5 - 6	SANDY SILT (ML)	7.1	NP	NP	NP		
☆	B-10	10 - 11.5	SILT (ML)	16.5	NP	NP	NP		
⊙	B-11	2.5 - 4	SANDY SILT (ML)	5.2	NP	NP	NP		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
⊖	B-06	10 - 11.5	9.5	0.077			0.0	0.5	40.2		59.3	
⊠	B-07	2.5 - 3.5	12.5				0.0	0.8	29.2		70.0	
△	B-08	5 - 6	9.5	0.078			0.0	1.3	39.5		59.2	
☆	B-10	10 - 11.5	4.75				0.0	0.0	14.5		85.5	
⊙	B-11	2.5 - 4	9.5				0.0	0.6	38.6		60.8	

PROJECT: Rancho Viejo Solar Facility

PROJECT NUMBER: 66225093

SITE: NM 599 and NM 14
Santa Fe, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

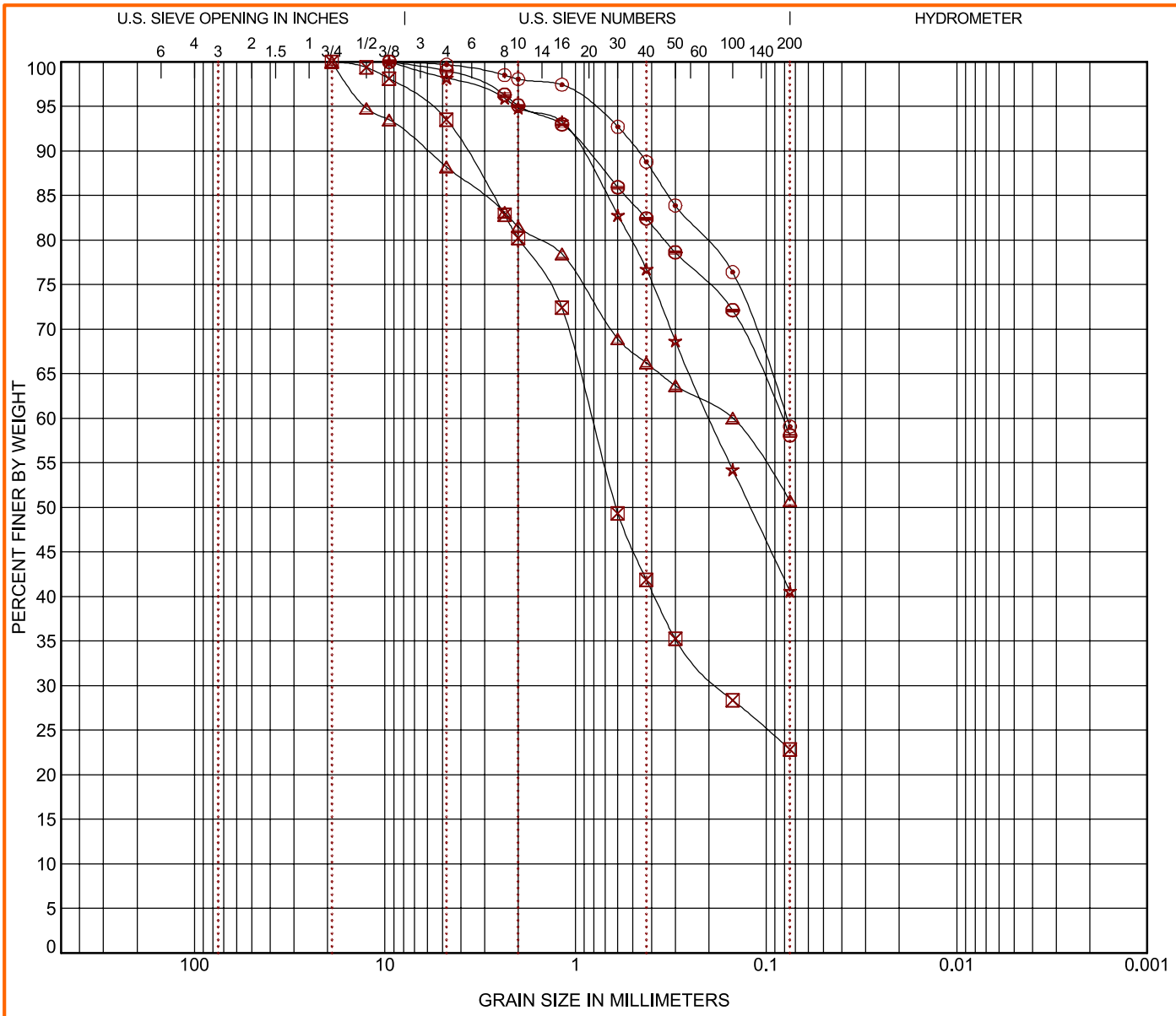
CLIENT: AES Clean Energy Development LLC
Boulder, CO

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/26/22

Exhibit B-15

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
⊖	B-12	5 - 6.5	SANDY SILT (ML)	8.1	NP	NP	NP		
⊠	B-13	10 - 11.5	SILTY SAND (SM)	3.1	NP	NP	NP		
△	B-14	2.5 - 3.5	SANDY SILT (ML)	4.8	NP	NP	NP		
★	B-15	5 - 6	SILTY SAND (SM)	4.0	NP	NP	NP		
⊙	B-Sub	2.5 - 4	SANDY SILT (ML)	9.8	NP	NP	NP		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
⊖	B-12	5 - 6.5	9.5	0.083			0.0	1.0	40.9		58.1	
⊠	B-13	10 - 11.5	19	0.82	0.177		0.0	6.5	70.7		22.8	
△	B-14	2.5 - 3.5	19	0.15			0.0	11.8	37.5		50.7	
★	B-15	5 - 6	9.5	0.198			0.0	1.8	57.6		40.6	
⊙	B-Sub	2.5 - 4	9.5	0.078			0.0	0.3	40.6		59.1	

PROJECT: Rancho Viejo Solar Facility

PROJECT NUMBER: 66225093

SITE: NM 599 and NM 14
Santa Fe, NM

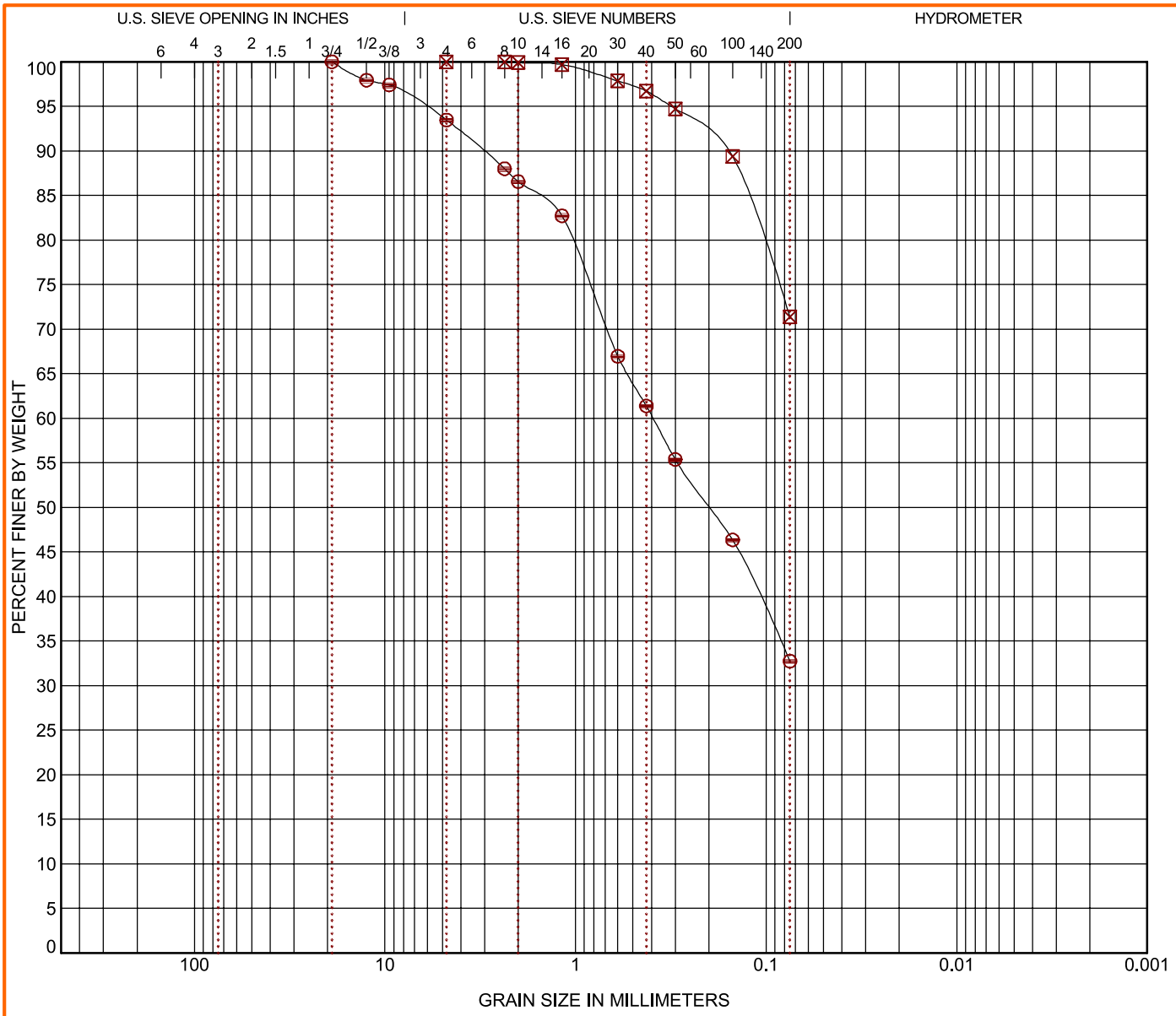
Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

CLIENT: AES Clean Energy Development LLC
Boulder, CO

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/26/22

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
⊖	B-Sub	10 - 11.5	SILTY SAND (SM)	4.5	NP	NP	NP		
⊠	B-Sub	25 - 26.5	SILT with SAND (ML)	8.2	NP	NP	NP		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
⊖	B-Sub	10 - 11.5	19	0.392			0.0	6.5	60.7		32.7	
⊠	B-Sub	25 - 26.5	4.75				0.0	0.0	28.6		71.4	

PROJECT: Rancho Viejo Solar Facility

PROJECT NUMBER: 66225093

SITE: NM 599 and NM 14
Santa Fe, NM

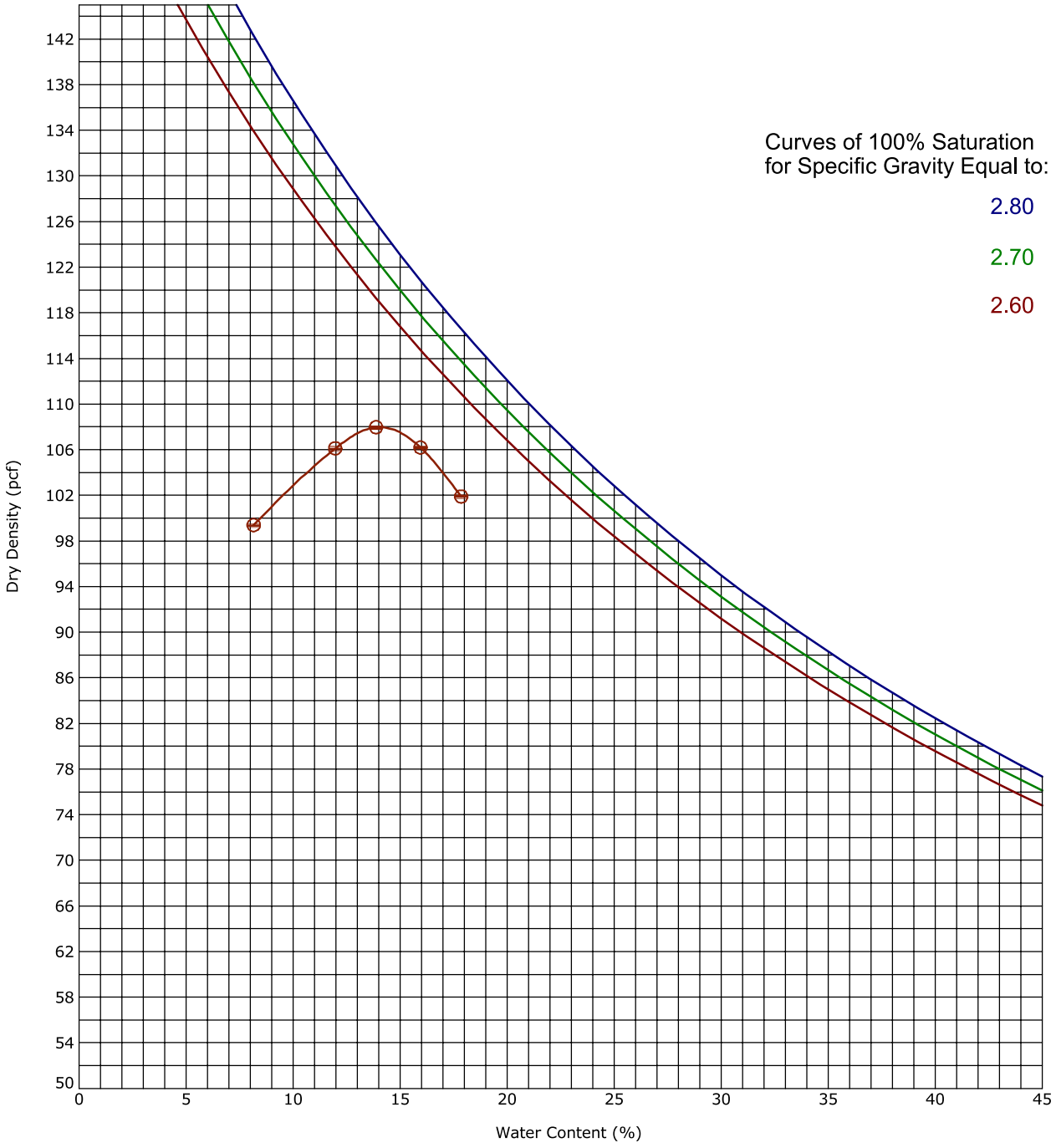
Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

CLIENT: AES Clean Energy Development LLC
Boulder, CO

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/26/22

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Moisture-Density Relationship



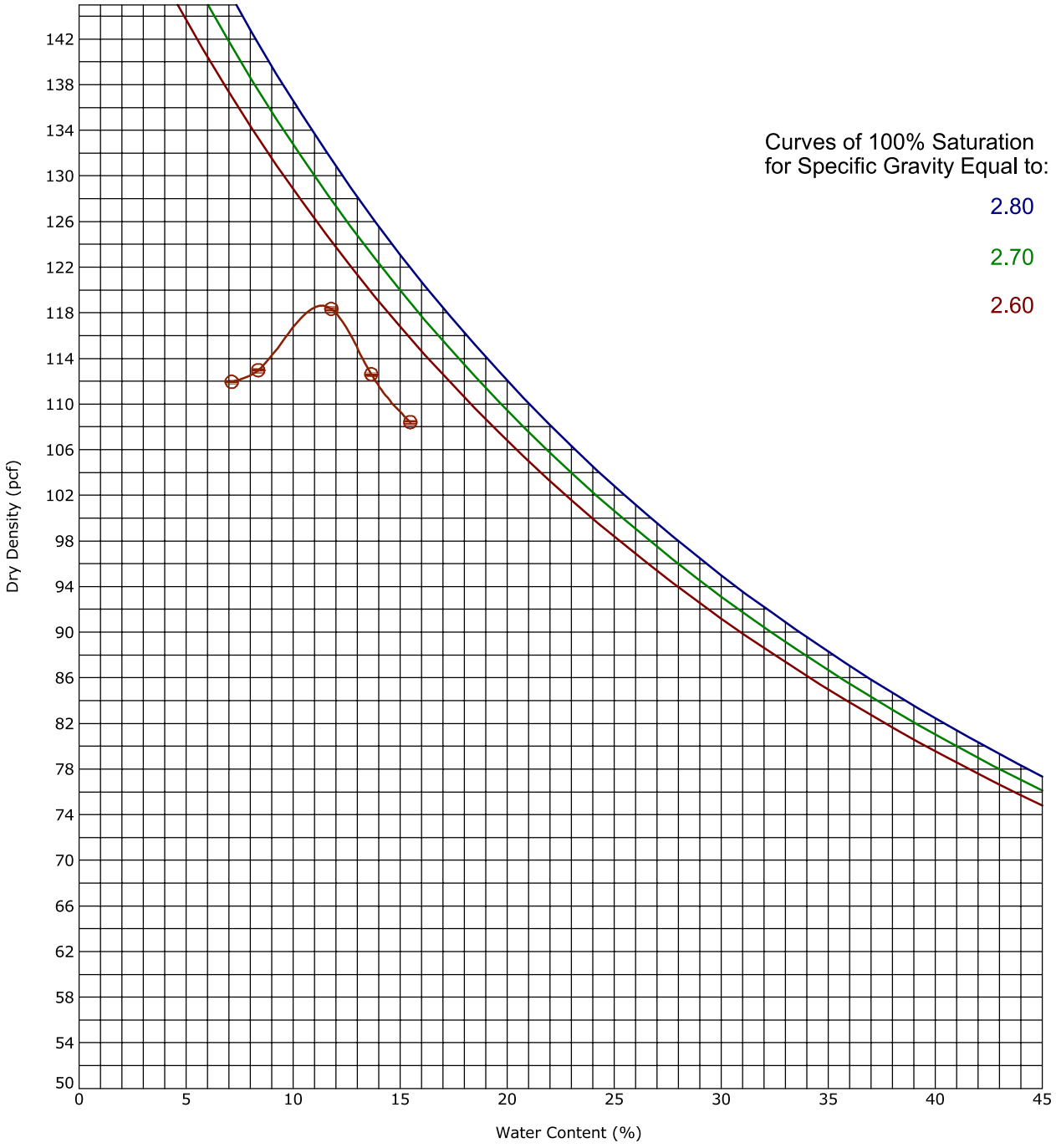
Boring ID	Depth (Ft)	Description of Materials
A-01	1.0 - 5.0	SANDY LEAN CLAY (CL)

Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
61.9	0.0	39	19	20	ASTM D4318-Method B	108.0	14.0

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
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Moisture-Density Relationship

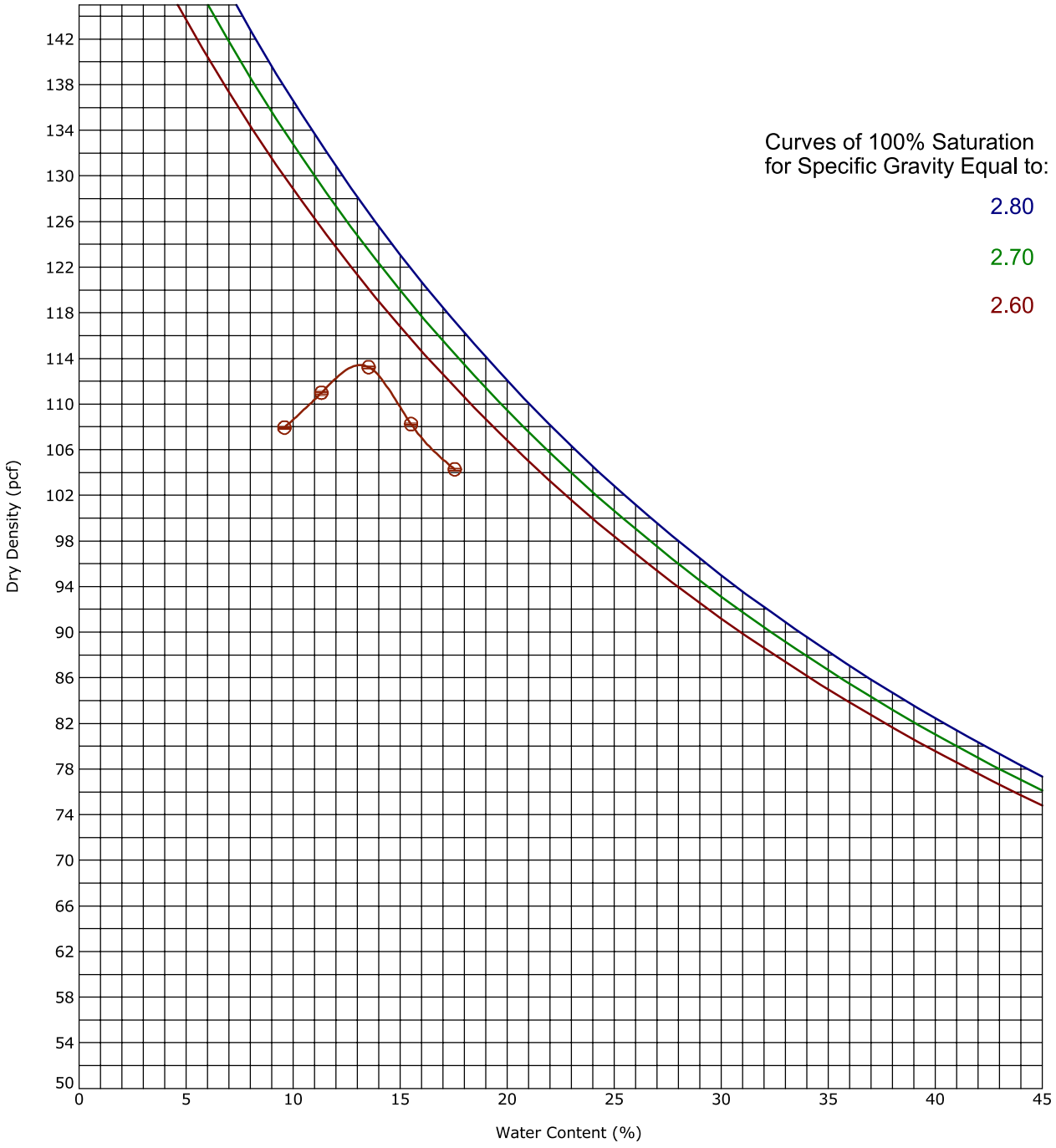


Boring ID	Depth (Ft)	Description of Materials
A-06	1.0 - 5.0	SILTY SAND (SM)

Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D698-Method B	118.6	11.4

Terracon
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Albuquerque, NM

Moisture-Density Relationship



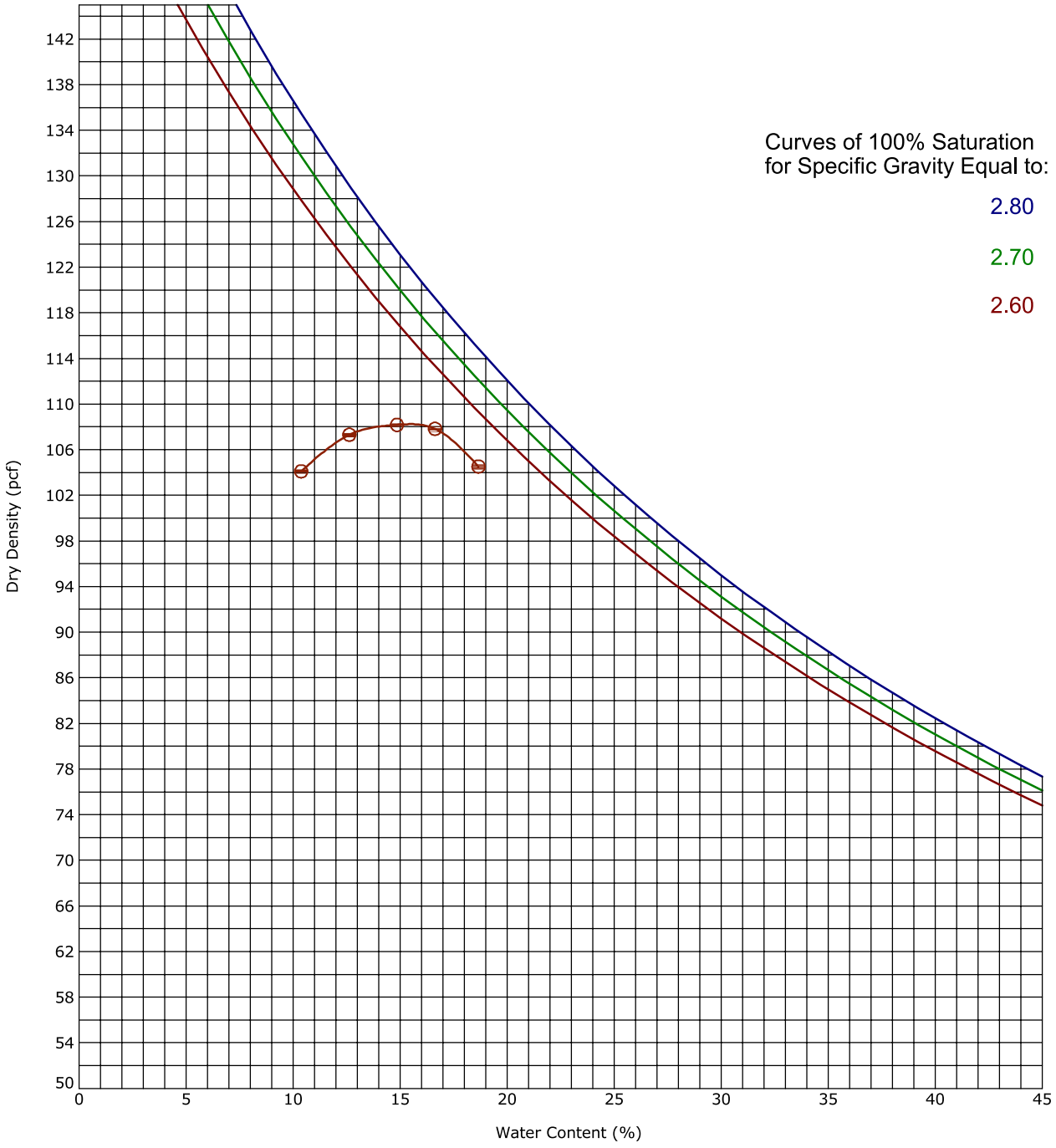
Boring ID	Depth (Ft)	Description of Materials
A-08	1.0 - 5.0	LEAN CLAY (CL)

Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D698-Method B	113.4	13.2

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Moisture-Density Relationship



Boring ID	Depth (Ft)	Description of Materials
A-11	1.0 - 5.0	LEAN CLAY (CL)

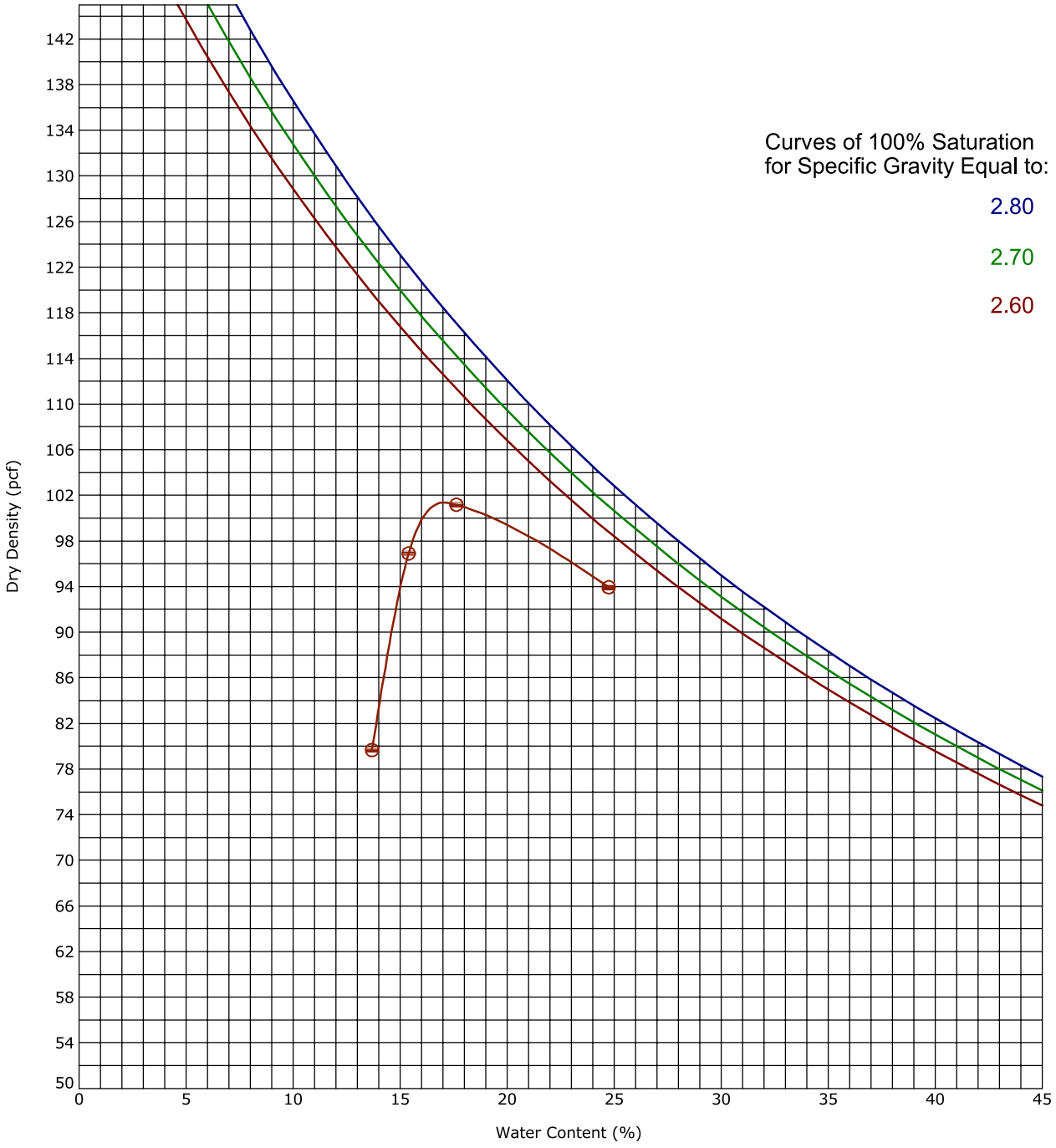
Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D698-Method B	108.2	15.5

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
Terracon Project No. 66225093

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Moisture-Density Relationship

ASTM D698-Method B



Boring ID	Depth (Ft)	Description of Materials
A-14	1.0 - 5.0	SILTY SAND

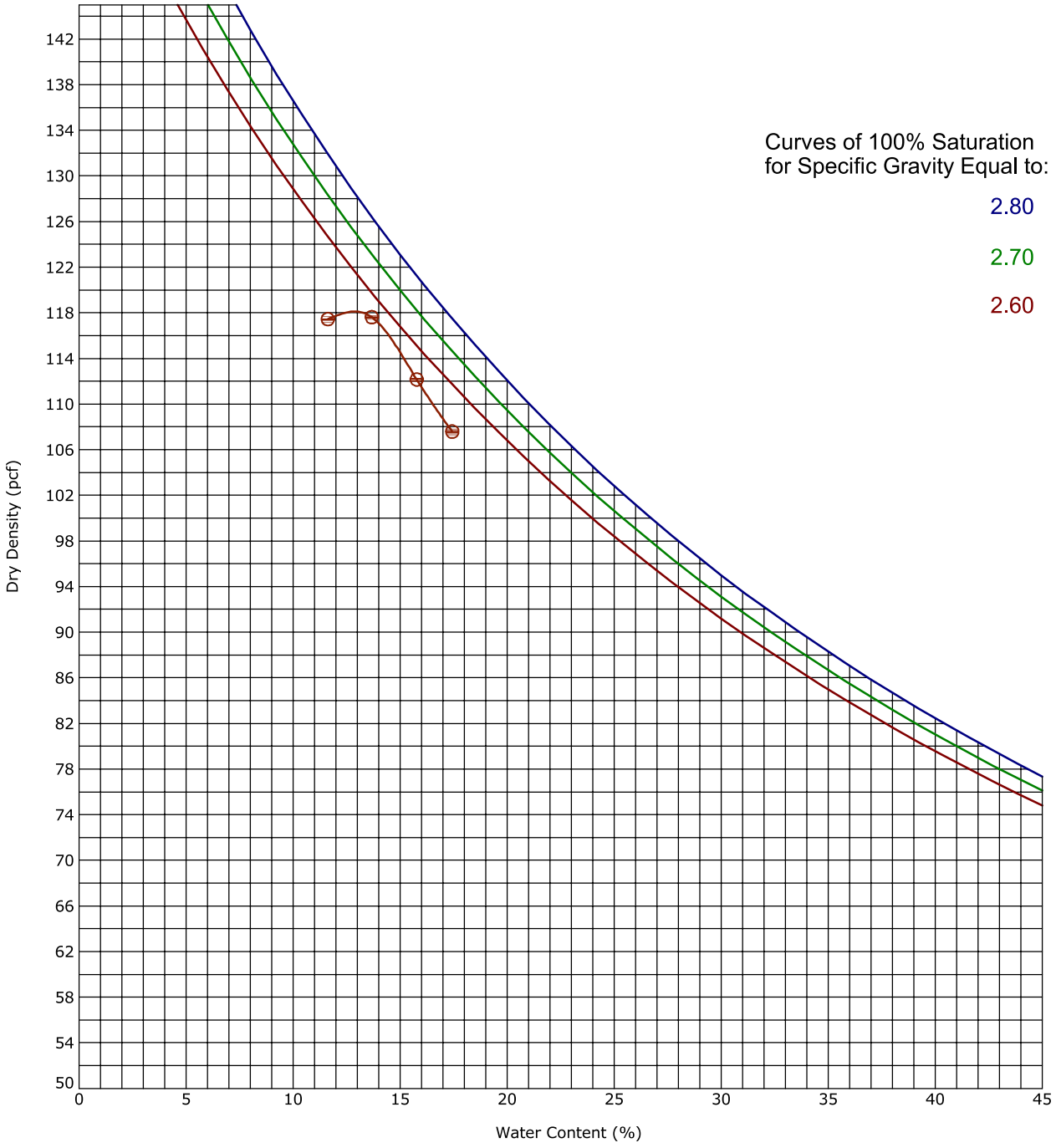
Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D698-Method B	101.4	17.0

Laboratory tests are not valid if separated from original report.

6805 Academy Pkwy West NE
Albuquerque, NM

Moisture-Density Relationship

ASTM D698-Method B

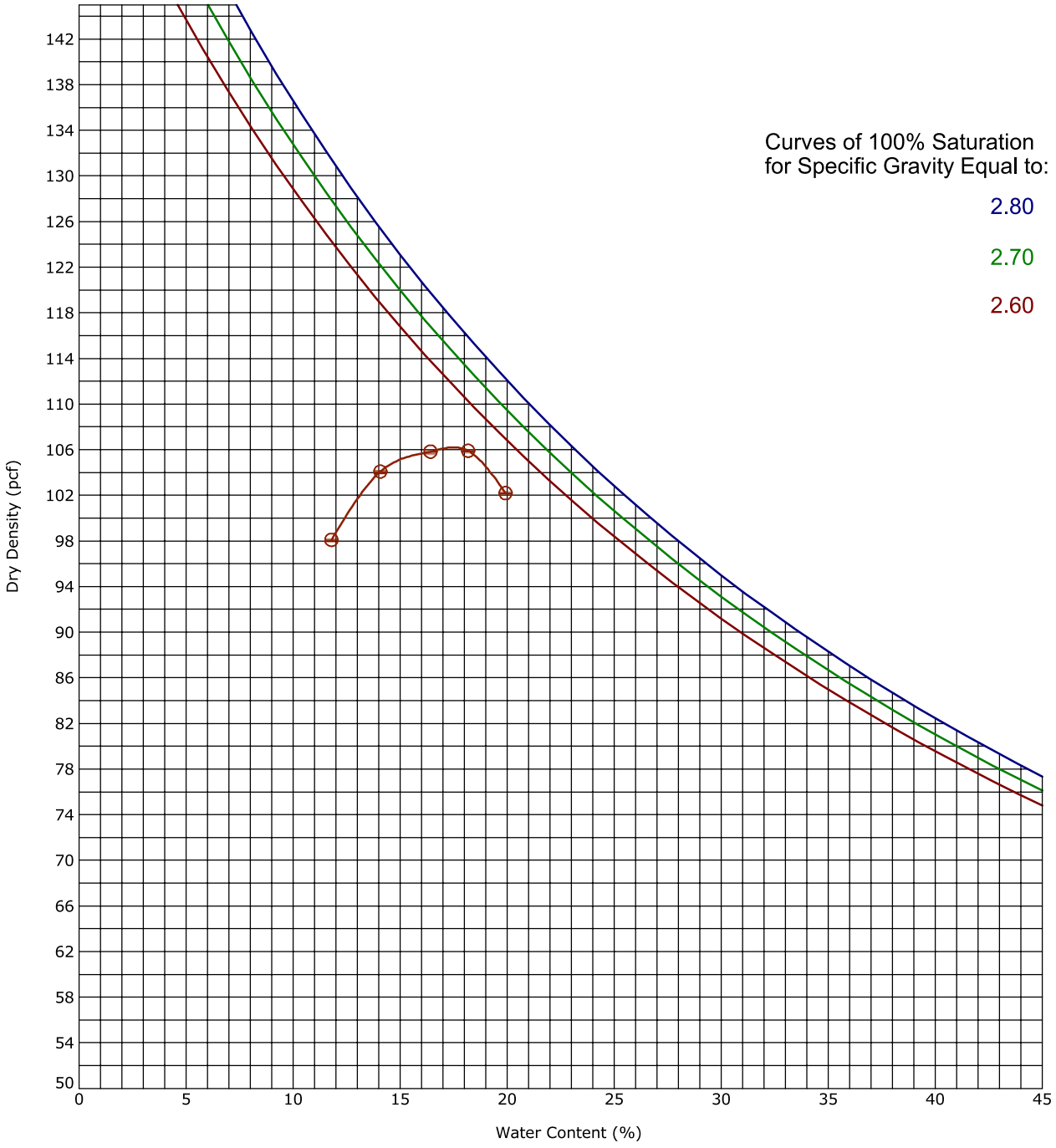


Boring ID	Depth (Ft)	Description of Materials
BW-01	1.0 - 5.0	LEAN CLAY W/SAND

Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D698-Method B	118.1	12.9

Terracon
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Albuquerque, NM

Moisture-Density Relationship

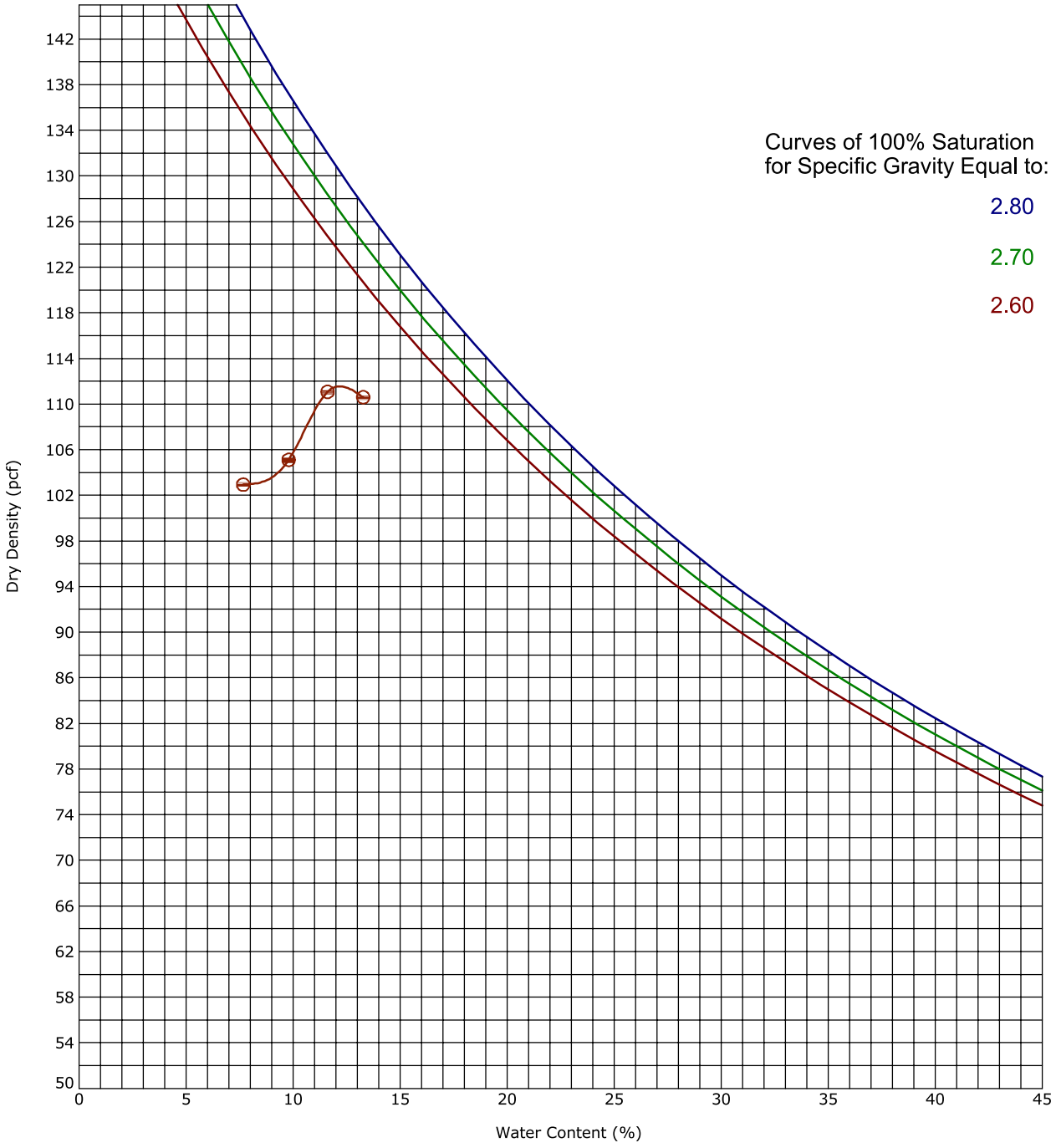


Boring ID	Depth (Ft)	Description of Materials
T-01	1.0 - 5.0	CLAYEY SAND (SC)

Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D698-Method B	106.2	17.5

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Albuquerque, NM

Moisture-Density Relationship

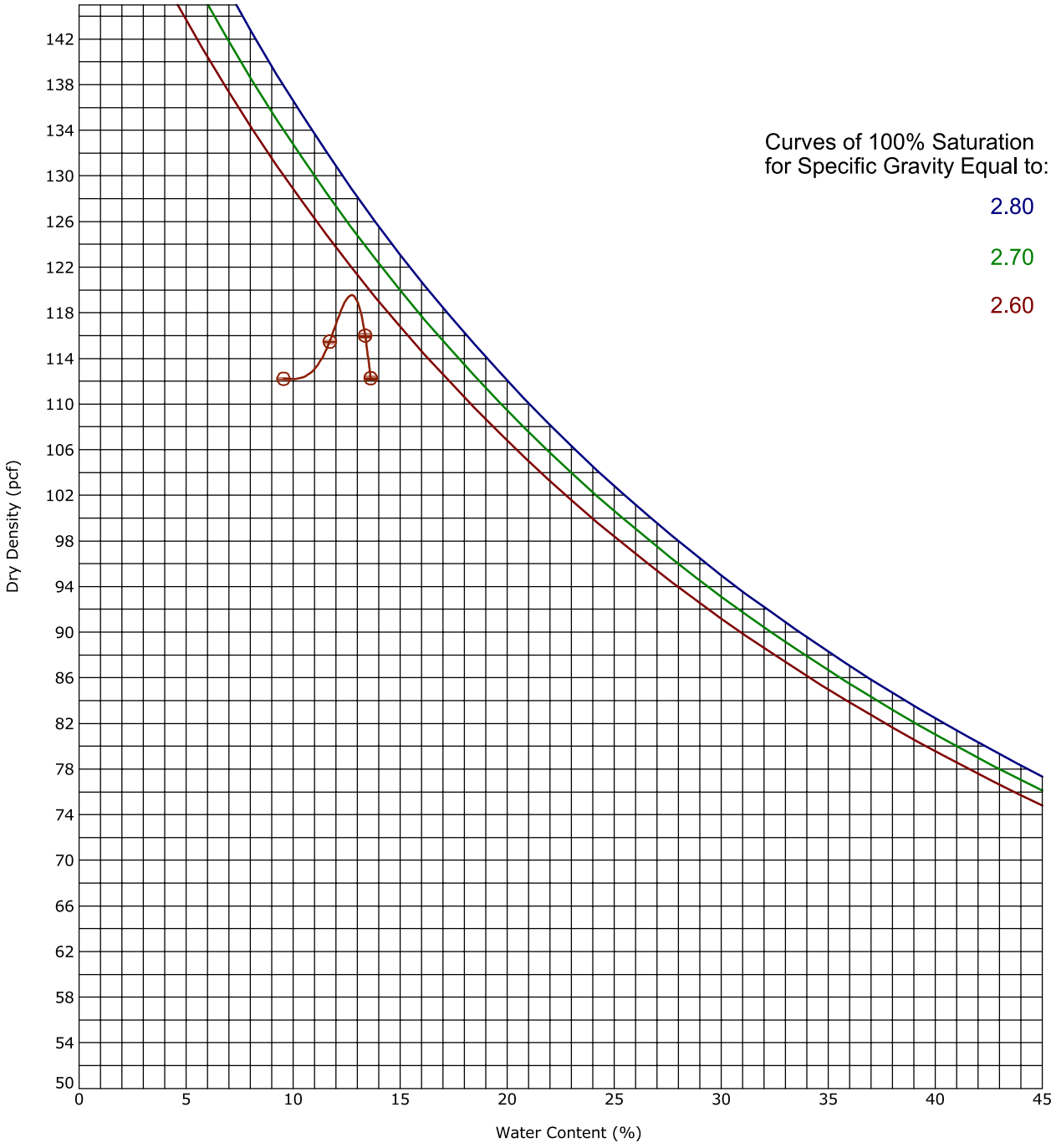


Boring ID	Depth (Ft)	Description of Materials
T-02	1.0 - 5.0	CLAYEY SAND (SC)

Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D698-Method B	111.5	12.2

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Albuquerque, NM

Moisture-Density Relationship



Boring ID	Depth (Ft)	Description of Materials
T-03	1.0 - 5.0	LEAN CLAY (CL)

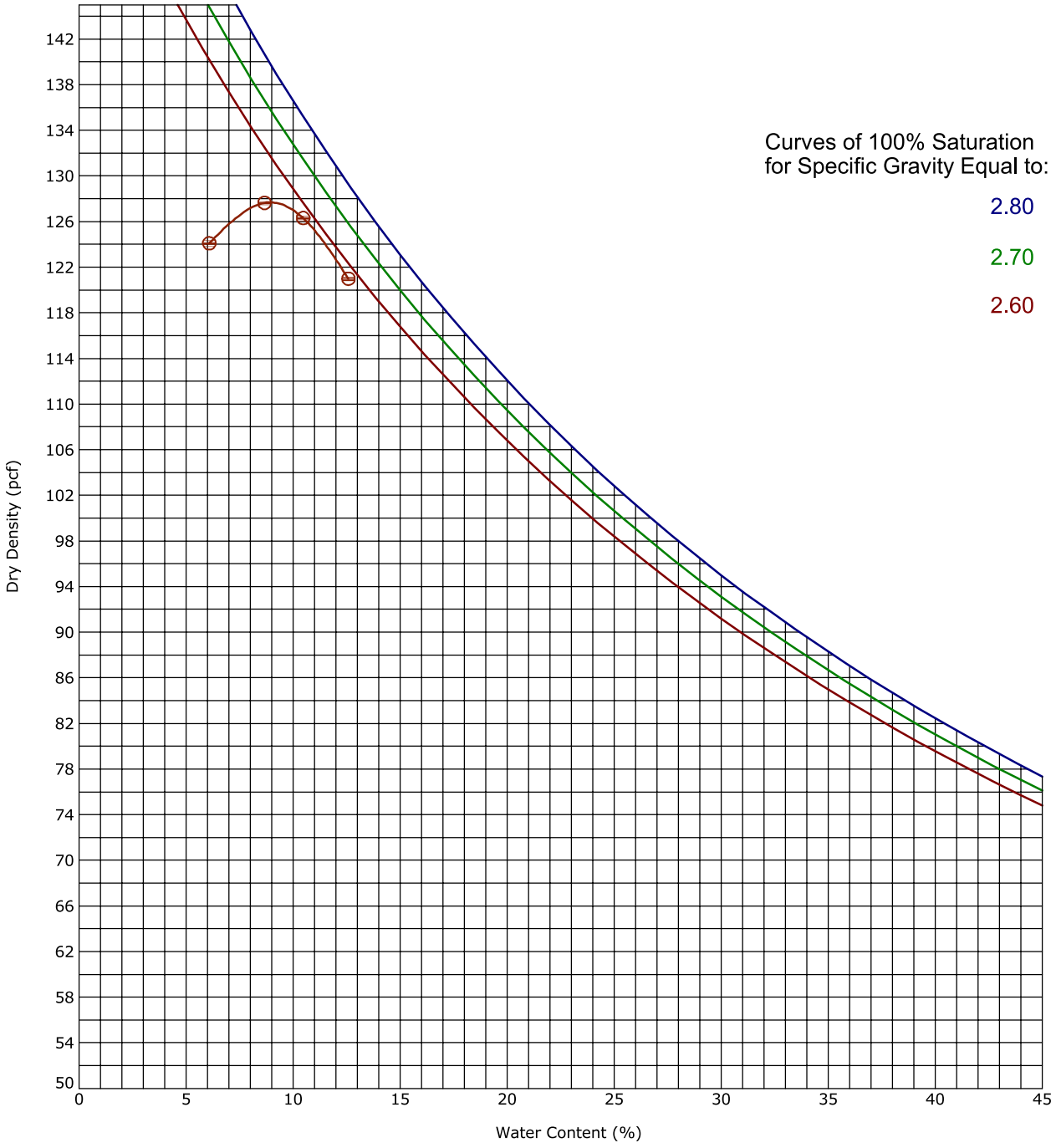
Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D698-Method B	119.5	12.7

Rancho Viejo Solar
NM 599 and NM 14 | Santa Fe, NM
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Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Moisture-Density Relationship

ASTM D698-Method B

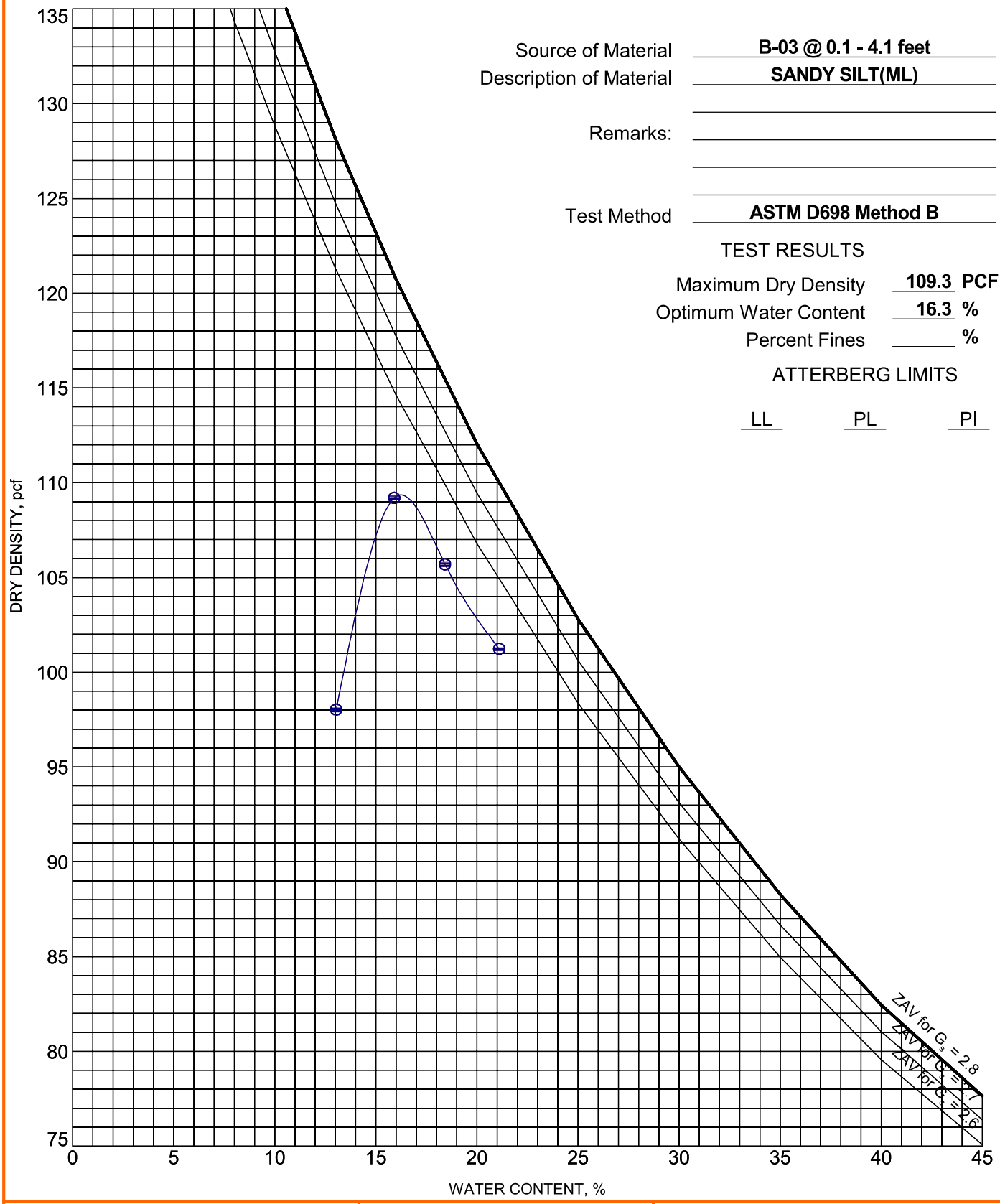


Boring ID	Depth (Ft)	Description of Materials
T-04	1.0 - 5.0	LEAN CLAY

Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D698-Method B	127.7	8.9

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **B-03 @ 0.1 - 4.1 feet**

Description of Material: **SANDY SILT(ML)**

Remarks:

Test Method: **ASTM D698 Method B**

TEST RESULTS

Maximum Dry Density	**109.3**	**PCF**
Optimum Water Content	**16.3**	**%**
Percent Fines		**%**

ATTERBERG LIMITS

LL	PL	PI

PROJECT: Rancho Viejo Solar Facility

PROJECT NUMBER: 66225093

SITE: NM 599 and NM 14
Santa Fe, NM

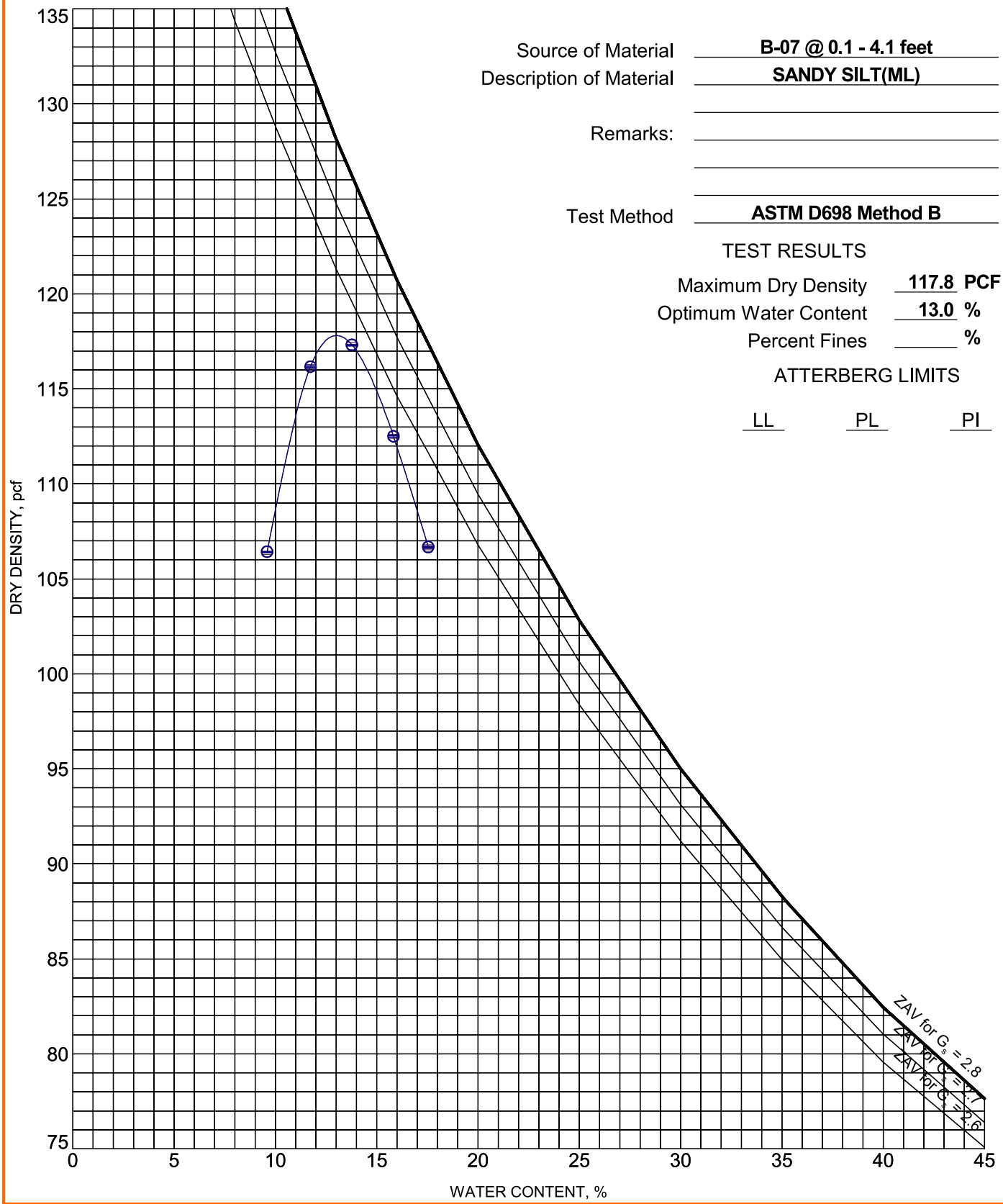
Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

CLIENT: AES Clean Energy Development LLC
Boulder, CO

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V2 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/26/22

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **B-07 @ 0.1 - 4.1 feet**

Description of Material: **SANDY SILT(ML)**

Remarks:

Test Method: **ASTM D698 Method B**

TEST RESULTS

Maximum Dry Density	**117.8**	**PCF**
Optimum Water Content	**13.0**	**%**
Percent Fines		**%**

ATTERBERG LIMITS

LL	PL	PI

PROJECT: Rancho Viejo Solar Facility

PROJECT NUMBER: 66225093

SITE: NM 599 and NM 14
Santa Fe, NM

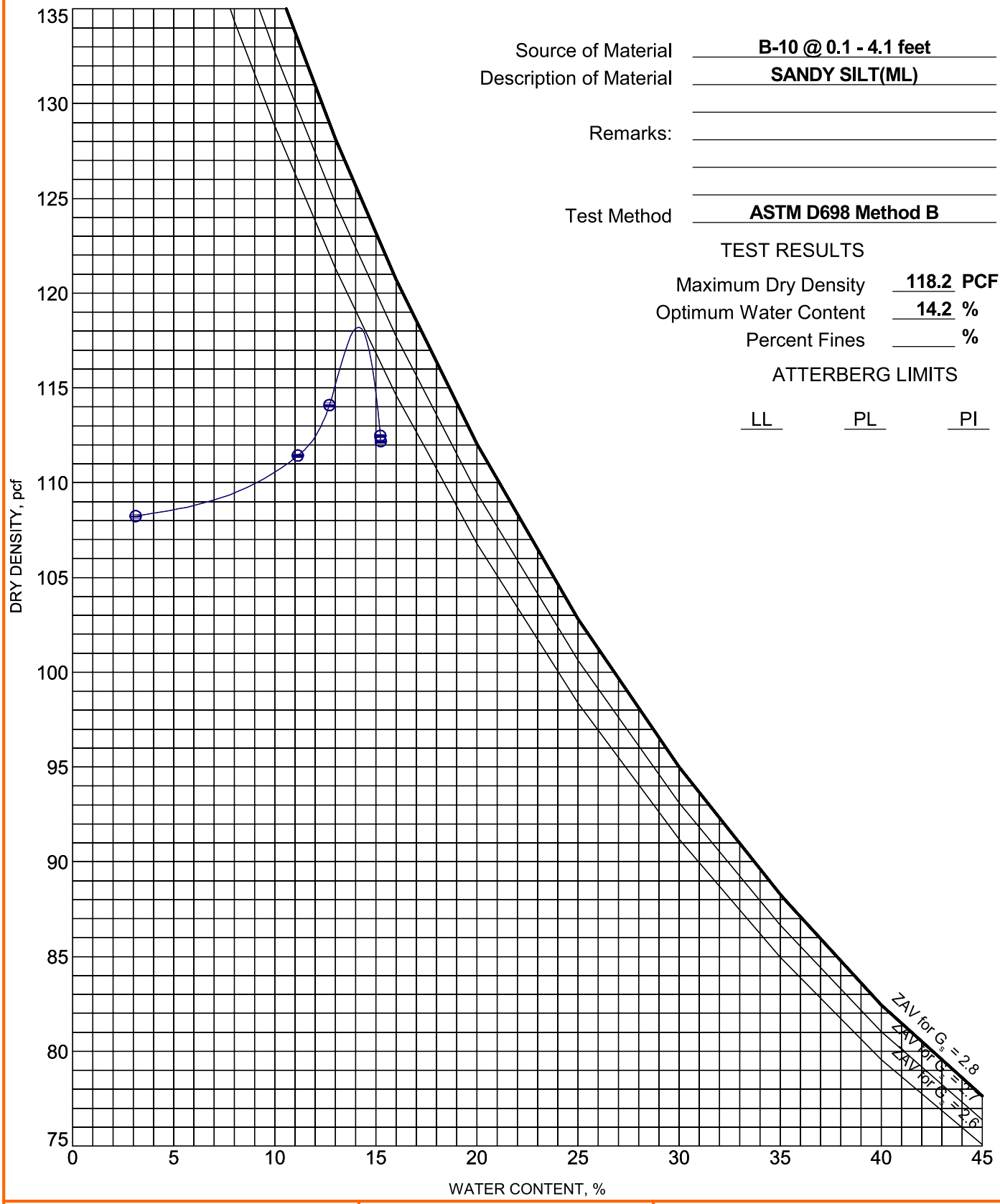
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MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **B-10 @ 0.1 - 4.1 feet**

Description of Material: **SANDY SILT(ML)**

Remarks:

Test Method: **ASTM D698 Method B**

TEST RESULTS

Maximum Dry Density	**118.2**	**PCF**
Optimum Water Content	**14.2**	**%**
Percent Fines		**%**

ATTERBERG LIMITS

LL	PL	PI

PROJECT: Rancho Viejo Solar Facility

PROJECT NUMBER: 66225093

SITE: NM 599 and NM 14
Santa Fe, NM

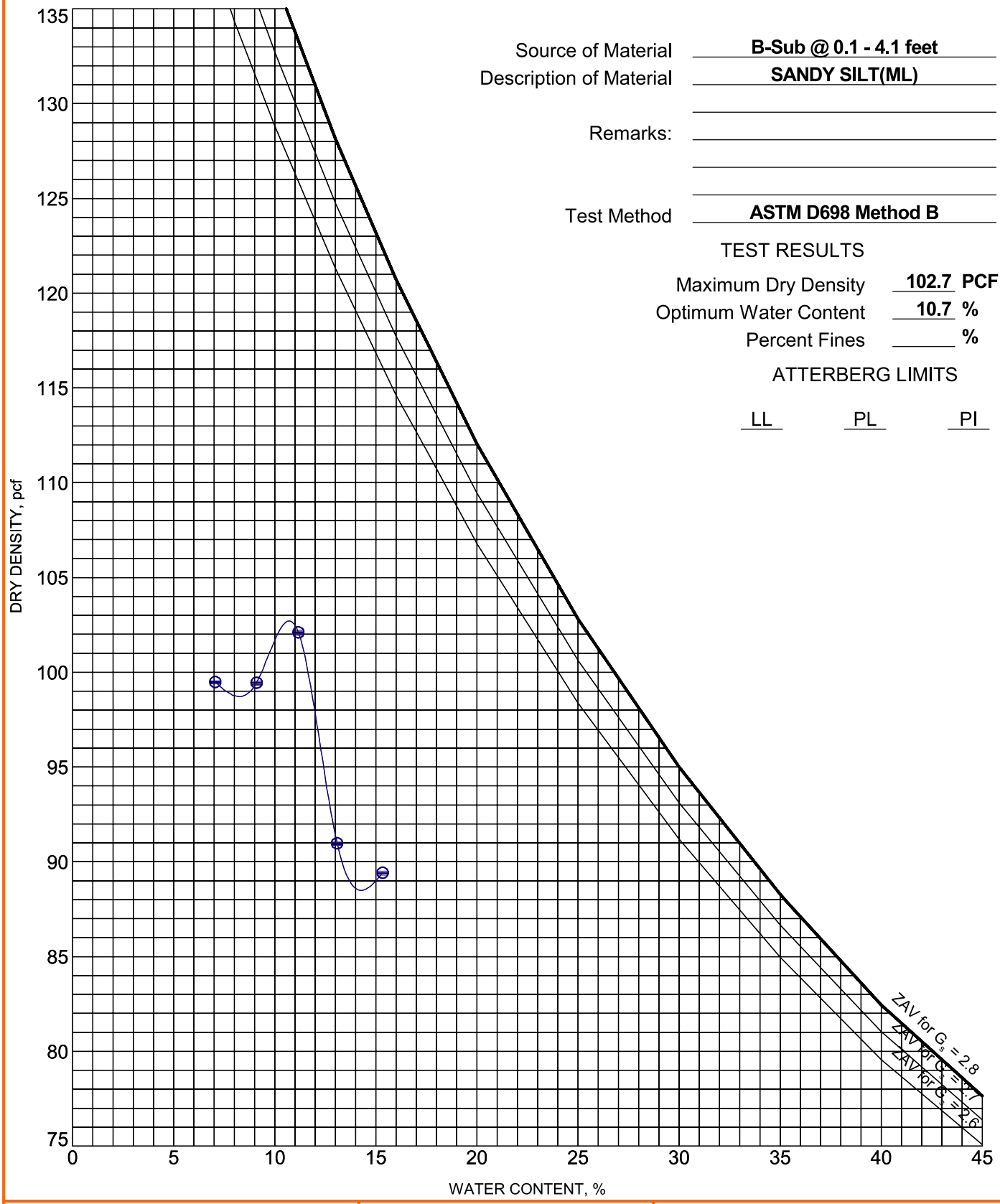
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MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **B-Sub @ 0.1 - 4.1 feet**

Description of Material: **SANDY SILT(ML)**

Remarks:

Test Method: **ASTM D698 Method B**

TEST RESULTS

Maximum Dry Density	**102.7**	**PCF**
Optimum Water Content	**10.7**	**%**
Percent Fines		**%**

ATTERBERG LIMITS

LL	PL	PI

PROJECT: Rancho Viejo Solar Facility

PROJECT NUMBER: 66225093

SITE: NM 599 and NM 14
Santa Fe, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

CLIENT: AES Clean Energy Development LLC
Boulder, CO

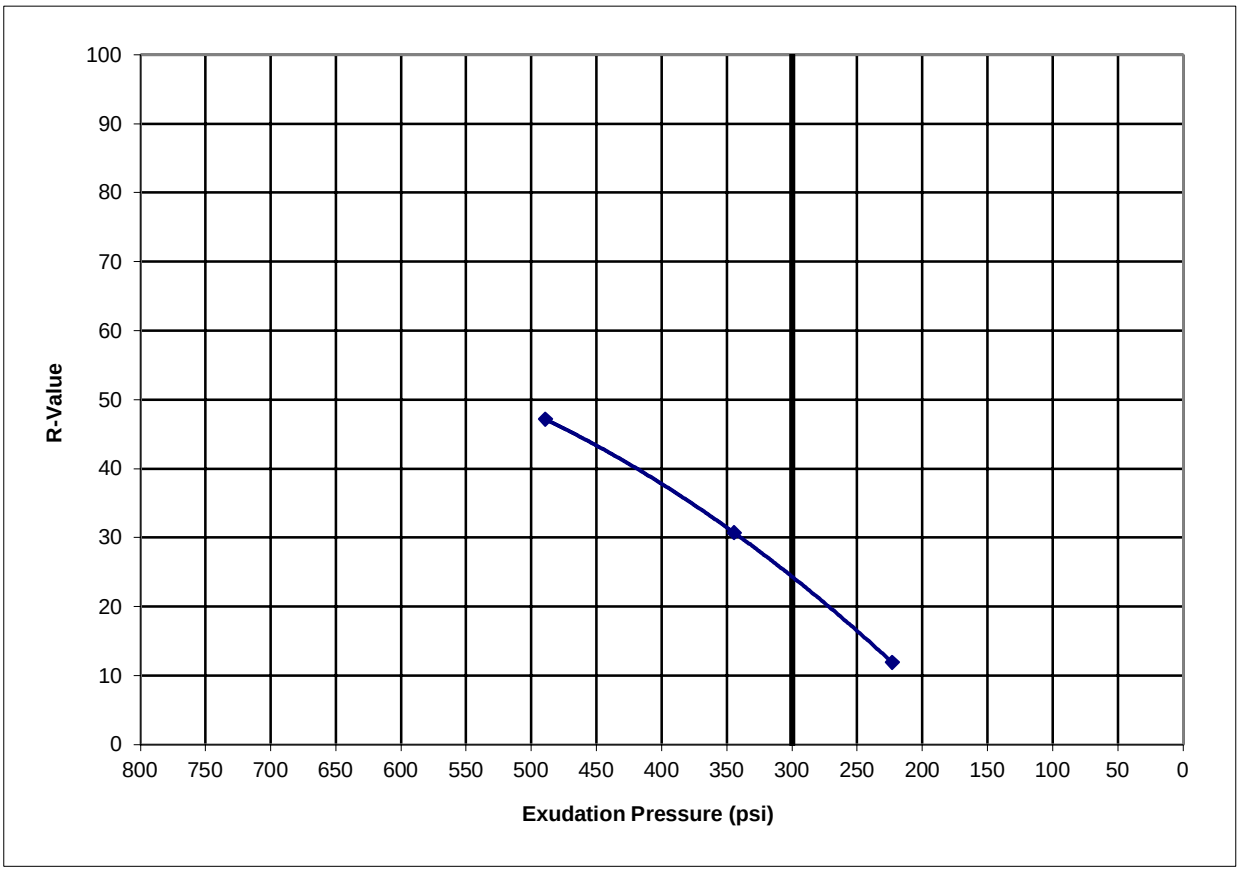
LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V2 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/26/22

PROJECT: Rancho Viejo Solar Facility
JOB NO: 66225093
LOCATION: Santa Fe County, NM
MATERIAL: Silty Clay
SAMPLE SOURCE: P-03@0'-4'

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN I. D.	A	B	C
Moisture Content	21.1%	18.5%	17.2%
Compaction Pressure (psi)	*	150	225
Specimen Height (inches)	2.54	2.50	2.49
Dry Density (pcf)	104.5	110.4	113.3
Horiz. Pres. @ 1000lbs (psi)	54.0	37.0	28.0
Horiz. Pres. @ 2000lbs (psi)	131.0	94.0	67.0
Displacement	4.10	3.96	3.89
Expansion Pressure (psi)	0.1	0.2	0.6
Exudation Pressure (psi)	223	344	489
R Value	12	31	47

* HAND TAMPED



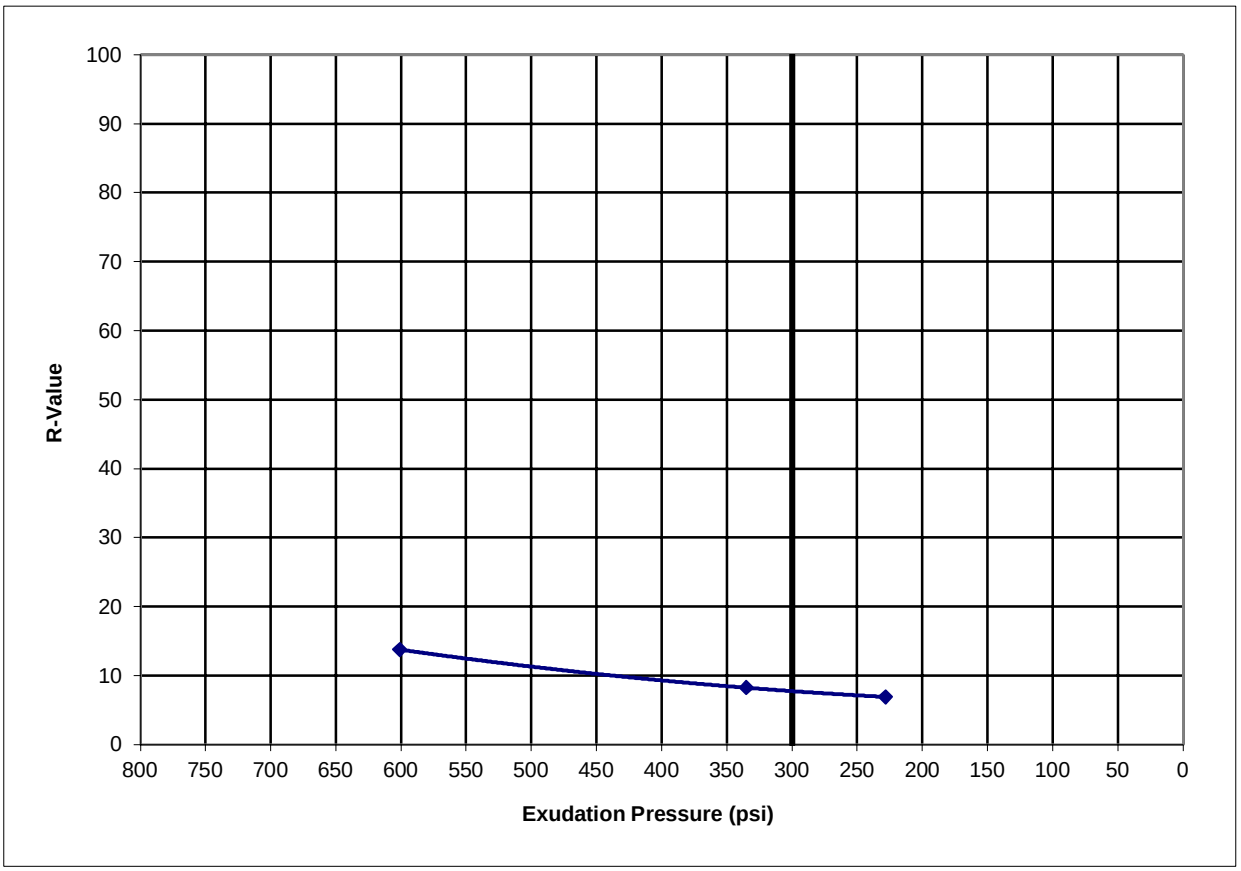
R Value at 300 PSI = 24.3

PROJECT: Rancho Viejo Solar Facility
JOB NO: 66225093
LOCATION: Santa Fe County, NM
MATERIAL: Silty Clay
SAMPLE SOURCE: P-07@0'-4'

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN I. D.	A	B	C
Moisture Content	27.8%	25.2%	22.6%
Compaction Pressure (psi)	*	*	75
Specimen Height (inches)	2.56	2.49	2.52
Dry Density (pcf)	93.7	98.6	102.5
Horiz. Pres. @ 1000lbs (psi)	68.0	58.0	54.0
Horiz. Pres. @ 2000lbs (psi)	140.0	138.0	131.0
Displacement	5.12	4.45	3.47
Expansion Pressure (psi)	0.0	0.0	0.1
Exudation Pressure (psi)	228	335	601
R Value	7	8	14

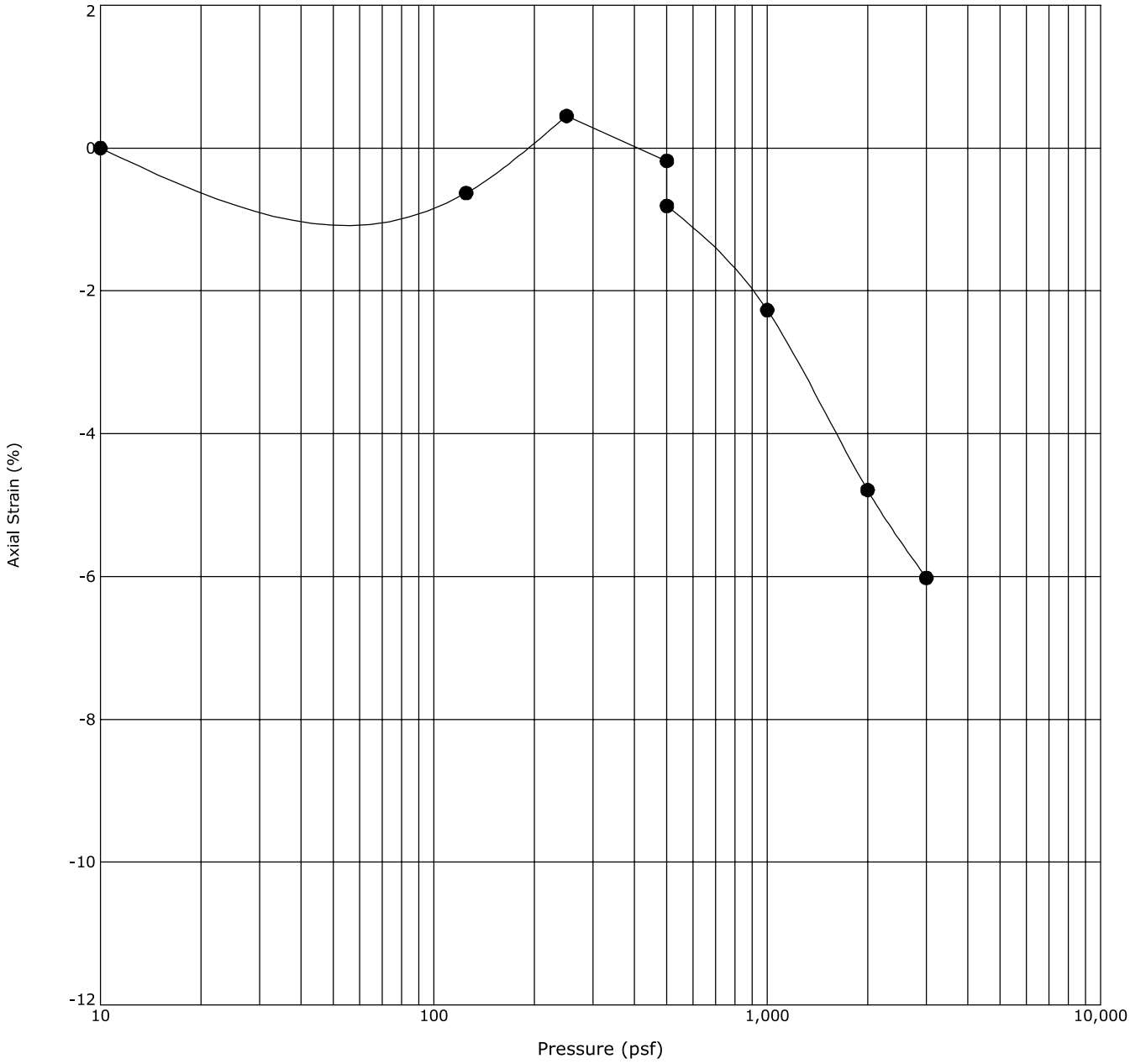
* HAND TAMPED



R Value at 300 PSI = 7.7

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Albuquerque, NM

Swell Consolidation Test

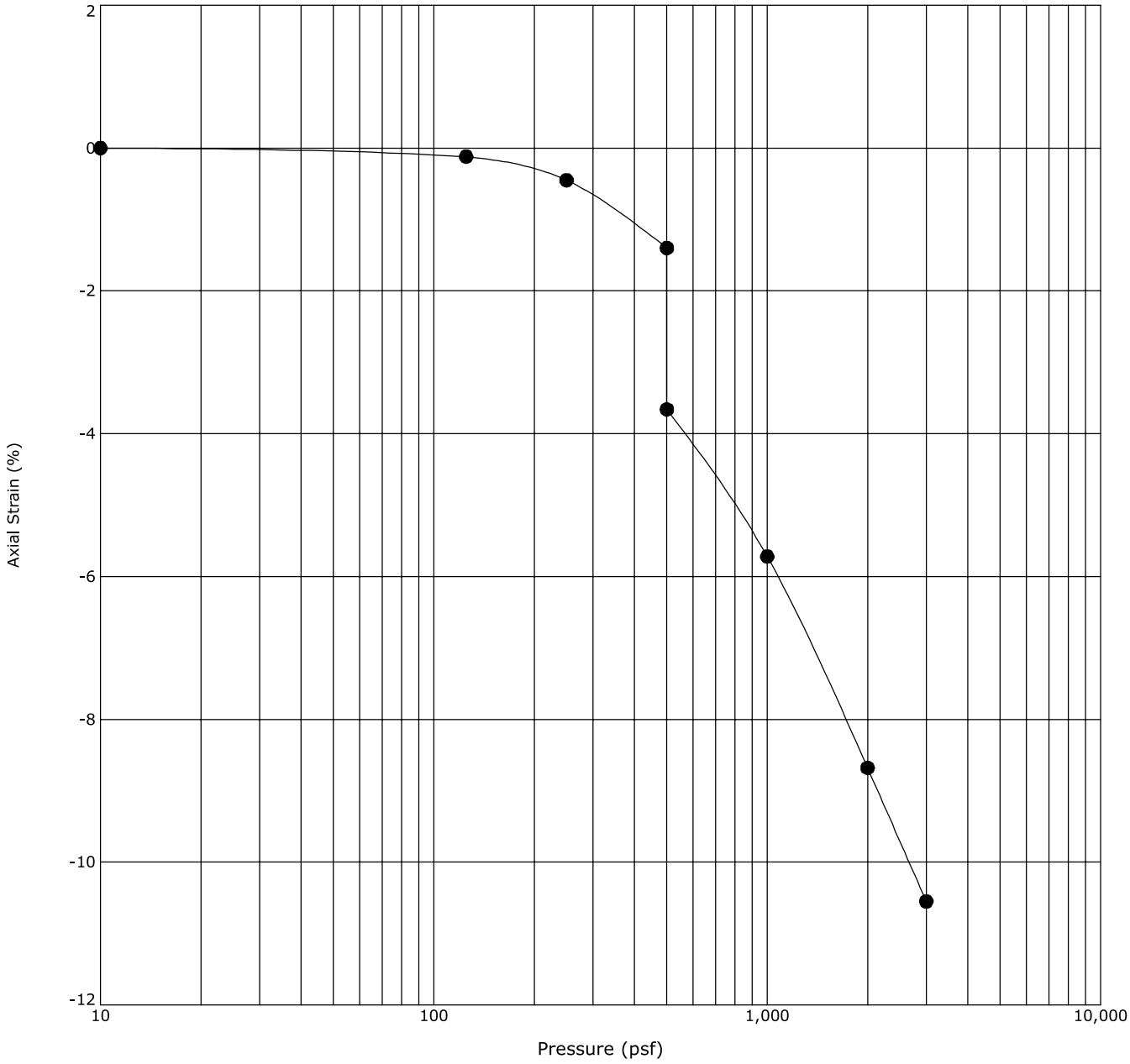


Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	A-03	2.5 - 3.5	SANDY LEAN CLAY	CL	88	10.2

Notes: Sample inundated with water at 500 pounds per square foot (psf).
Sample Disturbed.

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Swell Consolidation Test

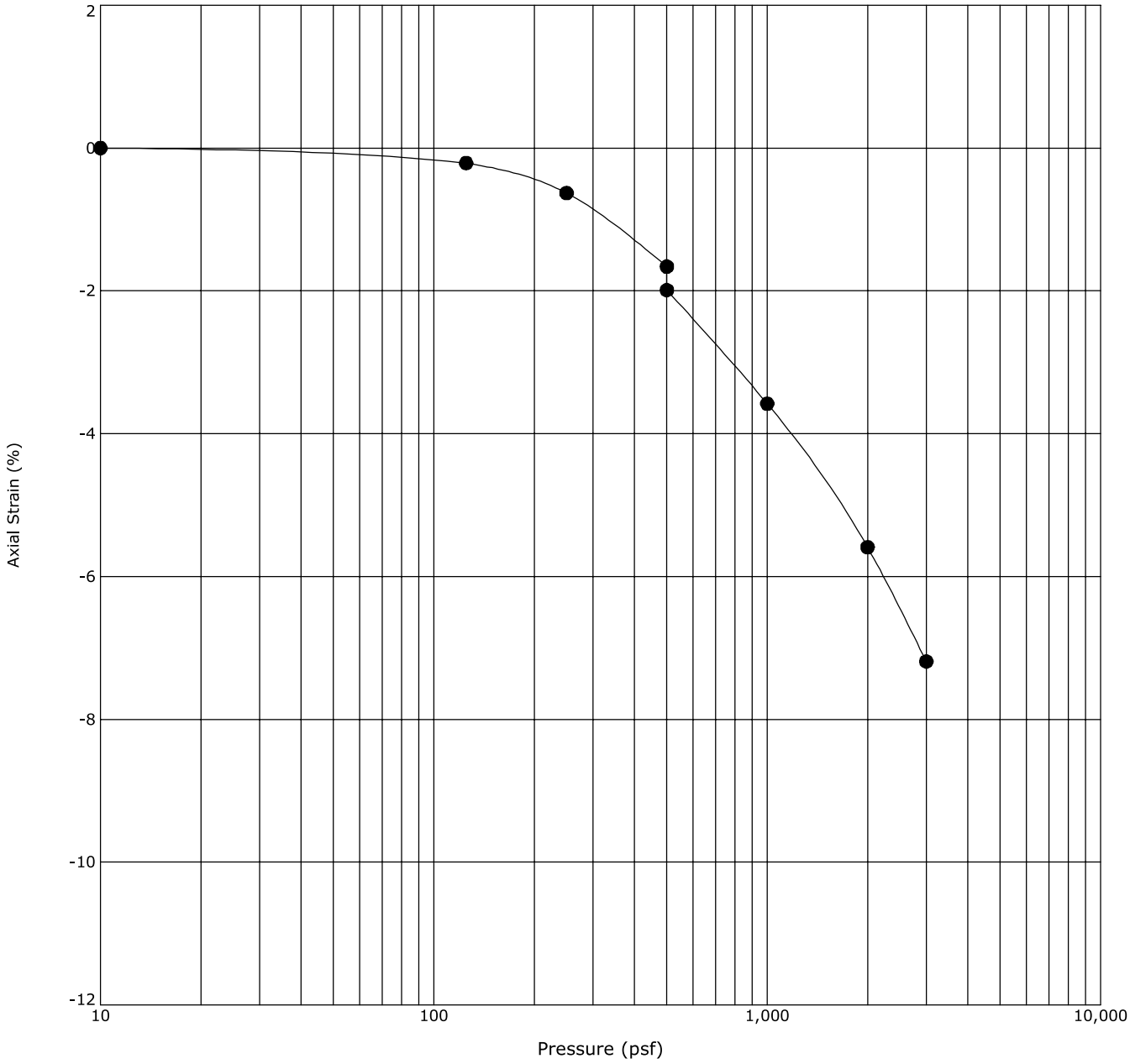


Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	A-06	7.5 - 8.5	SANDY SILT	ML	92	6.5

Notes: Sample inundated with water at 500 pounds per square foot (psf).

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Swell Consolidation Test

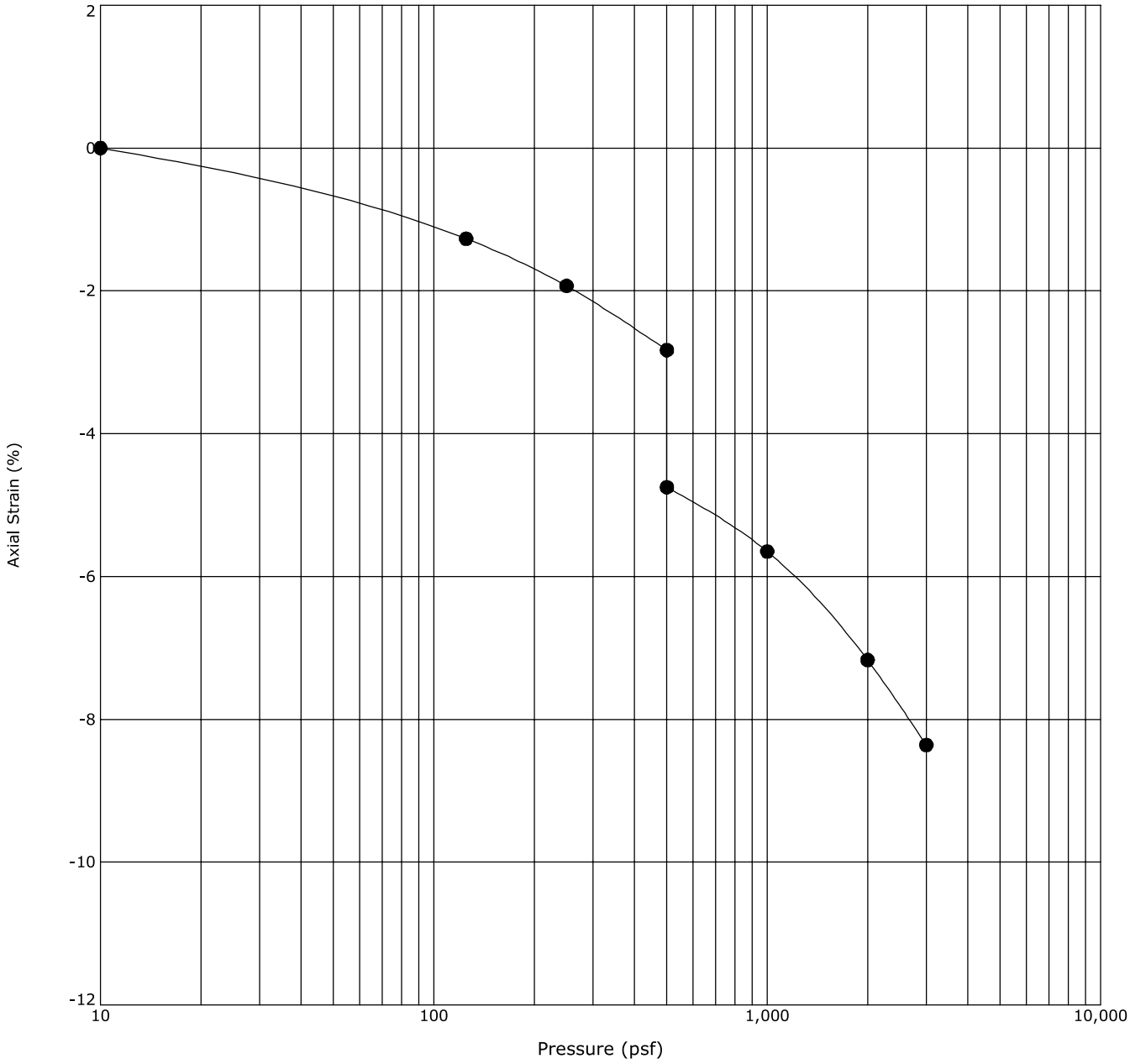


Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	A-08	5 - 6	SILTY CLAY	CL-ML	95	6.4

Notes: Sample inundated with water at 500 pounds per square foot (psf).

Terracon
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Albuquerque, NM

Swell Consolidation Test

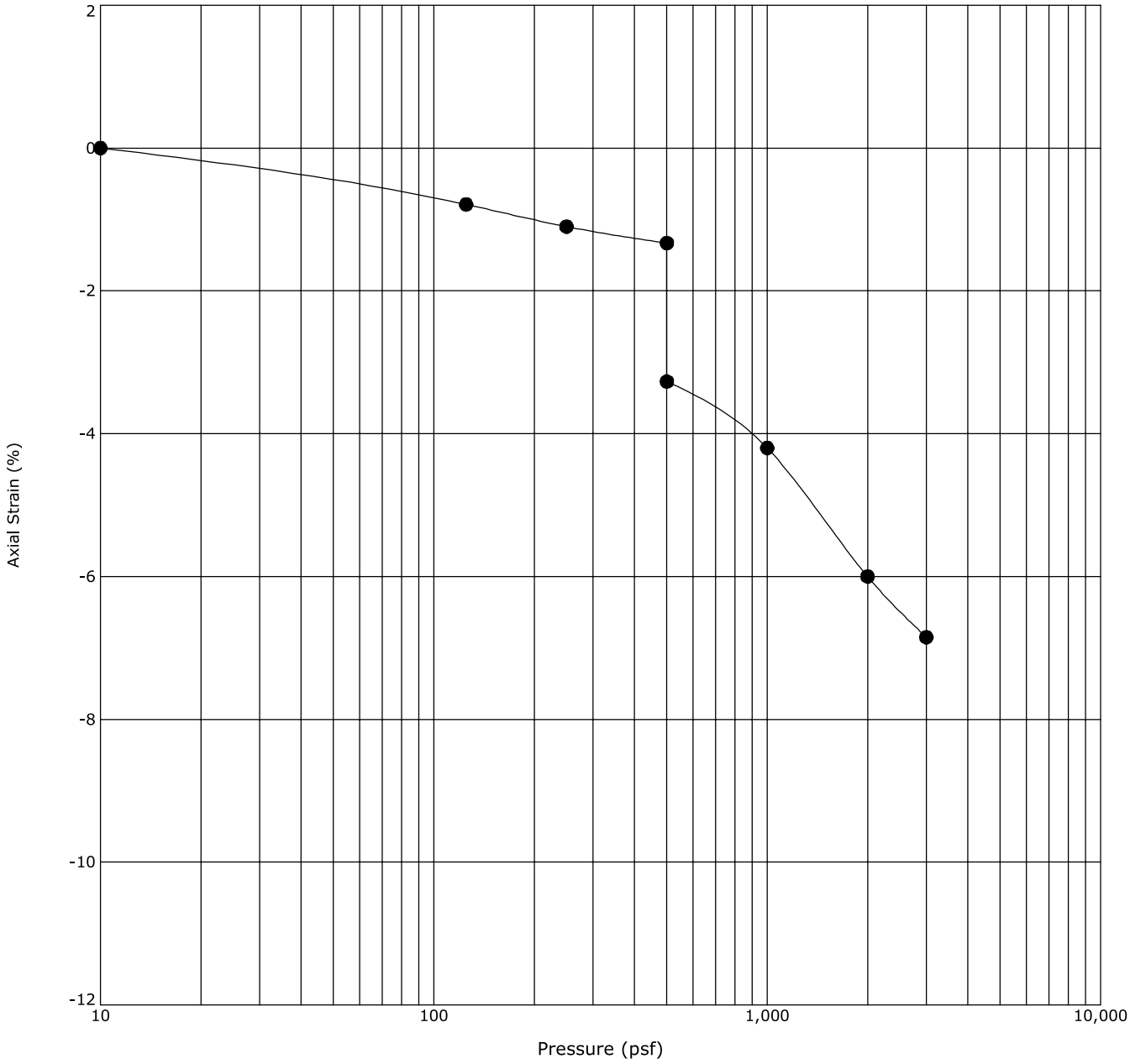


Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	A-10	7.5 - 8.5	SANDY LEAN CLAY	CL	92	6.8

Notes: Sample inundated with water at 500 pounds per square foot (psf).

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Swell Consolidation Test

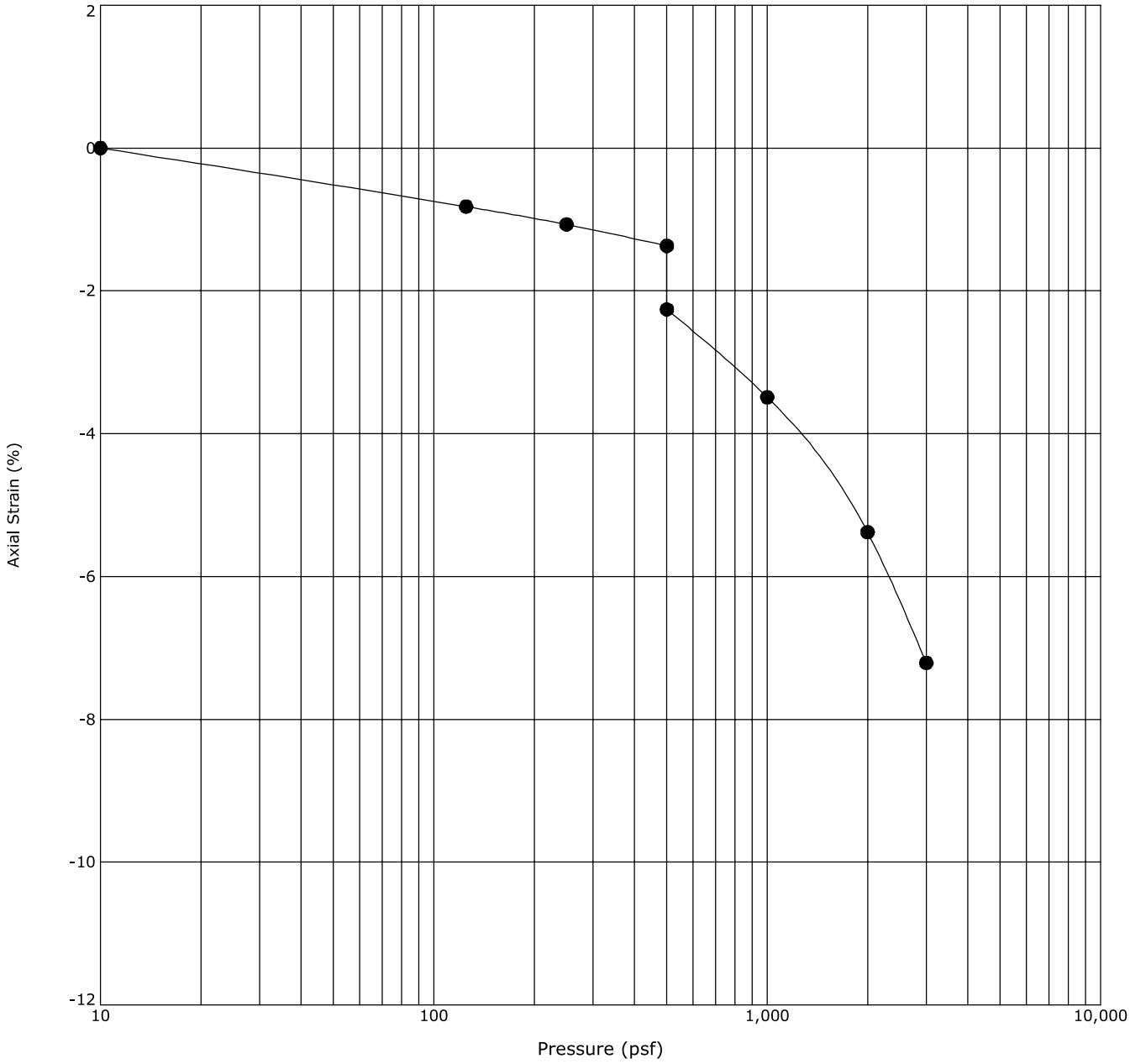


Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	Bess-02	2.5 - 3.5	SILTY SAND	SM	76	12.7

Notes: Sample inundated with water at 500 pounds per square foot (psf).

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Swell Consolidation Test

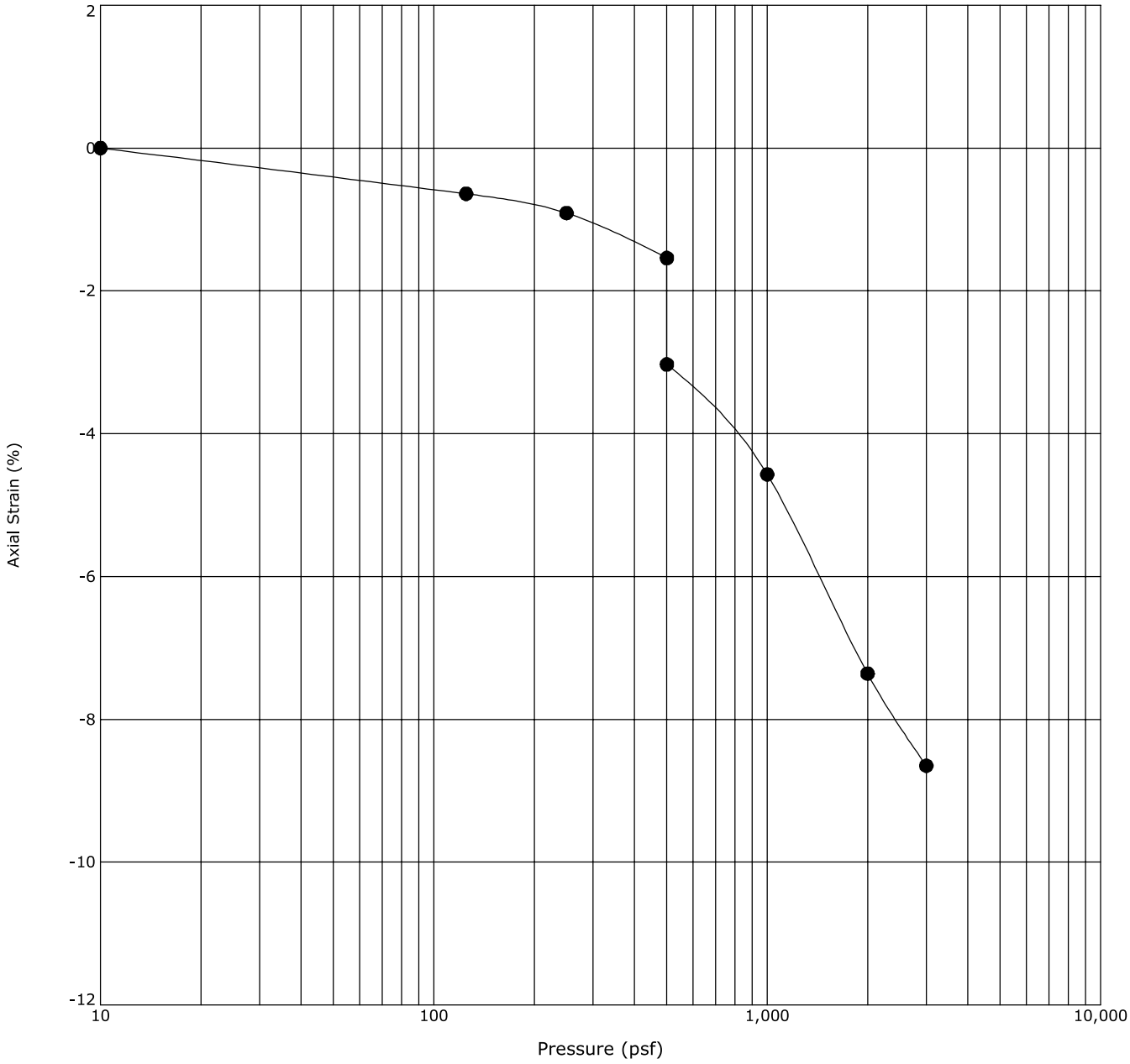


Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	Bess-03	2.5 - 3.5	CLAYEY SAND	SC	102	5.4

Notes: Sample inundated with water at 500 pounds per square foot (psf).

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Swell Consolidation Test

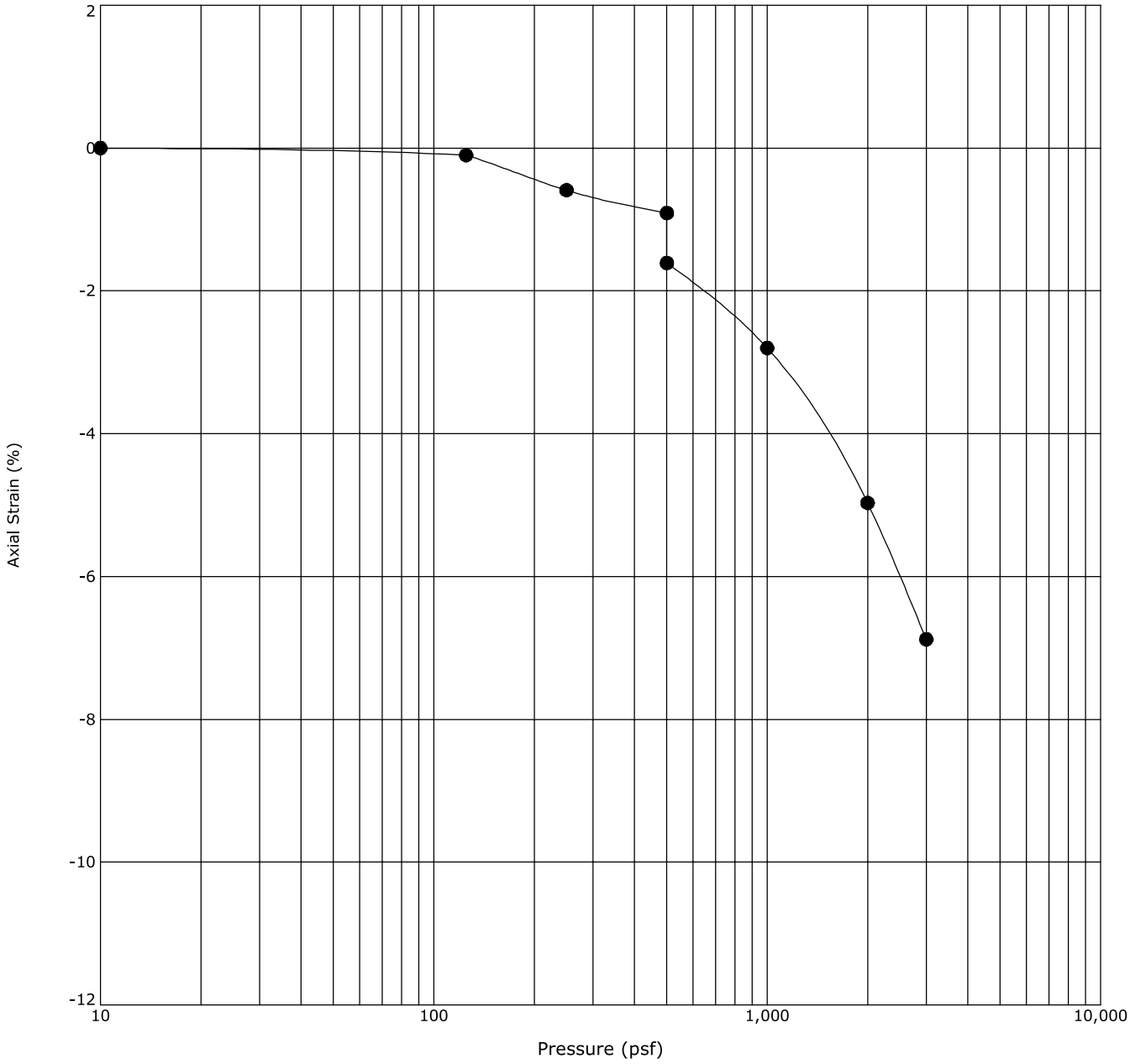


Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	Sub-01	2.5 - 3.5	SANDY LEAN CLAY (CL)	CL	93	9.1

Notes: Sample inudated with water at 500 pounds per square foot (psf).

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

Swell Consolidation Test

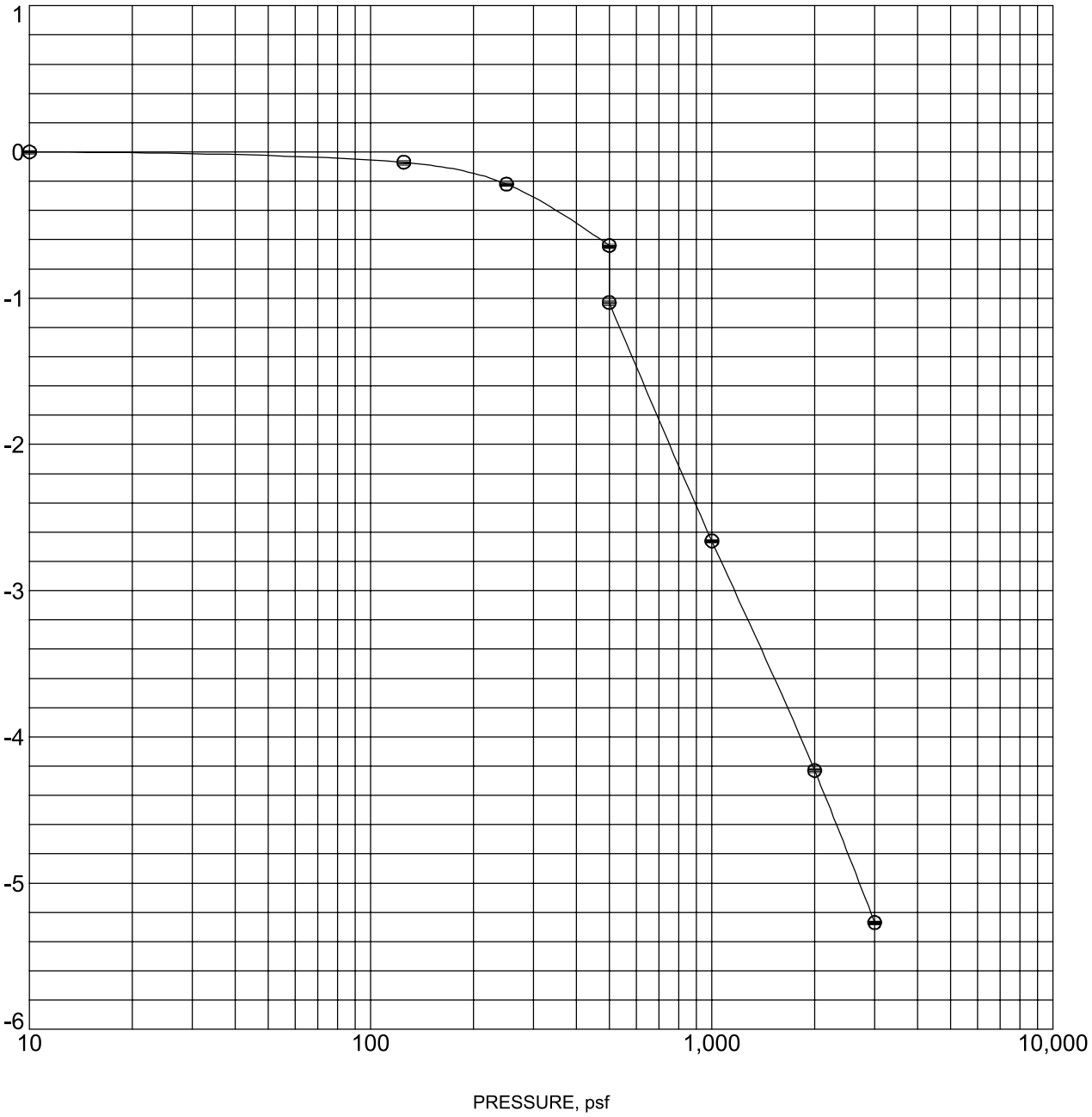


Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	Sub-02	5 - 6	SANDY LEAN CLAY	CL	90	9.6

Notes: Sample inudated with water at 500 pounds per square foot (psf).

SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification		Classification	γ_d, pcf	WC, %
⊖	B-Sub 0.5 - 1.5 ft	SANDY SILT(ML)	7	78.4

NOTES: Sample Inundated with water at 500 pounds per square foot (psf),

PROJECT: Rancho Viejo Solar Facility

PROJECT NUMBER: 66225093

SITE: NM 599 and NM 14
Santa Fe, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM

CLIENT: AES Clean Energy Development LLC
Boulder, CO

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC_CONSOL_STRAIN-USCS 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/26/22

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client
AES Clean Energy Development LLC

Project
Rancho Viejo Solar Facility

Santa Fe County, NM

Sample Submitted By: Terracon (66) **Date Received:** 10/16/2023 **Lab No.: 23-0567**

Results of Corrosion Analysis

Sample Number	--	--	--	--
Sample Location	A-7	BW-2	BW-3	Sub-1
Sample Depth (ft.)	0.0-1.5	5.0-6.5	2.5-4.0	0.0-1.5
pH Analysis, ASTM G 51	6.35	8.29	8.26	7.10
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	85	74	68	24
Sulfides, AWWA 4500-S D, (mg/Kg)	Nil	Nil	Nil	Nil
Chlorides, ASTM D512, (mg/kg)	87	62	125	75
Red-Ox, AWWA 2580 B, (mV)	+733	+725	+720	+733
Total Salts, AWWA 2520 B, (mg/Kg)	280	780	1304	269
Saturated Minimum Resistivity, ASTM G-187, (ohm-cm)	3417	2144	1273	5896

Analyzed By N. Campo

Nathan Campo
Engineering Technician III

The tests were performed in general accordance with applicable ASTM and AWWA test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client
AES Clean Energy Development LLC

Project
Rancho Viejo Solar Facility

Santa Fe County, NM

Sample Submitted By: Terracon (66) **Date Received:** 10/16/2023 **Lab No.: 23-0567**

Results of Corrosion Analysis

Sample Number	--	--
Sample Location	BESS-1	BESS-2
Sample Depth (ft.)	0.0-1.5	0.0-1.5
pH Analysis, ASTM G 51	6.38	7.19
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	27	52
Sulfides, AWWA 4500-S D, (mg/Kg)	Nil	Nil
Chlorides, ASTM D512, (mg/kg)	87	100
Red-Ox, AWWA 2580 B, (mV)	+732	+733
Total Salts, AWWA 2520 B, (mg/Kg)	341	264
Saturated Minimum Resistivity, ASTM G-187, (ohm-cm)	3350	4087

Analyzed By N. Campo

Nathan Campo
Engineering Technician III

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750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client
AES Clean Energy Development LLC

Project
Rancho Viejo Solar Facility
Santa Fe County, NM

Sample Submitted By: Terracon (66) **Date Received:** 8/5/2022 **Lab No.: 22-0541**

Results of Corrosion Analysis

Sample Number	--	--	--	--
Sample Location	B-01	B-02	B-03	B-04
Sample Depth (ft.)	Grab	Grab	Grab	Grab
pH Analysis, AASHTO T 289	7.55	8.16	8.35	7.55
Water Soluble Sulfate (SO4), AASHTO T 290 (mg/Kg)	94	113	129	76
Chlorides, AASHTO T 291 (mg/kg)	97	120	155	37
Red-Ox, AWWA 2580 B (mV)	+734	+733	+726	+735
Minimum Resistivity (Saturated), AASHTO T 288, (ohm-cm)	6700	2345	1340	3350

Analyzed By:
Nathan Campo
Engineering Technician II

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Client
AES Clean Energy Development LLC

Project
Rancho Viejo Solar Facility
Santa Fe County, NM

Sample Submitted By: Terracon (66) **Date Received:** 8/5/2022 **Lab No.: 22-0541**

Results of Corrosion Analysis

Sample Number	--	--	--	--
Sample Location	B-05	B-06	B-07	B-08
Sample Depth (ft.)	Grab	Grab	Grab	Grab
pH Analysis, AASHTO T 289	7.52	7.17	6.84	7.08
Water Soluble Sulfate (SO4), AASHTO T 290 (mg/Kg)	107	94	120	94
Chlorides, AASHTO T 291 (mg/kg)	65	75	80	70
Red-Ox, AWWA 2580 B (mV)	+735	+735	+734	+735
Minimum Resistivity (Saturated), AASHTO T 288, (ohm-cm)	3484	4556	3551	5427

Analyzed By:
Nathan Campo
Engineering Technician II

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Project
Rancho Viejo Solar Facility
Santa Fe County, NM

Sample Submitted By: Terracon (66) **Date Received:** 8/5/2022 **Lab No.: 22-0541**

Results of Corrosion Analysis

Sample Number	--	--	--	--
Sample Location	B-09	B-10	B-11	B-12
Sample Depth (ft.)	Grab	Grab	Grab	Grab
pH Analysis, AASHTO T 289	6.80	7.22	6.66	6.60
Water Soluble Sulfate (SO4), AASHTO T 290 (mg/Kg)	92	127	72	75
Chlorides, AASHTO T 291 (mg/kg)	90	65	47	50
Red-Ox, AWWA 2580 B (mV)	+732	+734	+728	+735
Minimum Resistivity (Saturated), AASHTO T 288, (ohm-cm)	3350	4221	1474	5762

Analyzed By:
Nathan Campo
Engineering Technician II

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Client
AES Clean Energy Development LLC

Project
Rancho Viejo Solar Facility
Santa Fe County, NM

Sample Submitted By: Terracon (66) **Date Received:** 8/5/2022 **Lab No.: 22-0541**

Results of Corrosion Analysis

Sample Number	--	--	--	--
Sample Location	B-13	B-14	B-15	B-16/B-Sub
Sample Depth (ft.)	Grab	Grab	Grab	Grab
pH Analysis, AASHTO T 289	6.58	6.84	7.38	7.69
Water Soluble Sulfate (SO4), AASHTO T 290 (mg/Kg)	95	133	88	103
Chlorides, AASHTO T 291 (mg/kg)	47	102	57	50
Red-Ox, AWWA 2580 B (mV)	+734	+732	+723	+731
Minimum Resistivity (Saturated), AASHTO T 288, (ohm-cm)	6633	4891	1943	2278

Analyzed By:
Nathan Campo
Engineering Technician II

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THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. SOIL PROPERTIES 2. 66225093 RANCHO VIEJO SOLAR FINAL DESIGN.GPJ TERRACON_DATATEMPLATE.GDT 11/30/23

SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI										
A-01	0.0 - 1.5	SM		7														2
A-01	2.5 - 4.0	CL		9	62	39	19	20										
A-01	5.0 - 5.5		104	7														1, 2
A-01	7.5 - 9.0			8														2
A-01	10.0 - 11.5			7														2
A-01	12.5 - 14.0			1														2
A-01	15.0 - 16.5			1														2
A-02	0.0 - 1.5	SC		7														2
A-02	2.5 - 4.0			9														2
A-02	5.0 - 5.5	CL	100	8	56	38	18	20										1
A-02	7.5 - 9.0			7														2
A-02	10.0 - 11.5			5														2
A-02	12.5 - 14.0			2														2
A-02	15.0 - 16.5			2														2
A-02	20.0 - 21.5			2														2
A-03	0.0 - 1.5	SM		7														2
A-03	2.5 - 3.0		88	10														1, 2
A-03	5.0 - 6.5			7														2
A-03	7.5 - 9.0	CL		7	65	30	16	14										
A-03	10.0 - 11.5			8														2
A-03	12.5 - 14.0			6														2
A-03	15.0 - 16.5			4														2
A-03	20.0 - 21.5			6														2
A-04	0.0 - 1.5	SM		6														2
A-04	2.5 - 4.0			9														2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: Rancho Viejo Solar

SITE: NM 599 and NM 14
Santa Fe, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM
PH. 505-797-4287 FAX. 505-797-4288

PROJECT NUMBER: 66225093

CLIENT: AES Clean Energy Development LLC
Boulder, CO

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. SOIL PROPERTIES 2. 66225093 RANCHO VIEJO SOLAR FINAL DESIGN.GPJ TERRACON_DATATEMPLATE.GDT 11/30/23

SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI										
A-04	5.0 - 5.5	SM	101	6	39	NP	NP	NP										1
A-04	7.5 - 9.0			2														2
A-04	10.0 - 10.5		113	2														1, 2
A-04	12.5 - 14.0			1														2
A-04	15.0 - 16.5			1														2
A-04	20.0 - 21.5			5														2
A-05	0.0 - 1.5	SM		5														2
A-05	2.5 - 3.0		94	12														1, 2
A-05	5.0 - 6.5			6														2
A-05	7.5 - 9.0	CL		5	56	31	15	16										
A-05	10.0 - 11.5			3														2
A-05	12.5 - 14.0			2														2
A-05	15.0 - 16.5			1														2
A-05	20.0 - 21.5			3														2
A-06	0.0 - 1.5	SM		5														2
A-06	2.5 - 4.0			5														2
A-06	5.0 - 6.5	ML		6	71	NP	NP	NP										
A-06	7.5 - 8.0		92	7														1, 2
A-06	10.0 - 11.5	SC		6														2
A-06	15.0 - 16.5			7														2
A-06	20.0 - 21.5			9														2
A-07	2.5 - 4.0	CL		7	80	32	17	15										
A-07	5.0 - 6.5			7														2
A-07	7.5 - 8.0		90	8														1, 2
A-07	10.0 - 11.5			9														2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: Rancho Viejo Solar

SITE: NM 599 and NM 14
Santa Fe, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM
PH. 505-797-4287 FAX. 505-797-4288

PROJECT NUMBER: 66225093

CLIENT: AES Clean Energy Development LLC
Boulder, CO

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. SOIL PROPERTIES 2. 66225093 RANCHO VIEJO SOLAR FINAL DESIGN.GPJ TERRACON_DATATEMPLATE.GDT 11/30/23

SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI										
A-07	12.5 - 14.0			9														2
A-07	15.0 - 16.5			8														2
A-07	20.0 - 21.5			9														2
A-08	0.0 - 1.5	CL		8														2
A-08	2.5 - 4.0			6														2
A-08	5.0 - 5.5		95	6														1, 2
A-08	7.5 - 9.0	ML		5	57	NP	NP	NP										
A-08	10.0 - 11.5			7														2
A-08	15.0 - 16.5			10														2
A-08	20.0 - 21.5			8														2
A-09	0.0 - 1.5	CL		6														2
A-09	2.5 - 4.0			7														2
A-09	7.5 - 9.0	SM		5	45	NP	NP	NP										
A-09	10.0 - 11.5			7														2
A-09	12.5 - 14.0			9														2
A-09	15.0 - 16.5			5														2
A-09	20.0 - 21.5			6														2
A-10	0.0 - 1.5	CL		5														2
A-10	2.5 - 4.0			10														2
A-10	5.0 - 6.5	CL		8	57	34	16	18										
A-10	7.5 - 8.5		92	7														1, 2
A-10	10.0 - 11.5			5														2
A-10	12.5 - 14.0			9														2
A-10	15.0 - 16.5			10														2
A-10	20.0 - 21.5			10														2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: Rancho Viejo Solar

SITE: NM 599 and NM 14
Santa Fe, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM
PH. 505-797-4287 FAX. 505-797-4288

PROJECT NUMBER: 66225093

CLIENT: AES Clean Energy Development LLC
Boulder, CO

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. SOIL PROPERTIES 2. 66225093 RANCHO VIEJO SOLAR FINAL DESIGN.GPJ TERRACON_DATATEMPLATE.GDT 11/30/23

SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI										
A-11	0.0 - 1.5	CL		7														2
A-11	2.5 - 4.0			7														2
A-11	5.0 - 5.5	CL	81	7	66	32	18	14										1
A-11	7.5 - 9.0			8														2
A-11	10.0 - 11.5			6														2
A-11	12.5 - 14.0			7														2
A-11	15.0 - 16.5			5														2
A-11	20.0 - 21.5			5														2
A-12	0.0 - 1.5	CL		3														2
A-12	2.5 - 4.0			5														2
A-12	5.0 - 6.0		100	3														1, 2
A-12	7.5 - 9.0	SM		4	42	NP	NP	NP										
A-12	10.0 - 11.5			7														2
A-12	12.5 - 14.0			8														2
A-12	15.0 - 16.5			10														2
A-12	20.0 - 21.5			9														2
A-13	0.0 - 1.5	SC		6														2
A-13	2.5 - 3.5		84	6														1, 2
A-13	5.0 - 6.5	CL		8	59	35	16	19										
A-13	7.5 - 9.0			7														2
A-13	10.0 - 11.5			7														2
A-13	12.5 - 14.0			7														2
A-13	15.0 - 16.5			7														2
A-13	20.0 - 21.5			7														2
A-14	0.0 - 1.5	SC		8														2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: Rancho Viejo Solar

SITE: NM 599 and NM 14
Santa Fe, NM

Terracon
6805 Academy Pkwy West NE
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PH. 505-797-4287 FAX. 505-797-4288

PROJECT NUMBER: 66225093

CLIENT: AES Clean Energy Development LLC
Boulder, CO

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SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI										
A-14	2.5 - 3.5		83	11														1, 2
A-14	5.0 - 6.5	ML		9	60	NP	NP	NP										
A-14	7.5 - 9.0			10														2
A-14	10.0 - 11.5			39														2
A-14	12.5 - 14.0			9														2
A-14	15.0 - 16.5			8														2
A-14	20.0 - 21.5			4														2
A-15	2.5 - 4.0	SM		7	48	NP	NP	NP										
A-15	7.5 - 9.0			6														2
A-15	10.0 - 11.5			7														2
A-15	12.5 - 14.0			10														2
A-15	15.0 - 16.5	SM		8														2
A-15	20.0 - 21.5			5														2
Bess-01	2.5 - 4.0	CL		7	77	30	14	16										
Bess-01	5.0 - 6.0		105	8														1, 2
Bess-01	7.5 - 9.0			8														2
Bess-01	10.0 - 11.5	ML		7	67	NP	NP	NP										
Bess-01	12.5 - 14.0			5														2
Bess-01	15.0 - 16.5			5														2
Bess-01	20.0 - 21.5			4														2
Bess-01	25.0 - 26.5	SP-SM		1														2
Bess-01	30.0 - 31.5			3														2
Bess-01	35.0 - 36.5			8														2
Bess-01	40.0 - 41.5			8														2
Bess-02	2.5 - 3.5		76	13														1, 2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
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4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: Rancho Viejo Solar

SITE: NM 599 and NM 14
Santa Fe, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM
PH. 505-797-4287 FAX. 505-797-4288

PROJECT NUMBER: 66225093

CLIENT: AES Clean Energy Development LLC
Boulder, CO

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SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI										
Bess-02	5.0 - 6.5			10														2
Bess-02	7.5 - 9.0	SM		7	46	NP	NP	NP										
Bess-02	10.0 - 11.5			8														2
Bess-02	12.5 - 14.0			6														2
Bess-02	15.0 - 16.5	CL		8	62	26	16	10										
Bess-02	20.0 - 21.5			9														2
Bess-02	25.0 - 26.5			9														2
Bess-02	35.0 - 36.5			3														2
Bess-03	0.0 - 1.5	SC		6														2
Bess-03	2.5 - 3.5		102	5														1, 2
Bess-03	5.0 - 6.5			5														2
Bess-03	7.5 - 9.0			11														2
Bess-03	10.0 - 11.5			12														2
Bess-03	12.5 - 14.0			7														2
Bess-03	15.0 - 16.5			7														2
Bess-03	20.0 - 21.5	SW-SM		2	8	NP	NP	NP										
Bess-03	25.0 - 26.5			2														2
Bess-03	30.0 - 31.5			9														2
Bess-03	35.0 - 36.5			9														2
Bess-03	40.0 - 41.5			6														2
BW-01	2.5 - 4.0	SM		5	50	NP	NP	NP										
BW-01	5.0 - 6.0		100	7														1, 2
BW-01	7.5 - 9.0			7														2
BW-01	10.0 - 11.5			7														2
BW-01	15.0 - 16.5			7														2

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Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI										
BW-01	20.0 - 21.5	ML		6	60	NP	NP	NP										
BW-01	25.0 - 26.5			6														2
BW-01	30.0 - 31.5			3														2
BW-02	2.5 - 3.5		90	3														1, 2
BW-02	5.0 - 6.5	SM		4	35	NP	NP	NP										
BW-02	7.5 - 9.0			2														2
BW-02	10.0 - 11.5			2														2
BW-02	15.0 - 16.5			4														2
BW-02	20.0 - 21.5			2														2
BW-02	25.0 - 26.5	SM		5	40	NP	NP	NP										
BW-02	30.0 - 31.5			9														2
BW-03	5.0 - 6.0	ML	97	4	56	NP	NP	NP										1
BW-03	7.5 - 9.0			7														2
BW-03	10.0 - 11.5			5														2
BW-03	15.0 - 16.5	SM		2	20	NP	NP	NP										
BW-03	20.0 - 21.5			3														2
BW-03	25.0 - 26.5			3														2
BW-03	30.0 - 31.5			8														2
P-01	0.0 - 1.5	SC		7														2
P-01	2.5 - 3.5		90	7														1, 2
P-01	5.0 - 6.5			7														2
P-02	0.0 - 1.5	SC		6														2
P-02	2.5 - 4.0	CL		10	61	39	24	15										
P-02	5.0 - 6.0		95	8														1, 2
P-03	0.0 - 1.5	SC		7														2

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SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI										
P-03	2.5 - 3.5		95	7														1, 2
P-03	5.0 - 6.5			7		NP	NP	NP										
P-04	0.0 - 1.5	SC		7														2
P-04	2.5 - 4.0	ML		7	65	NP	NP	NP										
P-04	5.0 - 6.0		92	8														1, 2
P-05	0.0 - 1.5	SC		7														2
P-05	2.5 - 3.5		81	8														1, 2
P-05	5.0 - 6.5	CL		21	62	28	17	11										
P-06	0.0 - 1.5	SC		7														2
P-06	2.5 - 4.0			6														2
P-06	5.0 - 6.0	SM	91	6	41	NP	NP	NP										1
P-07	0.0 - 1.5	SC		7														2
P-07	2.5 - 3.5	SM	76	6	36	NP	NP	NP										1
P-07	5.0 - 6.5			6														2
P-08	0.0 - 1.5	SC		6														2
P-08	2.5 - 4.0	CL		7	64	35	24	11										
P-08	5.0 - 6.0		83	8														1, 2
Sub-01	2.5 - 3.5	CL	93	9	58	30	17	13										1
Sub-01	5.0 - 6.5			8														2
Sub-01	7.5 - 9.0			8														2
Sub-01	10.0 - 11.5			8														2
Sub-01	12.5 - 14.0			9														2
Sub-01	15.0 - 16.5			7														2
Sub-01	20.0 - 21.5	CL		8	69	29	16	13										
Sub-01	25.0 - 26.5			8														2

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SUMMARY OF LABORATORY RESULTS

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			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI										
Sub-01	30.0 - 31.5			6														2
Sub-01	35.0 - 36.5			6														2
Sub-01	40.0 - 41.5			6														2
Sub-02	0.0 - 1.5	SC		7														2
Sub-02	2.5 - 4.0	CL		9	62	30	22	8										
Sub-02	5.0 - 6.0		90	10														1, 2
Sub-02	7.5 - 9.0			9														2
Sub-02	10.0 - 11.5			9														2
Sub-02	12.5 - 14.0			7														2
Sub-02	15.0 - 16.5			5														2
Sub-02	20.0 - 21.5	SM		3	22	NP	NP	NP										
Sub-02	25.0 - 26.5			7														2
Sub-02	30.0 - 31.5			6														2
Sub-02	35.0 - 36.5			7														2
Sub-02	40.0 - 41.5			6														2
T-01	2.5 - 4.0			10														2
T-01	5.0 - 6.0	CL	103	7	64	31	12	19										1
T-01	7.5 - 9.0			6														2
T-01	10.0 - 11.5			7														2
T-01	15.0 - 16.5			7														2
T-01	20.0 - 21.5			5														2
T-01	25.0 - 26.5	SM		4	38	NP	NP	NP										
T-01	30.0 - 31.5			8														2
T-02	5.0 - 6.0		91	6														1, 2
T-02	7.5 - 9.0	ML		5	63	NP	NP	NP										

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SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI										
T-02	10.0 - 11.5			8														2
T-02	15.0 - 16.5			6														2
T-02	20.0 - 21.5	CL		8	58	26	16	10										
T-02	25.0 - 26.5			7														2
T-02	30.0 - 31.5			7														2
T-03	2.5 - 4.0			5														2
T-03	5.0 - 6.0		89	4														1, 2
T-03	7.5 - 9.0			3														2
T-03	10.0 - 11.5	SM		2	23	NP	NP	NP										
T-03	15.0 - 16.5			5														2
T-03	20.0 - 21.5			4														2
T-03	25.0 - 26.5	SM		3														2
T-03	30.0 - 31.5			2														2
T-04	2.5 - 3.5		101	4														1, 2
T-04	5.0 - 6.5			1														2
T-04	7.5 - 9.0			3														2
T-04	10.0 - 11.5			4														2
T-04	15.0 - 16.5	ML		6	61	NP	NP	NP										
T-04	20.0 - 21.5			4														2
T-04	25.0 - 26.5	SC-SM		11														2
T-04	30.0 - 31.5			4														2

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SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing		Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Swell (%)	Consolidation (%) 50	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI							
B-01	0.0 -	ML									7.6	6700	94	97	2
B-01	0.5 - 2.0	ML		5	57	NP	NP	NP							
B-01	2.5 - 3.5	ML	86	8											1, 2
B-01	5.0 - 6.5	ML		5											2
B-01	7.5 - 9.0	ML		5											2
B-01	10.0 - 11.5	ML		8											2
B-01	12.5 - 14.0	ML		5											2
B-01	15.0 - 16.5	ML		8											2
B-02	0.0 -	ML									8.2	2345	113	120	2
B-02	0.5 - 2.0	ML		5											2
B-02	2.5 - 4.0	ML		6											2
B-02	5.0 - 6.0	ML	86	9	75	NP	NP	NP							1
B-02	7.5 - 9.0	ML		8											2
B-02	10.0 - 11.5	ML		7											2
B-02	12.5 - 14.0	ML		10											2
B-02	15.0 - 16.5	ML		7											2
B-03	0.0 - 0.0	ML									8.4	1340	129	155	2
B-03	0.5 - 2.0	ML		9											2
B-03	2.5 - 4.0	ML		9											2
B-03	5.0 - 6.0	ML	93	8											1, 2
B-03	7.5 - 9.0	SM		7											2
B-03	10.0 - 11.5	SM		7	61	NP	NP	NP							
B-03	12.5 - 14.0	ML		11											2
B-03	15.0 - 16.5	ML		7											2
B-04	0.0 -	ML									7.6	3350	76	37	2

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			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Swell (%)	Consolidation (%) $_{50}$	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI							
B-04	0.5 - 2.0	ML		4											2
B-04	2.5 - 3.5	ML	99	7	75	NP	NP	NP							1
B-04	5.0 - 6.5	ML		7											2
B-04	7.5 - 9.0	ML		6											2
B-04	10.0 - 11.5	ML		7											2
B-04	12.5 - 14.0	SM		6											2
B-04	15.0 - 16.5	ML		10											2
B-05	0.0 -	ML									7.5	3484	107	65	2
B-05	0.5 - 1.5	ML	82	11											1, 2
B-05	2.5 - 4.0	ML		7											2
B-05	5.0 - 6.5	ML		7	61	NP	NP	NP							
B-05	7.5 - 9.0	ML		7											2
B-05	10.0 - 11.5	ML		6											2
B-05	12.5 - 14.0	ML		4											2
B-05	15.0 - 16.5	ML		3											2
B-06	0.0 -	ML									7.2	4556	94	75	2
B-06	0.5 - 2.0	ML		7											2
B-06	2.5 - 4.0	ML		6											2
B-06	5.0 - 6.0	ML	98	7											1, 2
B-06	7.5 - 9.0	ML		10											2
B-06	10.0 - 11.5	ML		6	59	NP	NP	NP							
B-06	12.5 - 14.0	ML		8											2
B-06	15.0 - 16.5	ML		7											2
B-07	0.0 - 0.0	ML									6.8	3551	120	80	2
B-07	0.5 - 2.0	ML		7											2

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			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Swell (%)	Consolidation (%) $_{50}$	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI							
B-07	2.5 - 3.5	ML	84	9	70	NP	NP	NP							1
B-07	5.0 - 6.5	ML		8											2
B-07	7.5 - 9.0	ML		8											2
B-07	10.0 - 11.5	ML		11											2
B-07	12.5 - 14.0	ML		11											2
B-07	15.0 - 16.5	ML		8											2
B-08	0.0 - 0.0	ML									7.1	5427	94	70	2
B-08	0.5 - 2.0	ML		9											2
B-08	2.5 - 4.0	ML		9											2
B-08	5.0 - 6.0	ML	96	7	59	NP	NP	NP							1
B-08	7.5 - 9.0	SM		6											2
B-08	10.0 - 11.5	SM		9											2
B-08	12.5 - 14.0	ML		11											2
B-08	15.0 - 16.5	ML		9											2
B-09	0.0 - 0.0	ML									6.8	3350	92	90	2
B-09	0.5 - 2.0	ML		9											2
B-09	2.5 - 3.5	ML	97	6											1, 2
B-09	5.0 - 6.5	ML		8											2
B-09	7.5 - 9.0	ML		6											2
B-09	10.0 - 11.5	ML		6											2
B-09	12.5 - 14.0	ML		7											2
B-09	15.0 - 16.5	ML		7											2
B-10	0.0 - 0.0	ML									7.2	4221	127	65	2
B-10	0.5 - 2.0	ML		6											2
B-10	2.5 - 3.5	SM	90	7											1, 2

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			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Swell (%)	Consolidation (%) 50	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI							
B-10	5.0 - 6.0	SM		7											2
B-10	7.5 - 9.0	ML		7											2
B-10	10.0 - 11.5	ML		17	86	NP	NP	NP							
B-10	12.5 - 14.0	ML		9											2
B-10	15.0 - 16.5	ML		7											2
B-11	0.0 -	ML									6.7	1474	72	47	2
B-11	0.5 - 2.0	ML		5											2
B-11	2.5 - 4.0	ML		5	61	NP	NP	NP							
B-11	5.0 - 6.0	ML	90	7											1, 2
B-11	7.5 - 9.0	ML		8											2
B-11	10.0 - 11.5	ML		8											2
B-11	12.5 - 14.0	ML		7											2
B-11	15.0 - 16.5	ML		8											2
B-12	0.0 -	ML									6.6	5762	75	50	2
B-12	0.5 - 2.0	ML		7											2
B-12	2.5 - 3.5	ML	84	8											1, 2
B-12	5.0 - 6.5	ML		8	58	NP	NP	NP							
B-12	7.5 - 9.0	ML		7											2
B-12	10.0 - 11.5	ML		4											2
B-12	12.5 - 14.0	ML		5											2
B-12	15.0 - 16.5	ML		6											2
B-13	0.0 -	ML									6.6	6633	95	47	2
B-13	0.5 - 2.0	ML		5											2
B-13	2.5 - 4.0	ML		5											2
B-13	5.0 - 6.0	ML		6											2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: Rancho Viejo Solar Facility

SITE: NM 599 and NM 14
Santa Fe, NM

Terracon
6805 Academy Pkwy West NE
Albuquerque, NM
PH. 505-797-4287 FAX. 505-797-4288

PROJECT NUMBER: 66225093

CLIENT: AES Clean Energy Development LLC
Boulder, CO

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. SOIL PROPERTIES 2 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/26/22

SUMMARY OF LABORATORY RESULTS

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing		Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Swell (%)	Consolidation (%) 50	pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)	
						LL	PL	PI							
B-13	7.5 - 9.0	ML		5											2
B-13	10.0 - 11.5	SM		3	23	NP	NP	NP							
B-13	12.5 - 14.0	SM		2											2
B-13	15.0 - 16.5	SM		4											2
B-14	0.0 -	ML									6.8	4891	133	102	2
B-14	0.5 - 2.0	ML		3											2
B-14	2.5 - 3.5	ML	93	5	51	NP	NP	NP							1
B-14	5.0 - 6.5	ML		5											2
B-14	7.5 - 9.0	SM		4											2
B-14	10.0 - 11.5	SM		1											2
B-14	12.5 - 14.0	SM		1											2
B-14	15.0 - 16.5	SM		2											2
B-15	0.0 - 0.0	ML									7.4	1943	88	57	2
B-15	0.5 - 2.0	ML		5											2
B-15	2.5 - 4.0	ML		6											2
B-15	5.0 - 6.0	ML	94	4	41	NP	NP	NP							1
B-15	7.5 - 9.0	SM		3											2
B-15	10.0 - 11.5	SM		2											2
B-15	12.5 - 14.0	SM		1											2
B-15	15.0 - 16.5	SM		3											2
B-Sub	0.0 - 0.0	ML									7.7	6633	103	50	2
B-Sub	0.5 - 1.5	ML	78	12											1, 2
B-Sub	2.5 - 4.0	SM		10	59	NP	NP	NP							
B-Sub	5.0 - 6.5	ML		7											2
B-Sub	7.5 - 9.0	SM		6											2

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

PROJECT: Rancho Viejo Solar Facility

SITE: NM 599 and NM 14
Santa Fe, NM

Terracon
6805 Academy Pkwy West NE
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PH. 505-797-4287 FAX. 505-797-4288

PROJECT NUMBER: 66225093

CLIENT: AES Clean Energy Development LLC
Boulder, CO

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. SOIL PROPERTIES 2 66225093 RANCHO VIEJO SOLA.GPJ TERRACON_DATATEMPLATE.GDT 9/26/22

APPENDIX C

THERMAL RESISTIVITY TESTING

Exploration Plan – Thermal Resistivity Locations

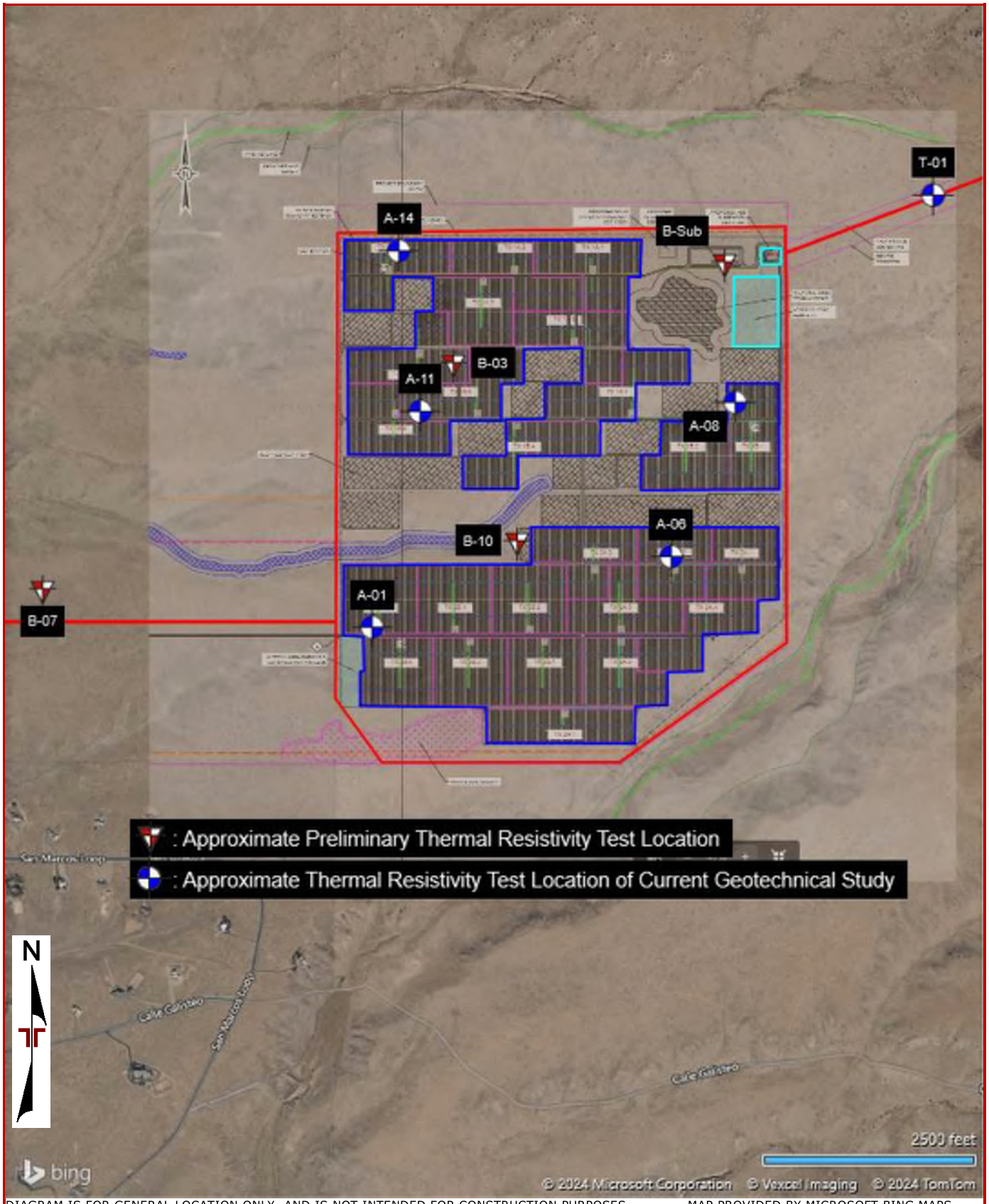


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan – Field Electrical Resistivity Locations



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

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info@geothermusa.com
http://www.geothermusa.com

December 21, 2023

Terracon
6805 Academy Parkway West NE
Albuquerque, New Mexico 87109
Attn: Stenson Lee

Re: Thermal Analysis of Native Soil Samples
Rancho Viejo Solar – Santa Fe, NM (Project No. 66225093)

The following is the report of thermal dryout characterization tests conducted on ten (10) bulk samples of native soil from the referenced project sent to our laboratory.

Thermal Resistivity Tests: The samples were tested at the 'optimum' moisture content and at 85% of the standard Proctor dry density ***provided by Terracon***. The tests were conducted in accordance with the IEEE standard 442-2017. The results are tabulated below and the thermal dryout curves are presented in **Figures 1 to 10.**

Sample ID, Description, Thermal Resistivity, Moisture Content and Density

Sample ID	Depth (ft)	Effort (%)	Description (Terracon)	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft^3)
				Wet	Dry		
A-01	1.0 - 5.0	85	Silty Sand (SM)	97	236	14	92
A-06	1.0 - 5.0	85	Silty Sand (SM)	69	157	11	101
A-08	1.0 - 5.0	85	Lean Clay (CL)	89	205	13	96
A-11	1.0 - 5.0	85	Lean Clay (CL)	92	218	16	92
A-14	1.0 - 5.0	85	Silty Sand (SM)	95	306	17	86
BW-01	1.0 - 5.0	85	Lean Clay w/ Sand	78	186	13	100
T-01	1.0 - 5.0	85	Clayey Sand (SC)	94	239	18	90

Sample ID, Description, Thermal Resistivity, Moisture Content and Density

Sample ID	Depth (ft)	Effort (%)	Description (Terracon)	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft^3)
				Wet	Dry		
T-02	1.0 - 5.0	85	Clayey Sand (SC)	90	239	12	95
T-03	1.0 - 5.0	85	Lean Clay (CL)	80	168	13	102
T-04	1.0 - 5.0	85	Lean Clay (CL)	67	137	9	109

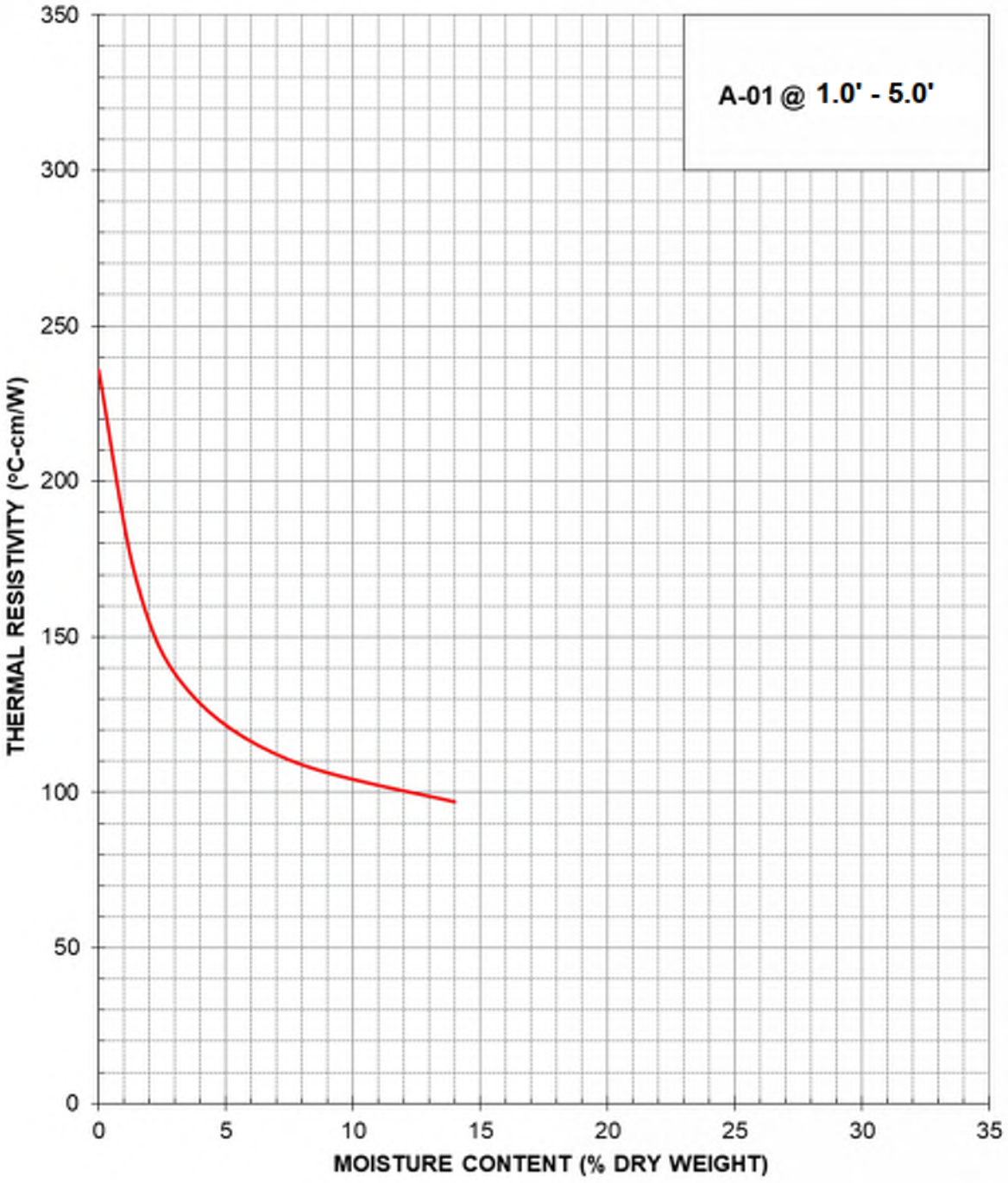
Please contact us if you have any questions or if we can be of further assistance.

Geotherm USA

Deepak Parmar

1.0' - 5.0'

THERMAL DRYOUT CURVE



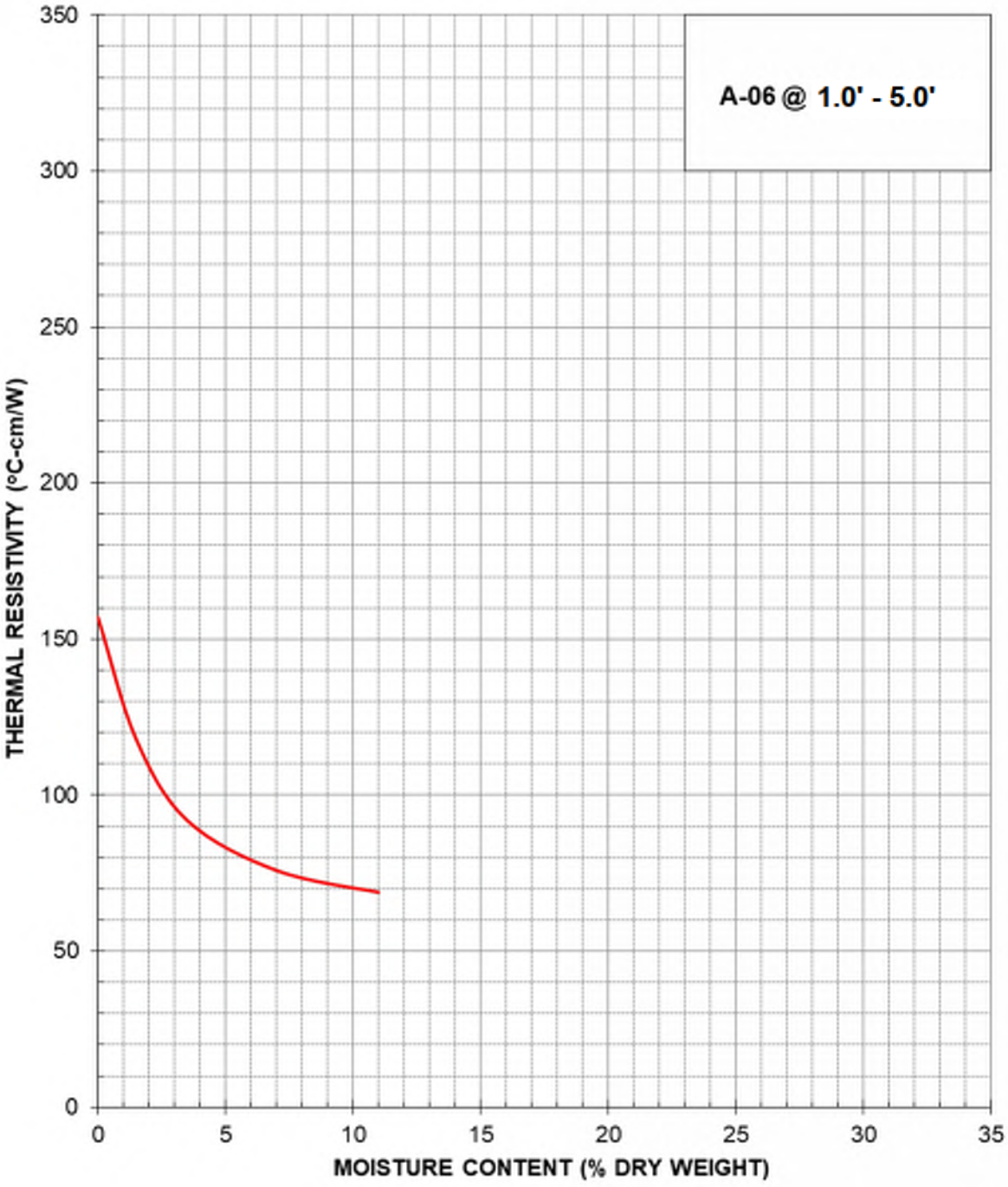
Terracon (Project No. 66225093)

Rancho Viejo Solar – Santa Fe, NM

Thermal Analysis of Native Soil Samples

December 2023 **Figure 1**

THERMAL DRYOUT CURVE



Terracon (Project No. 66225093)

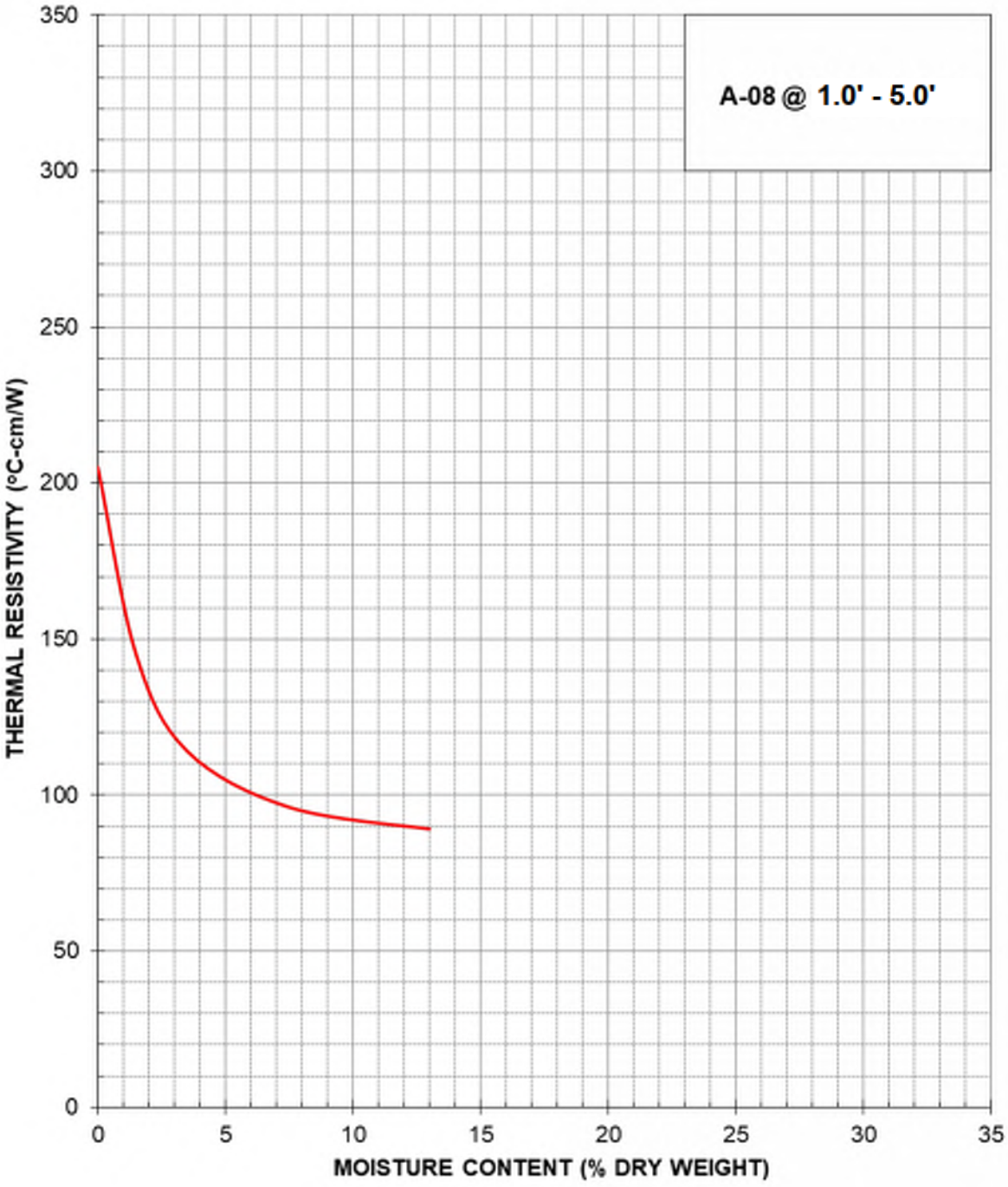
Rancho Viejo Solar – Santa Fe, NM

Thermal Analysis of Native Soil Samples

December 2023

Figure 2

THERMAL DRYOUT CURVE



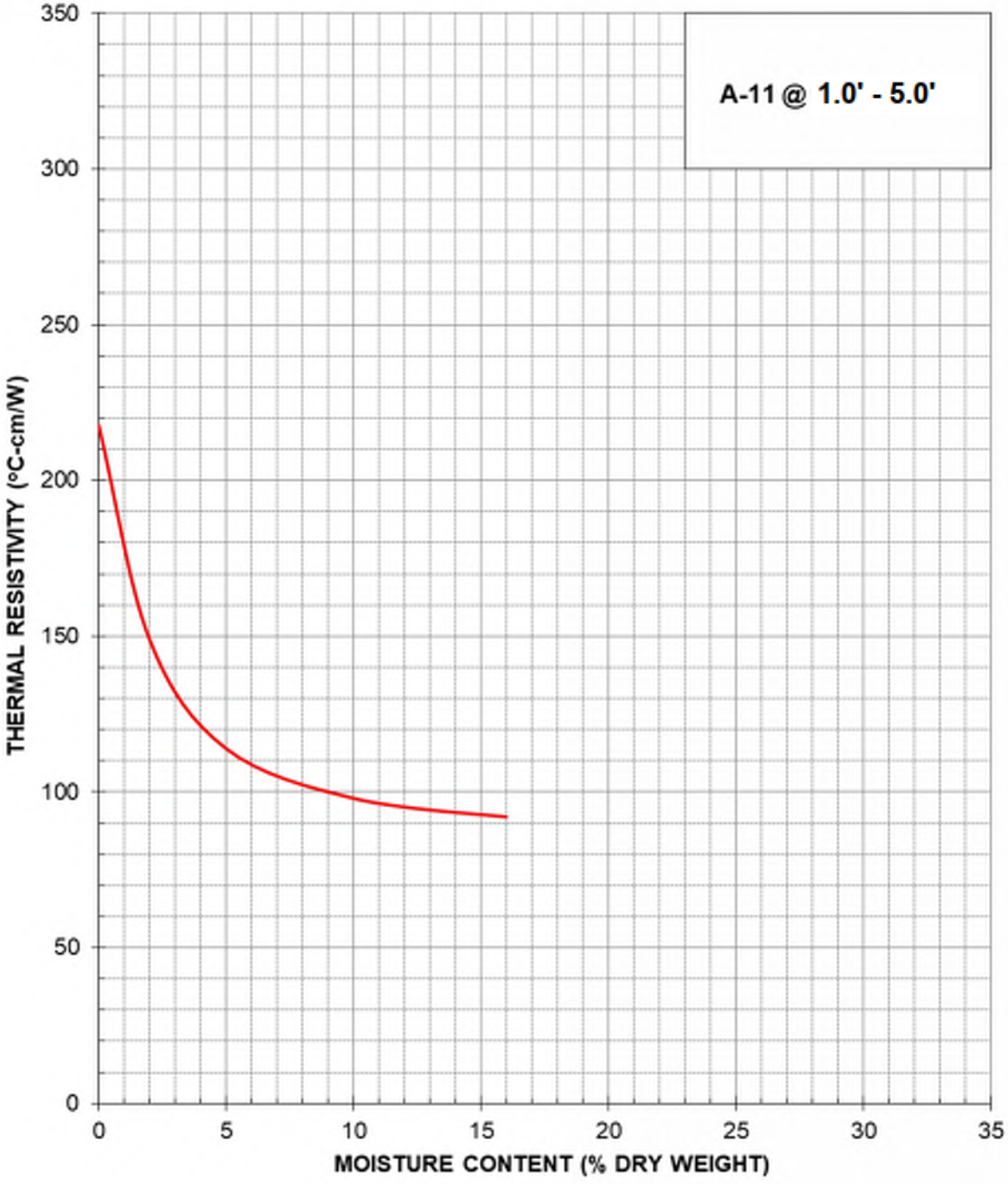
Terracon (Project No. 66225093)

Rancho Viejo Solar – Santa Fe, NM

Thermal Analysis of Native Soil Samples

December 2023 **Figure 3**

THERMAL DRYOUT CURVE



Terracon (Project No. 66225093)

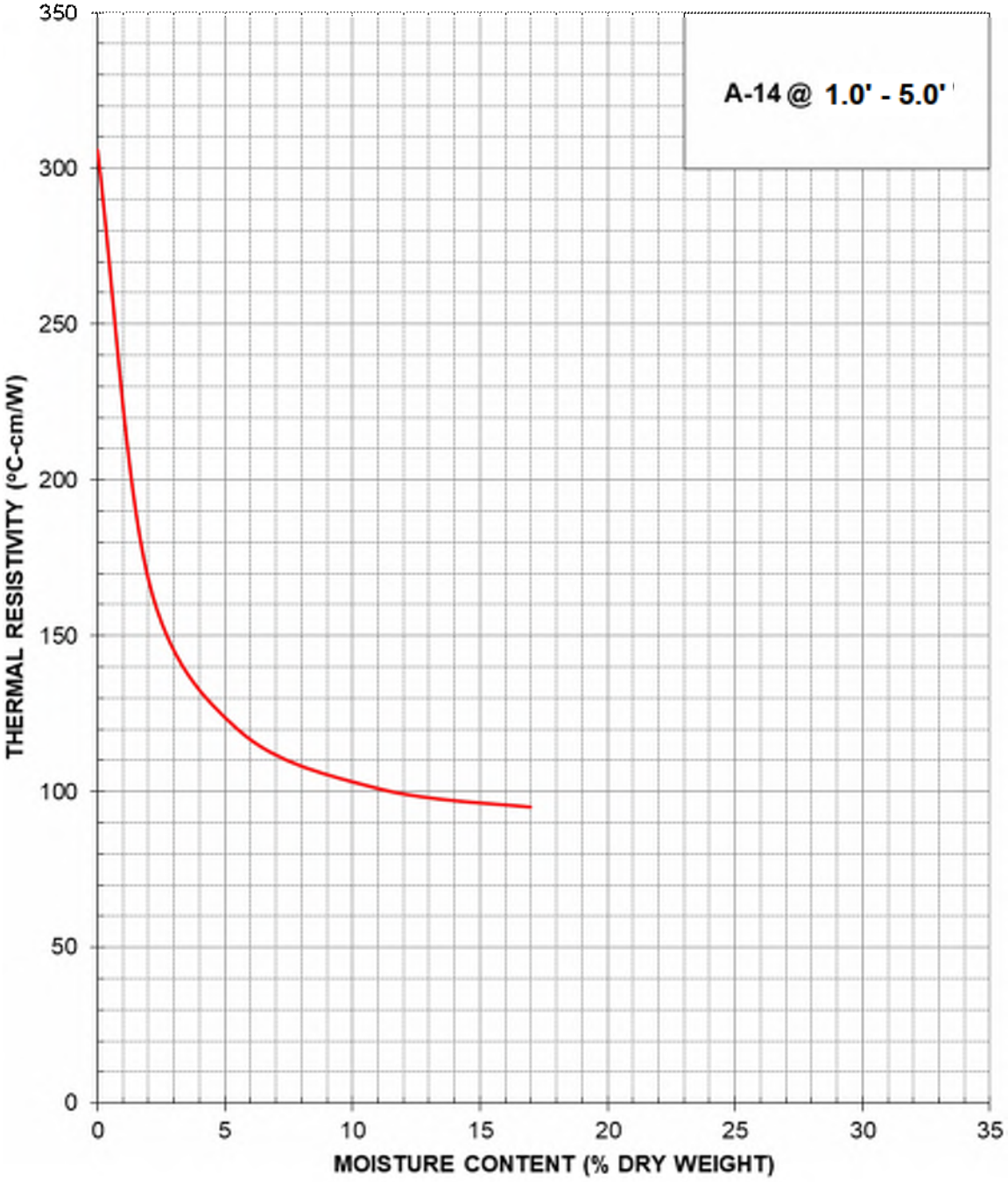
Rancho Viejo Solar – Santa Fe, NM

Thermal Analysis of Native Soil Samples

December 2023

Figure 4

THERMAL DRYOUT CURVE



Terracon (Project No. 66225093)

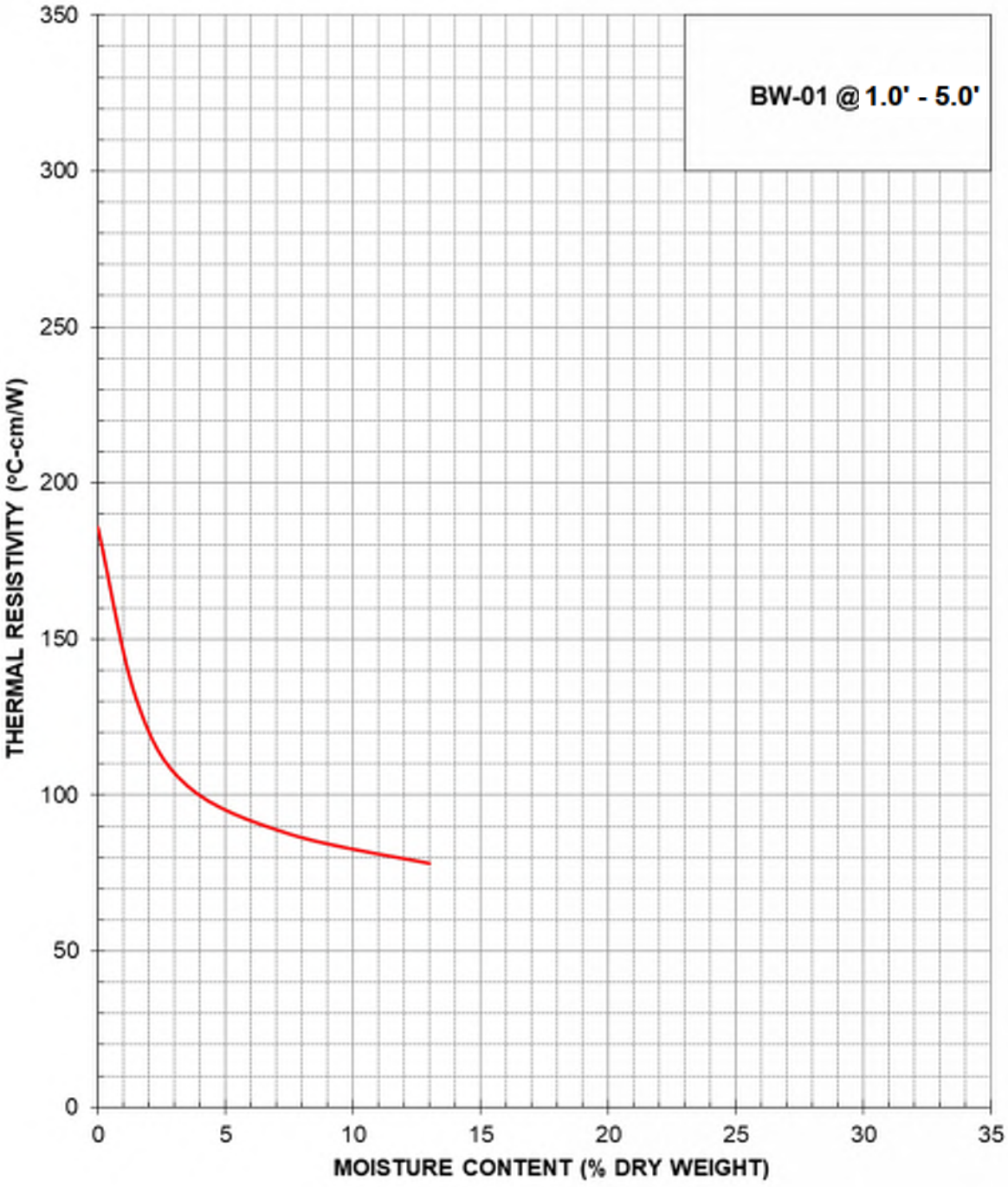
Rancho Viejo Solar – Santa Fe, NM

Thermal Analysis of Native Soil Samples

December 2023

Figure 5

THERMAL DRYOUT CURVE



Terracon (Project No. 66225093)

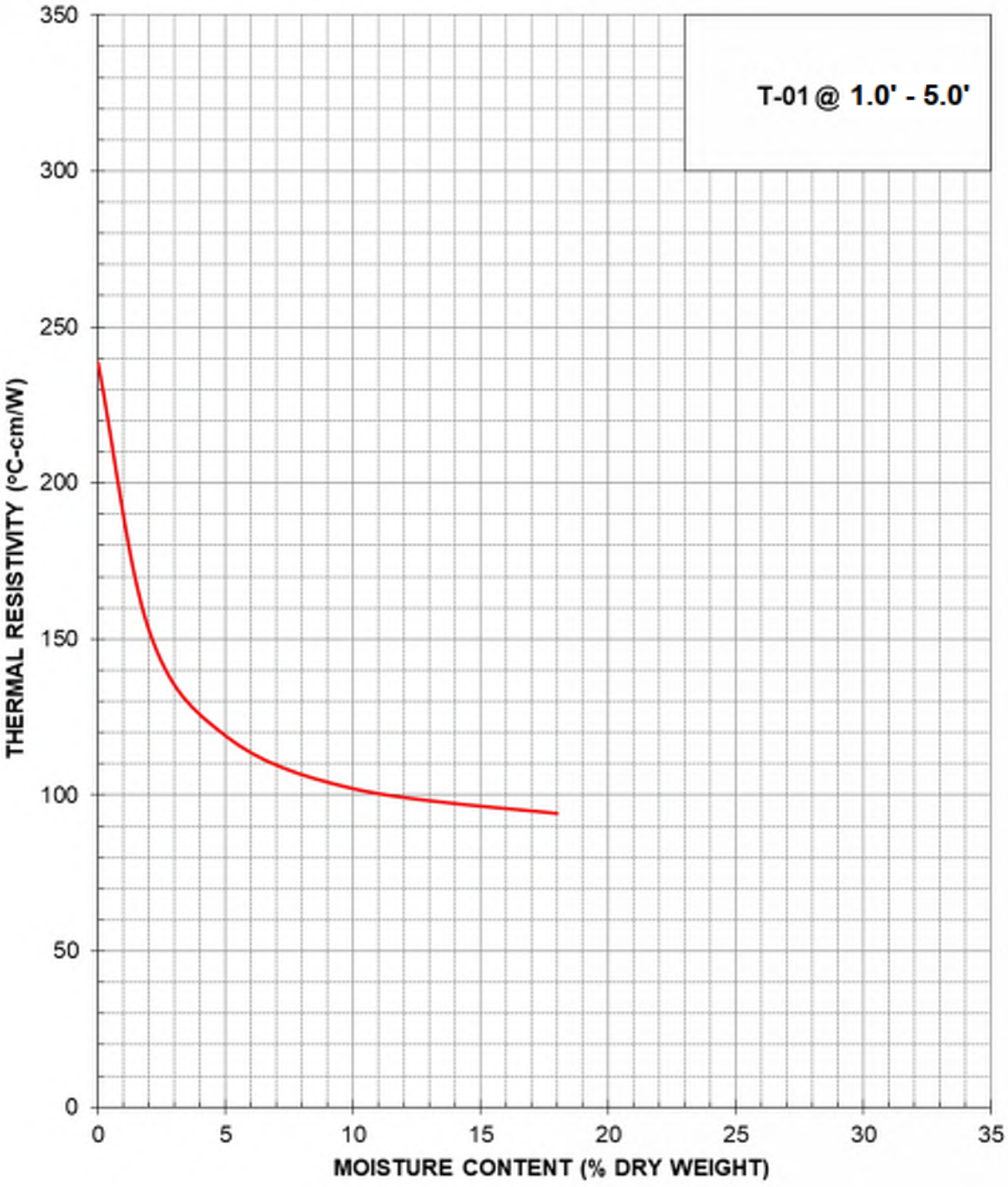
Rancho Viejo Solar – Santa Fe, NM

Thermal Analysis of Native Soil Samples

December 2023

Figure 6

THERMAL DRYOUT CURVE



Terracon (Project No. 66225093)

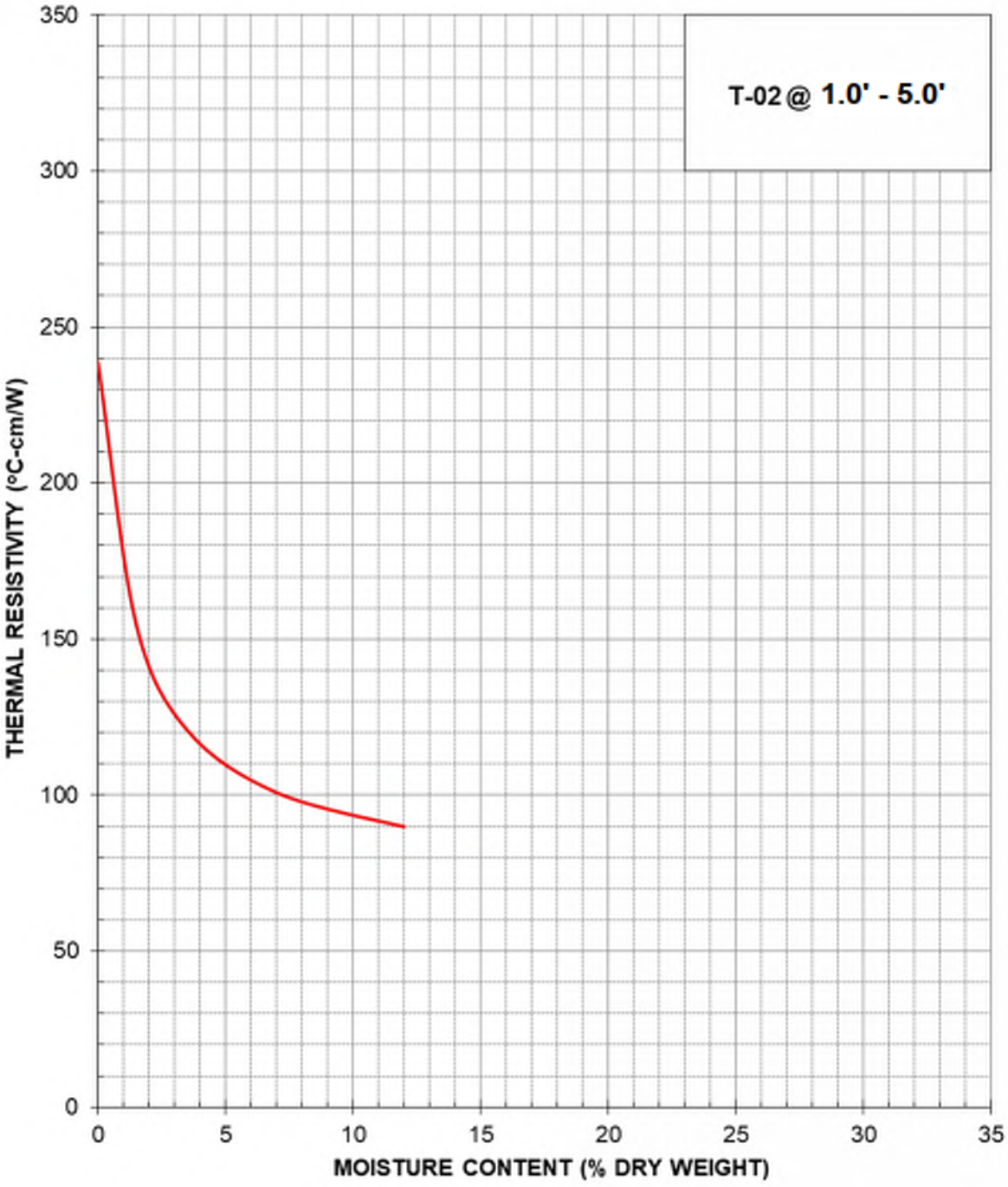
Rancho Viejo Solar – Santa Fe, NM

Thermal Analysis of Native Soil Samples

December 2023

Figure 7

THERMAL DRYOUT CURVE



Terracon (Project No. 66225093)

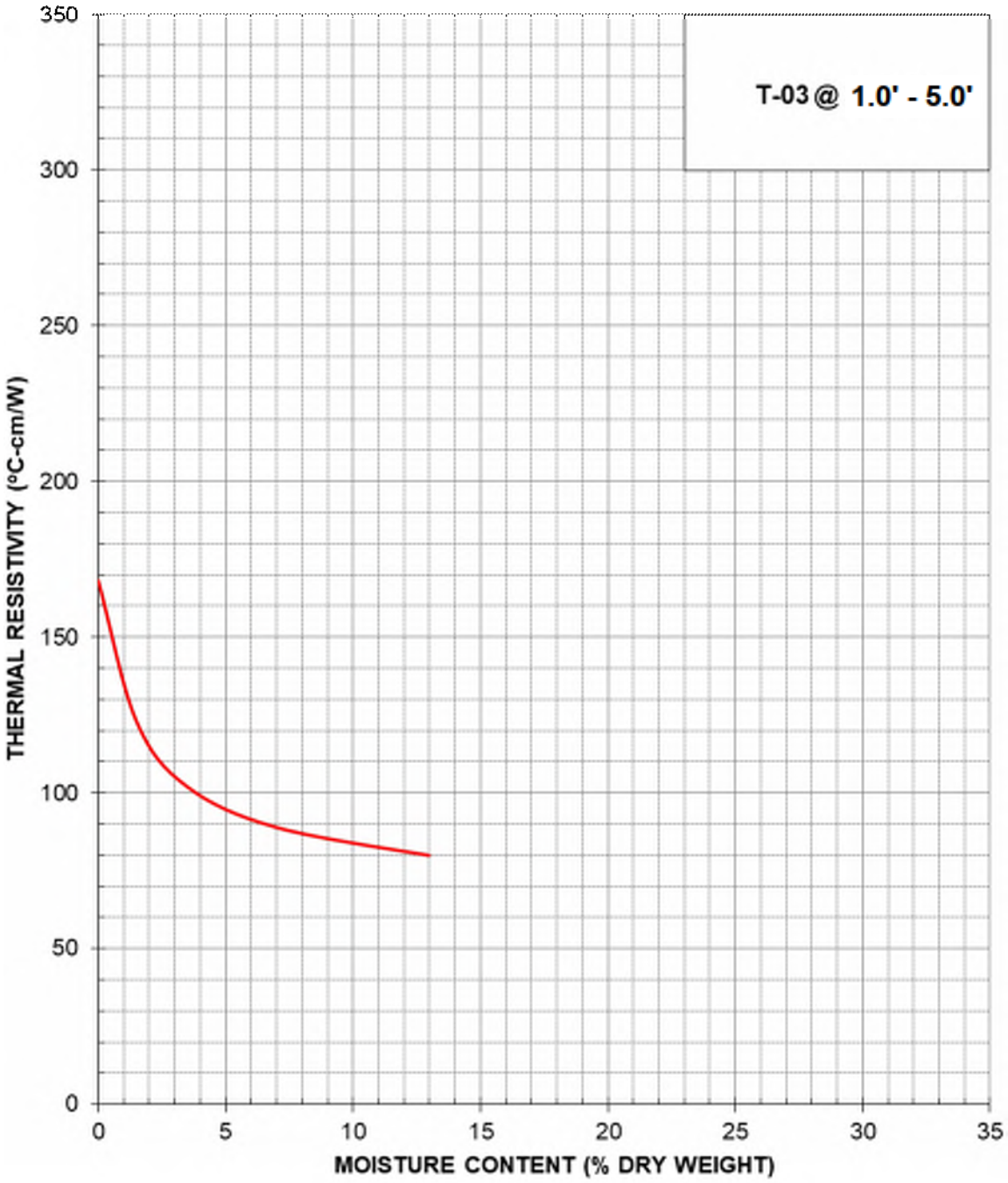
Rancho Viejo Solar – Santa Fe, NM

Thermal Analysis of Native Soil Samples

December 2023

Figure 8

THERMAL DRYOUT CURVE



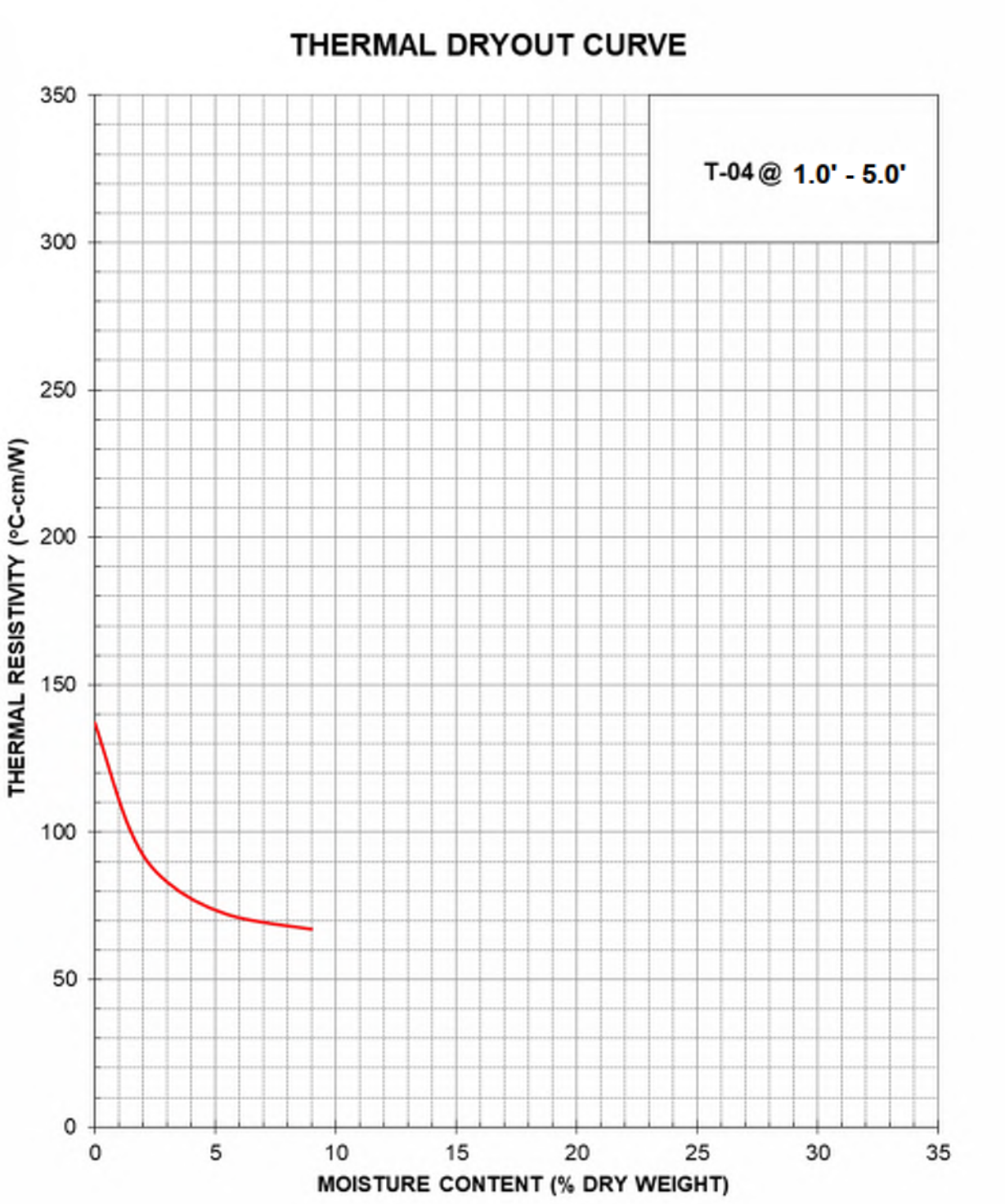
Terracon (Project No. 66225093)

Rancho Viejo Solar – Santa Fe, NM

Thermal Analysis of Native Soil Samples

December 2023

Figure 9



Terracon (Project No. 66225093)

Rancho Viejo Solar – Santa Fe, NM

Thermal Analysis of Native Soil Samples

December 2023 **Figure 10**

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info@geothermusa.com
http://www.geothermusa.com

September 2, 2022

Terracon
6805 Academy Parkway West NE
Albuquerque, New Mexico 87109
Attn: Stenson Lee

Re: Thermal Analysis of Native Soil Samples
Rancho Viejo Solar – Santa Fe County, NM (PO No. 66225093)

The following is the report of thermal dryout characterization tests conducted on four (4) samples of native soil from the referenced project sent to our laboratory.

Thermal Resistivity Tests: The samples were tested at the 'optimum' moisture content and at 90% and 95% of the standard Proctor dry density ***provided by Terracon***. The tests were conducted in accordance with the IEEE standard 442-2017. The results are tabulated below and the thermal dryout curves are presented in **Figures 1 to 4.**

Sample ID, Description, Thermal Resistivity, Moisture Content and Density

Sample ID	Effort (%)	Description (Terracon)	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft³)
			Wet	Dry		
B-03	90	Sandy silt (ML)	89	239	16	98
	95		83	202		104
B-07	90	Silt with sand (ML)	82	207	13	106
	95		76	173		112
B-10	90	Sandy silt (ML)	74	194	14	106
	95		69	163		112
B-Sub	90	Sandy silt (ML)	103	303	11	92
	95		92	262		98

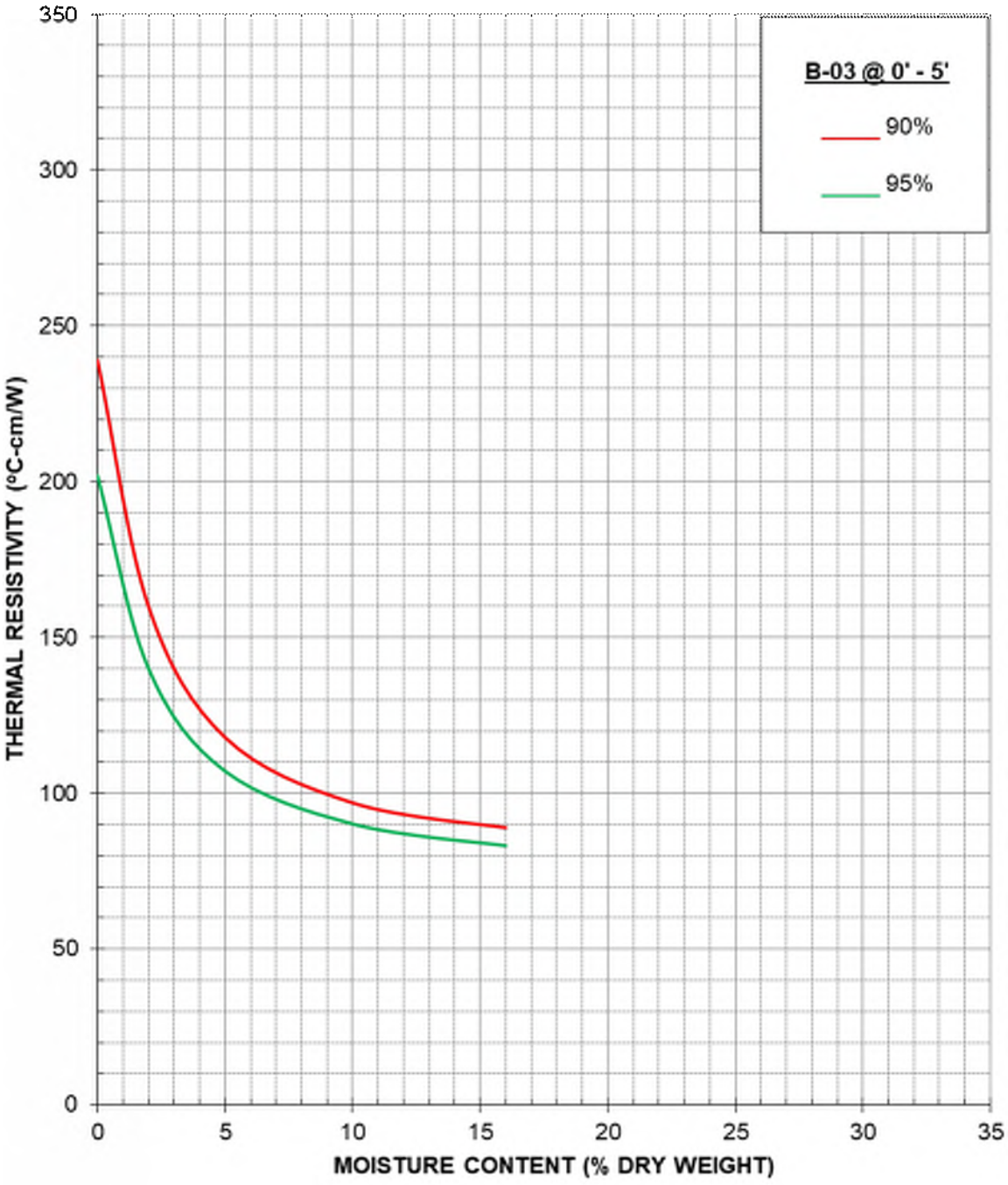
Please contact us if you have any questions or if we can be of further assistance.

Geotherm USA



Nimesh Patel

THERMAL DRYOUT CURVES



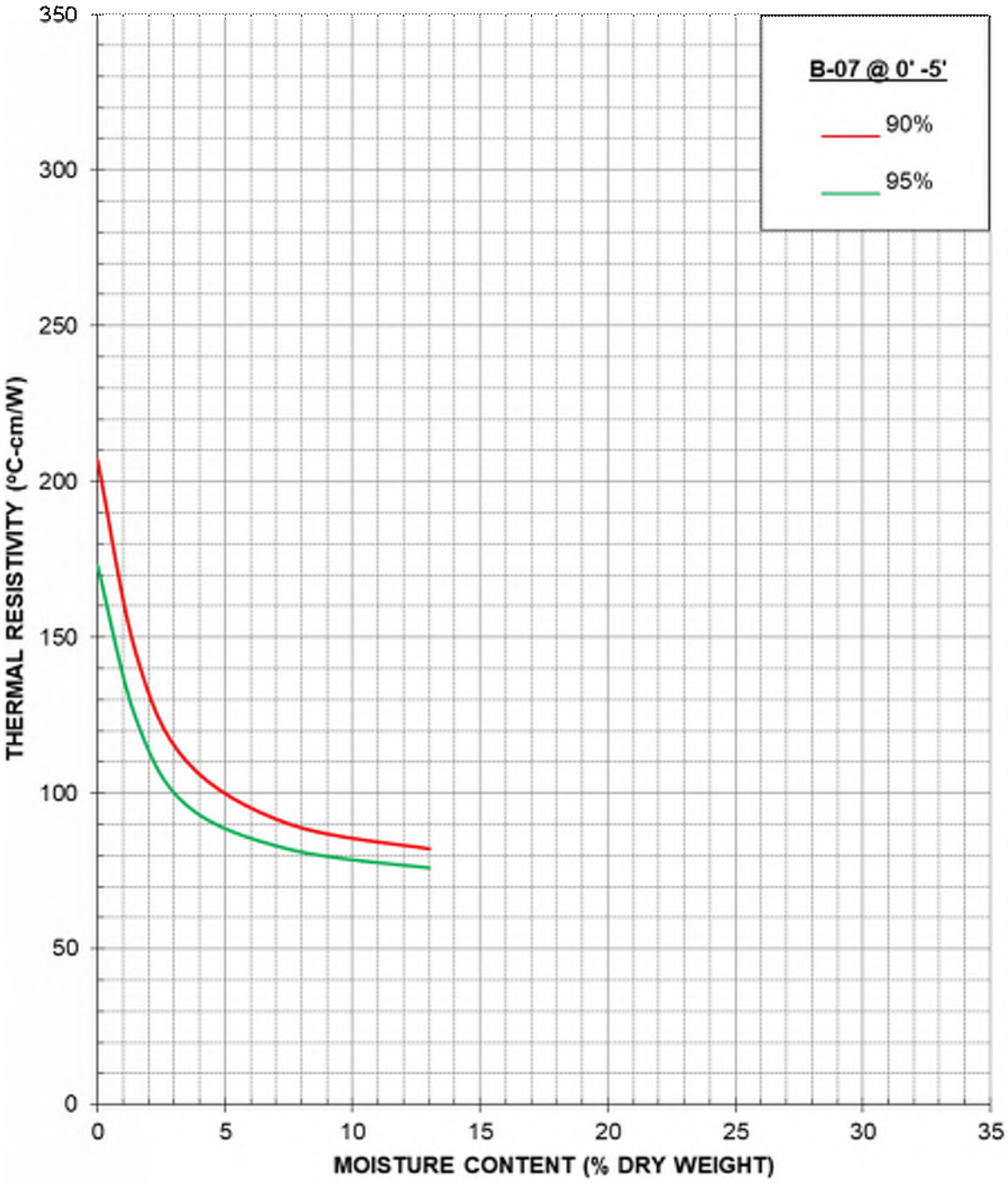
Terracon (PO No. 66225093)

Rancho Viejo Solar – Santa Fe County, NM

Thermal Analysis of Native Soil Samples

September 2022 **Figure 1**

THERMAL DRYOUT CURVES



Terracon (PO No. 66225093)

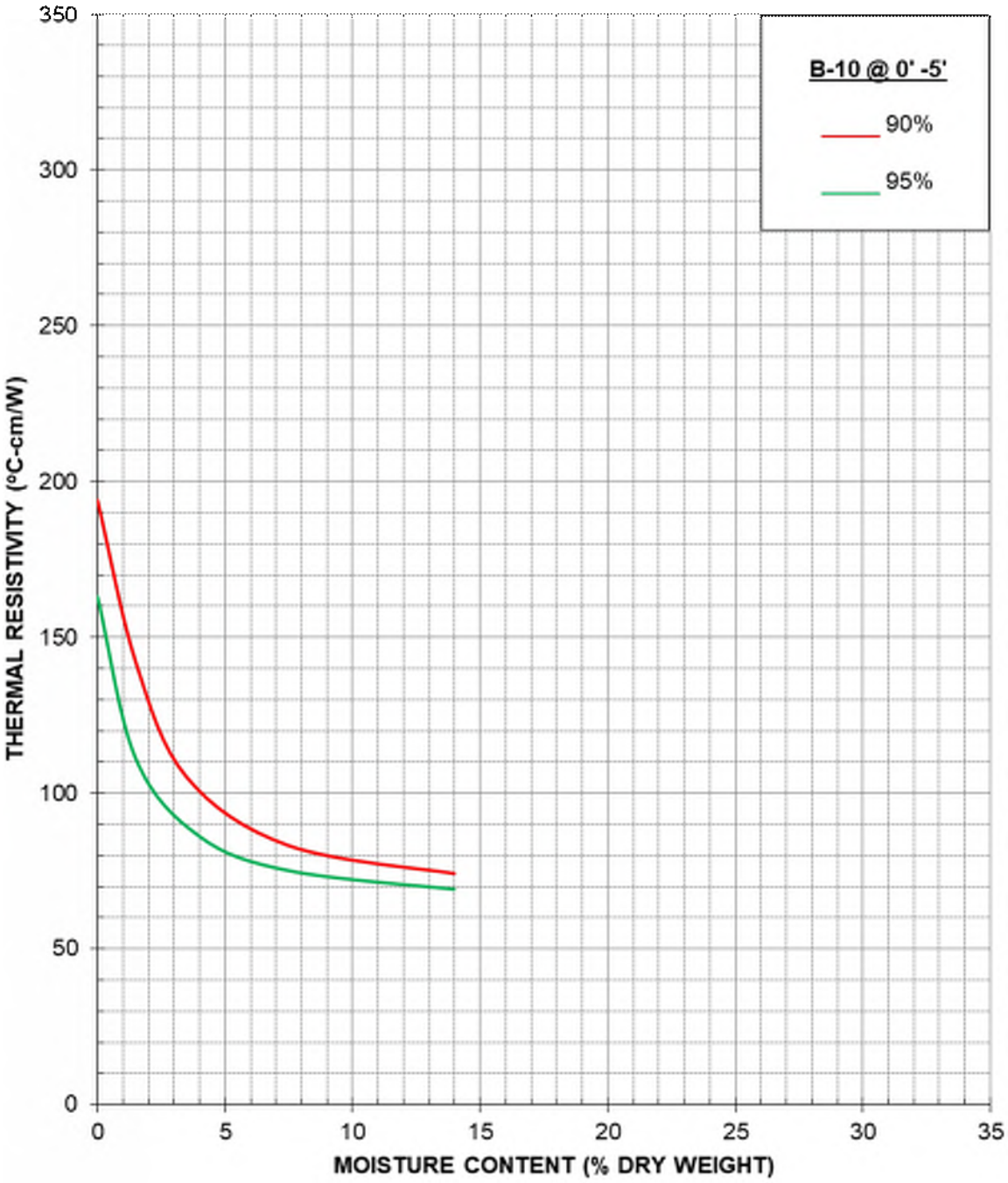
Rancho Viejo Solar – Santa Fe County, NM

Thermal Analysis of Native Soil Samples

September 2022

Figure 2

THERMAL DRYOUT CURVES



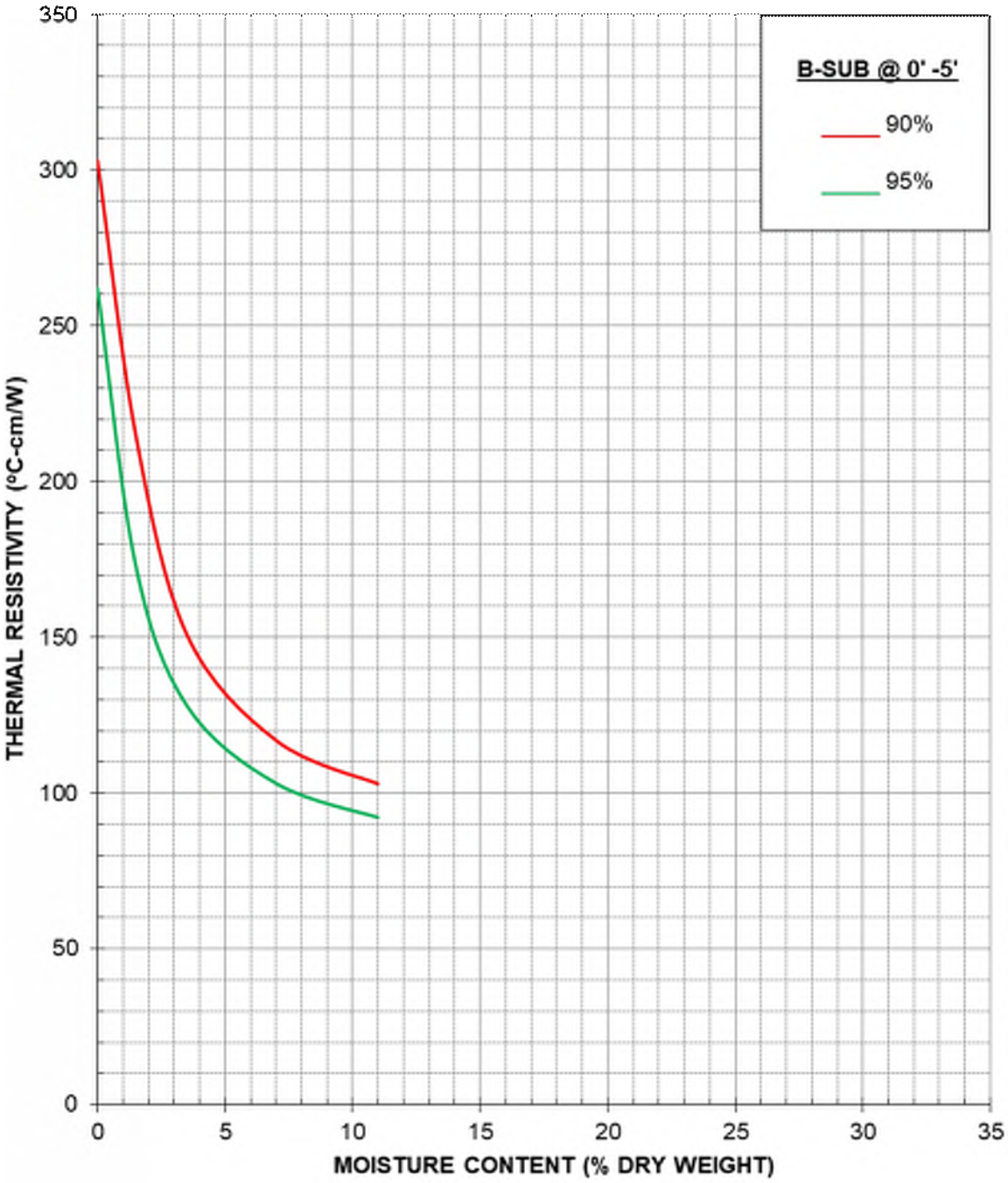
Terracon (PO No. 66225093)

Rancho Viejo Solar – Santa Fe County, NM

Thermal Analysis of Native Soil Samples

September 2022 **Figure 3**

THERMAL DRYOUT CURVES



Terracon (PO No. 66225093)

Rancho Viejo Solar – Santa Fe County, NM

Thermal Analysis of Native Soil Samples

September 2022

Figure 4

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http://www.geothermusa.com

March 19, 2024

Terracon
6805 Academy Parkway West NE
Albuquerque, New Mexico 87109
Attn: Stenson Lee

Re: Thermal Analysis of Native Soil Samples
Rancho Viejo Solar Part 2– Santa Fe, NM (Project No. 66225093)

The following is the report of thermal dryout characterization tests conducted on eight (8) bulk samples of native soil from the referenced project sent to our laboratory.

Thermal Resistivity Tests: The samples were tested at the 'optimum' moisture content and at 85% and 90% of the standard Proctor dry density ***provided by Terracon***. The tests were conducted in accordance with the **IEEE standard 442-2017**. The results are tabulated below and the thermal dryout curves are presented in **Figures 1 to 8.**

Sample ID, Description, Thermal Resistivity, Moisture Content and Density

Sample ID	Depth (ft)	Effort (%)	Description (Terracon)	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft^3)
				Wet	Dry		
A-01A	1 - 5	85	Lean Clay	99	209	14	93
A-01A	1 - 5	90	Lean Clay	94	182	14	98
A-06A	1 - 5	85	Lean Clay	92	178	11	100
A-06A	1 - 5	90	Lean Clay	87	155	11	106
A-08A	1 - 5	85	Lean Clay	108	266	17	87
A-08A	1 - 5	90	Lean Clay	103	231	17	93
A-11A	1 - 5	85	Lean Clay	89	200	14	96
A-11A	1 - 5	90	Lean Clay	85	174	14	101

Sample ID, Description, Thermal Resistivity, Moisture Content and Density

Sample ID	Depth (ft)	Effort (%)	Description (Terracon)	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft^3)
				Wet	Dry		
A-14A	1 - 5	85	Lean Clay	109	269	20	86
A-14A	1 - 5	90	Lean Clay	104	234	20	91
Sub-02A	1 - 5	85	Lean Clay	96	260	18	88
Sub-02A	1 - 5	90	Lean Clay	91	226	18	93
T-01A	1 - 5	85	Lean Clay	110	289	22	82
T-01A	1 - 5	90	Lean Clay	105	251	22	86
T-03A	1 - 5	85	Silty Sand	69	139	10	105
T-03A	1 - 5	90	Silty Sand	66	121	10	111

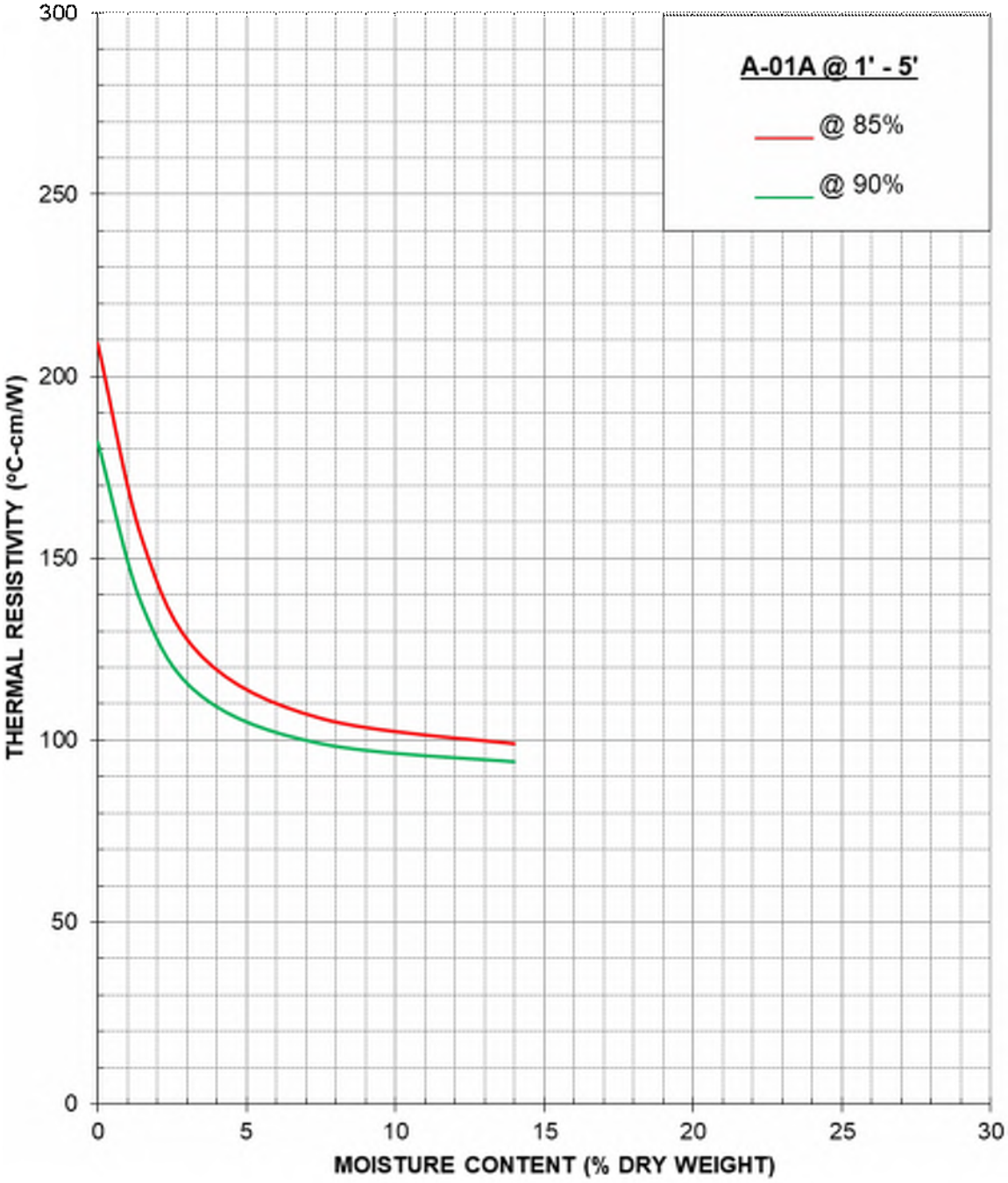
Please contact us if you have any questions or if we can be of further assistance.

Geotherm USA



Deepak Parmar

THERMAL DRYOUT CURVES



Terracon (Project No. 66225093)

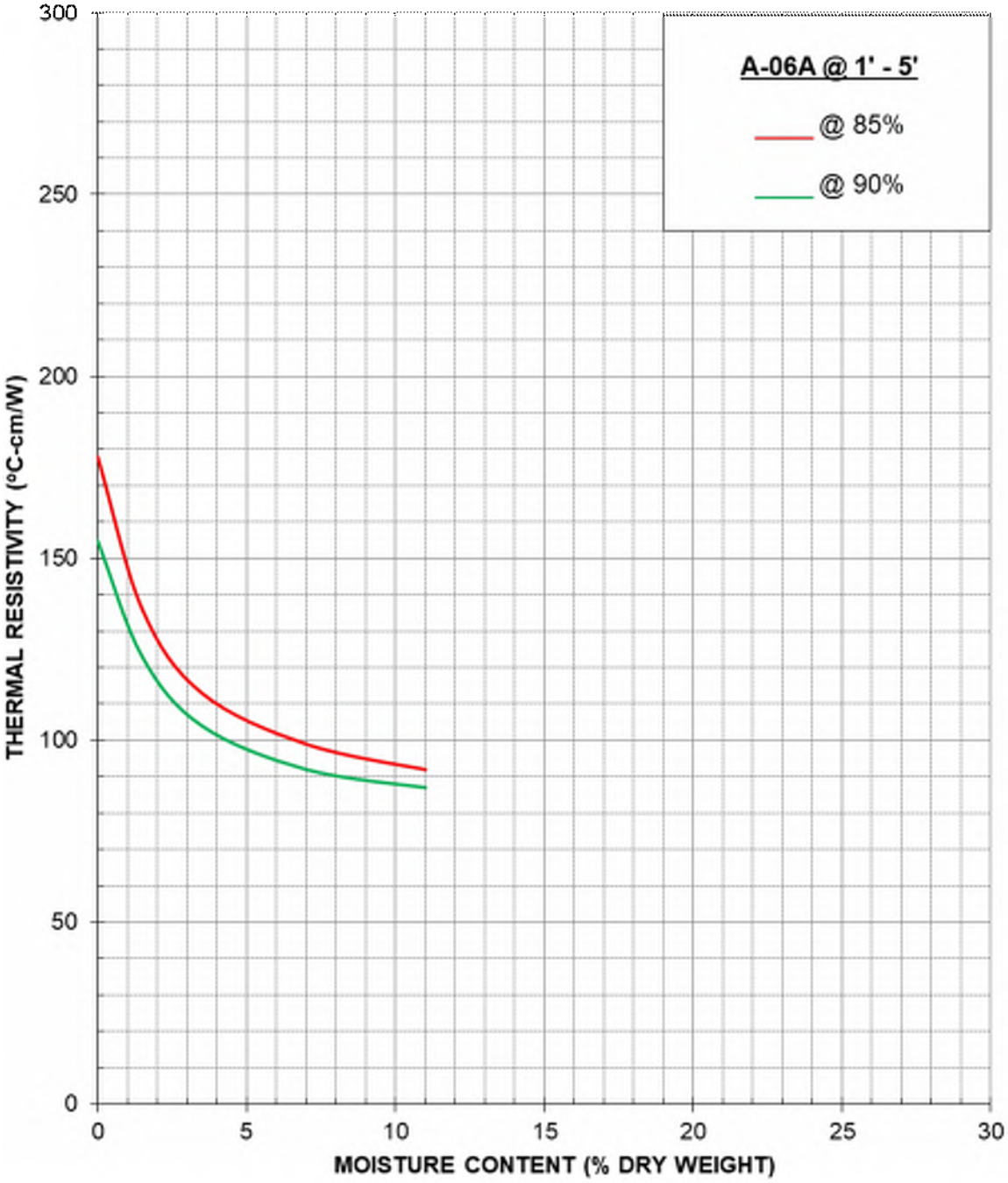
Rancho Viejo Solar Part 2 – Santa Fe, NM

Thermal Analysis of Native Soil Samples

March 2024

Figure 1

THERMAL DRYOUT CURVES



Terracon (Project No. 66225093)

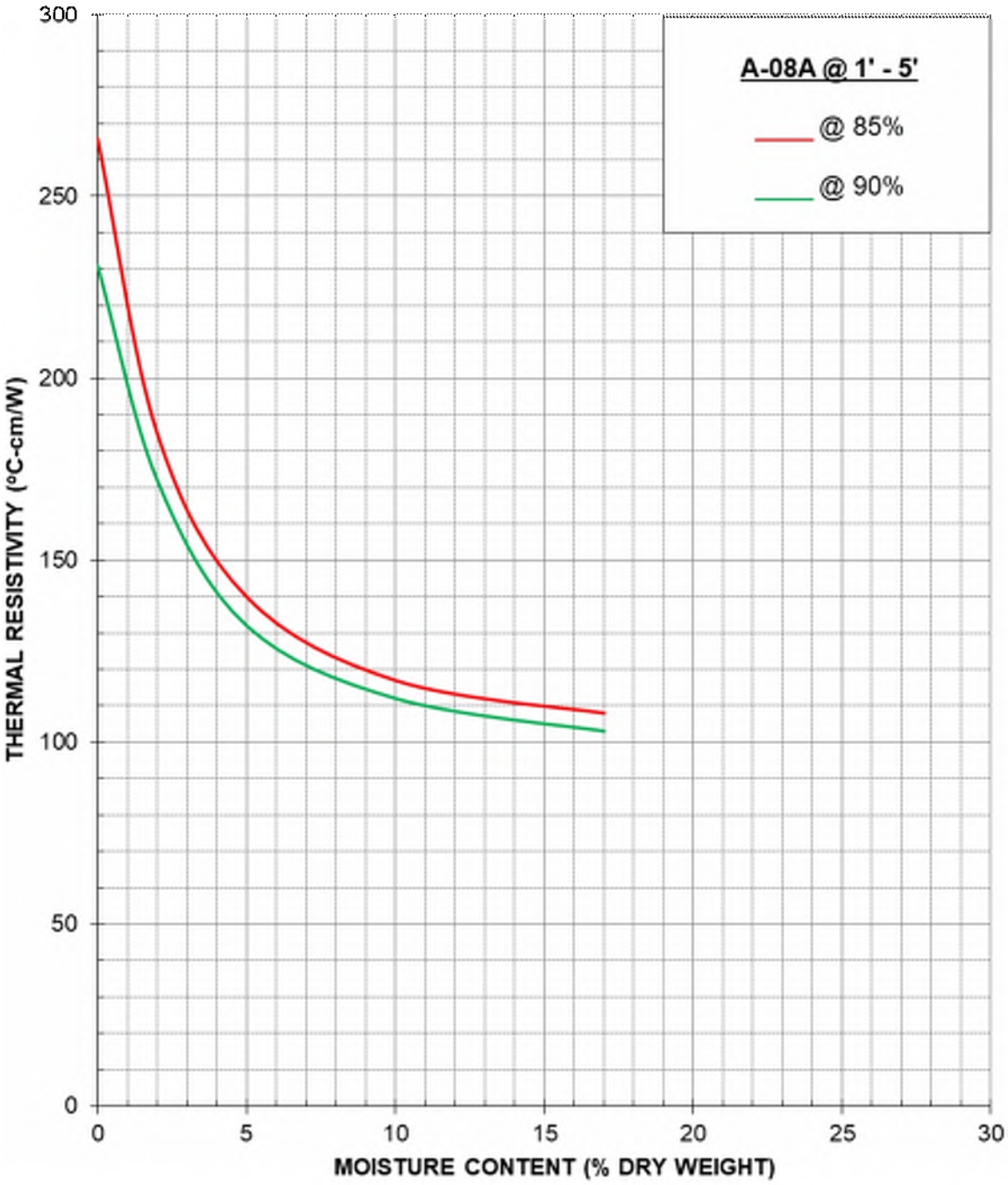
Rancho Viejo Solar Part 2 – Santa Fe, NM

Thermal Analysis of Native Soil Samples

March 2024

Figure 2

THERMAL DRYOUT CURVES



Terracon (Project No. 66225093)

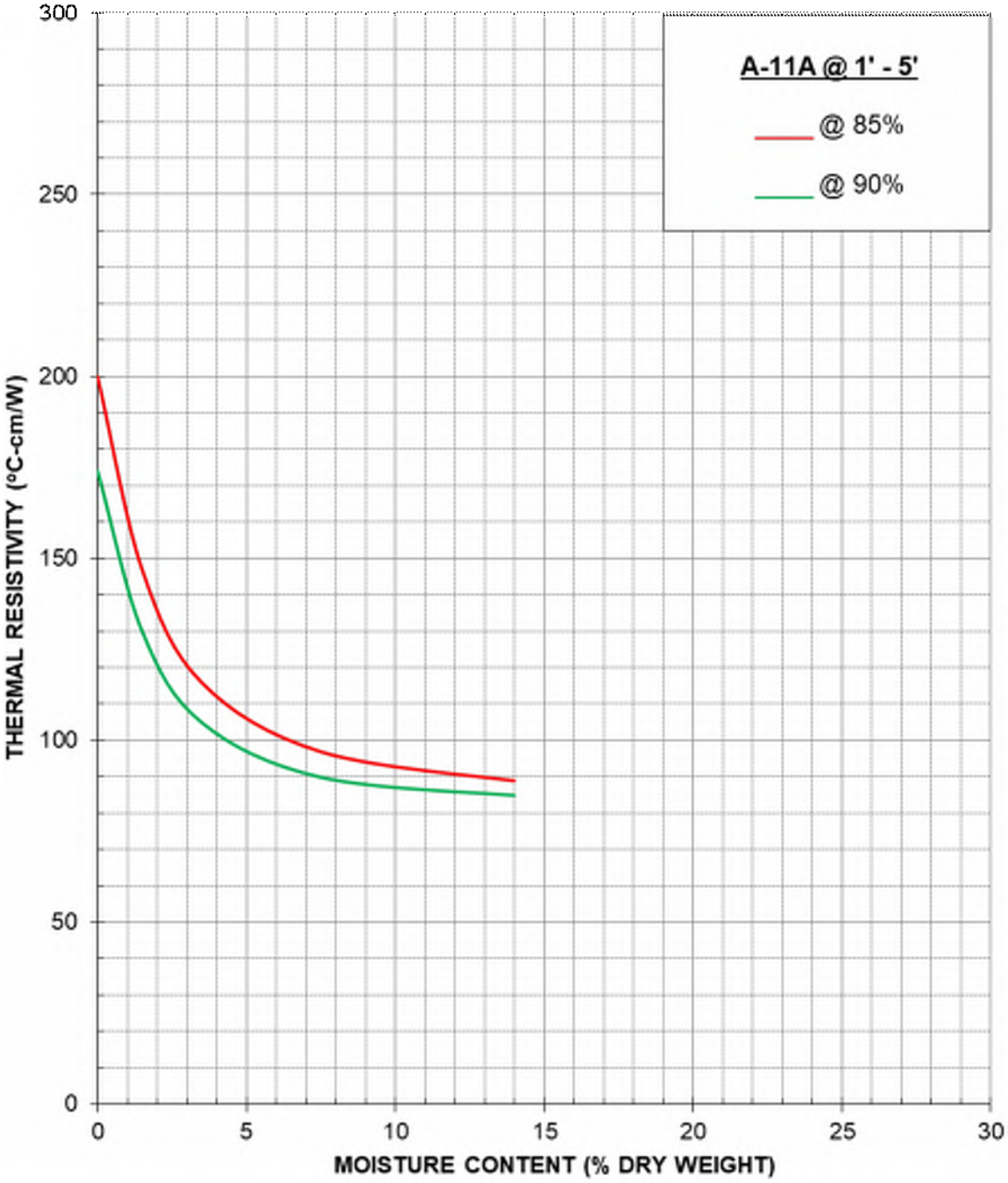
Rancho Viejo Solar Part 2 – Santa Fe, NM

Thermal Analysis of Native Soil Samples

March 2024

Figure 3

THERMAL DRYOUT CURVES



Terracon (Project No. 66225093)

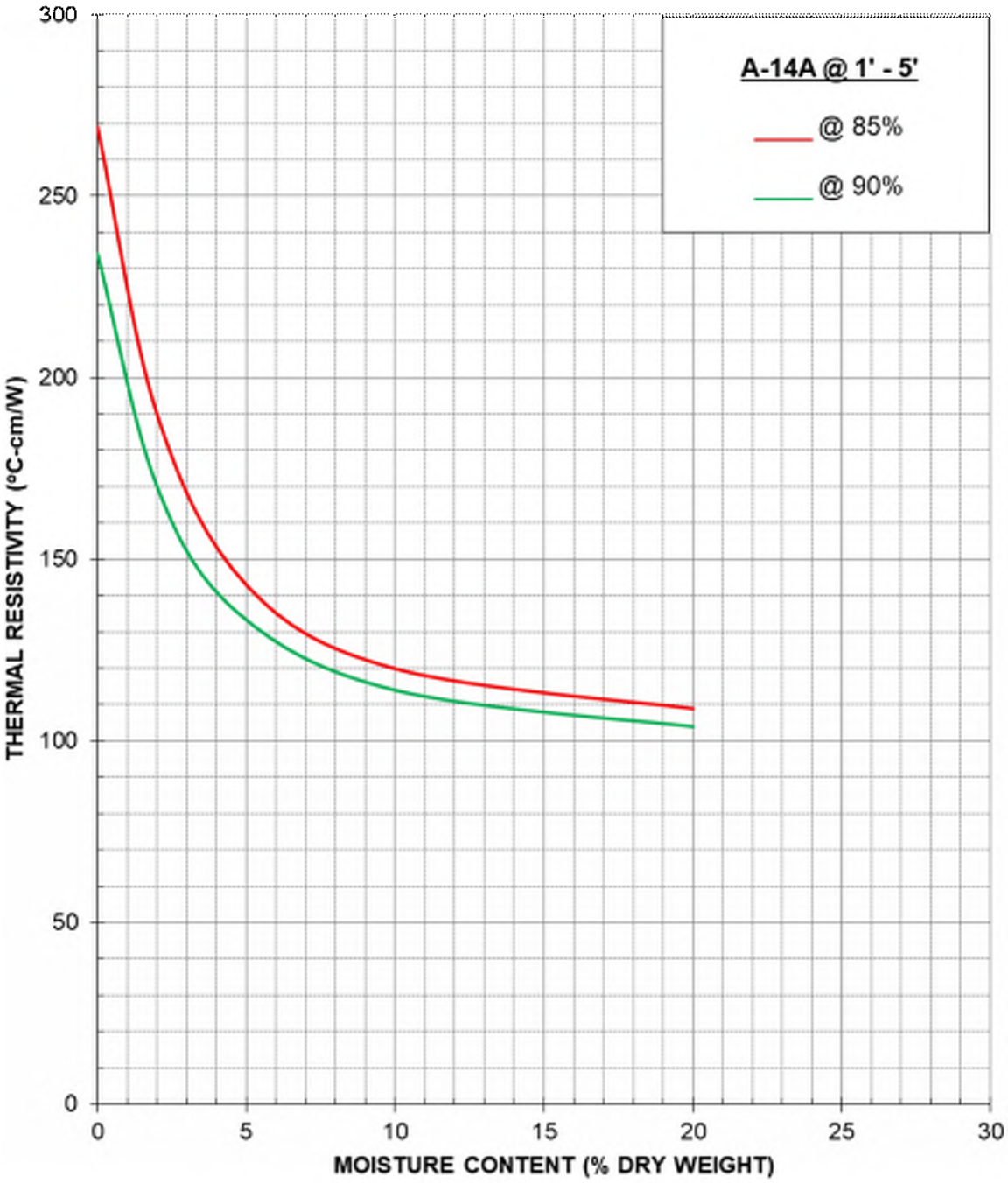
Rancho Viejo Solar Part 2 – Santa Fe, NM

Thermal Analysis of Native Soil Samples

March 2024

Figure 4

THERMAL DRYOUT CURVES



Terracon (Project No. 66225093)

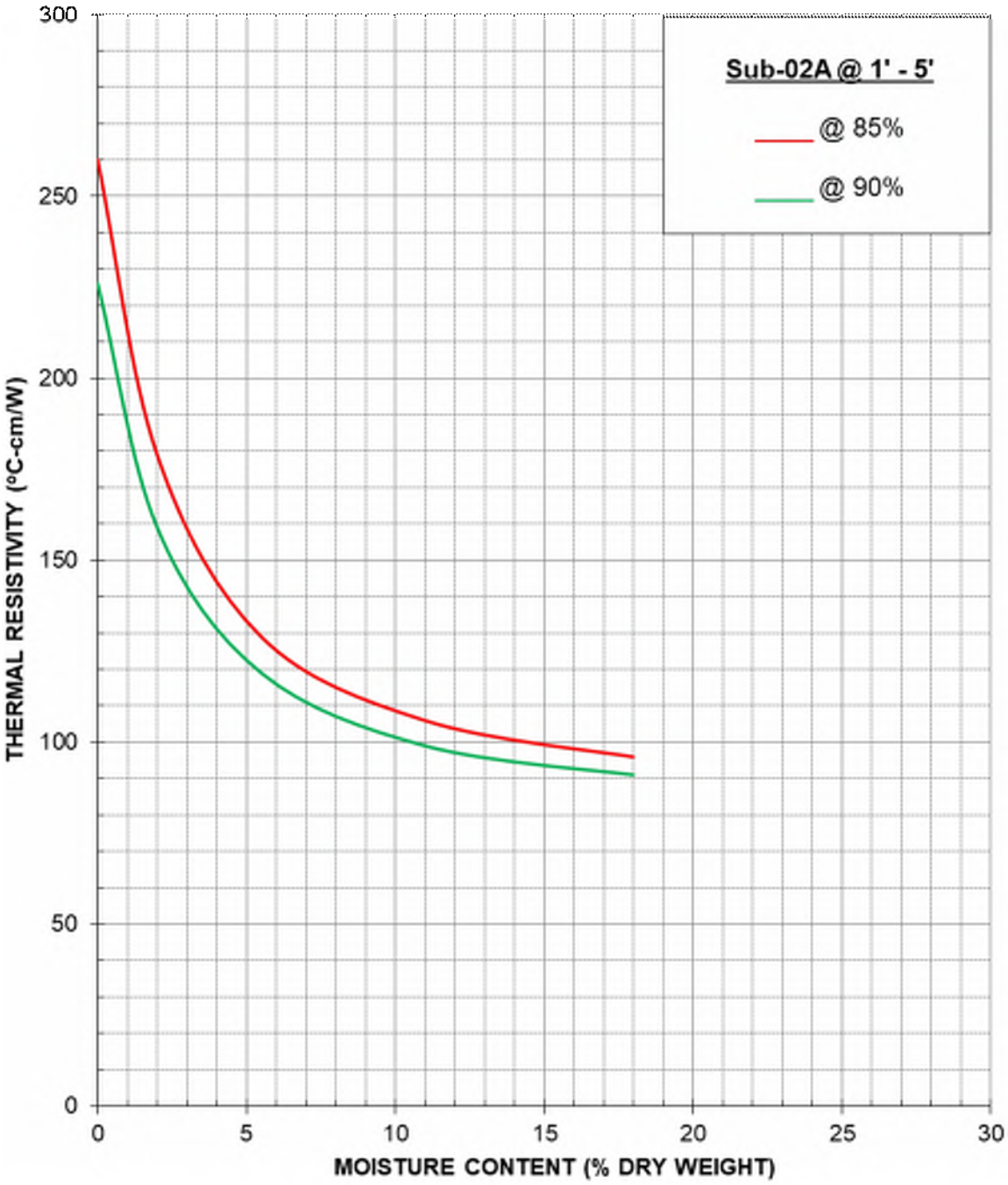
Rancho Viejo Solar Part 2 – Santa Fe, NM

Thermal Analysis of Native Soil Samples

March 2024

Figure 5

THERMAL DRYOUT CURVES



Terracon (Project No. 66225093)

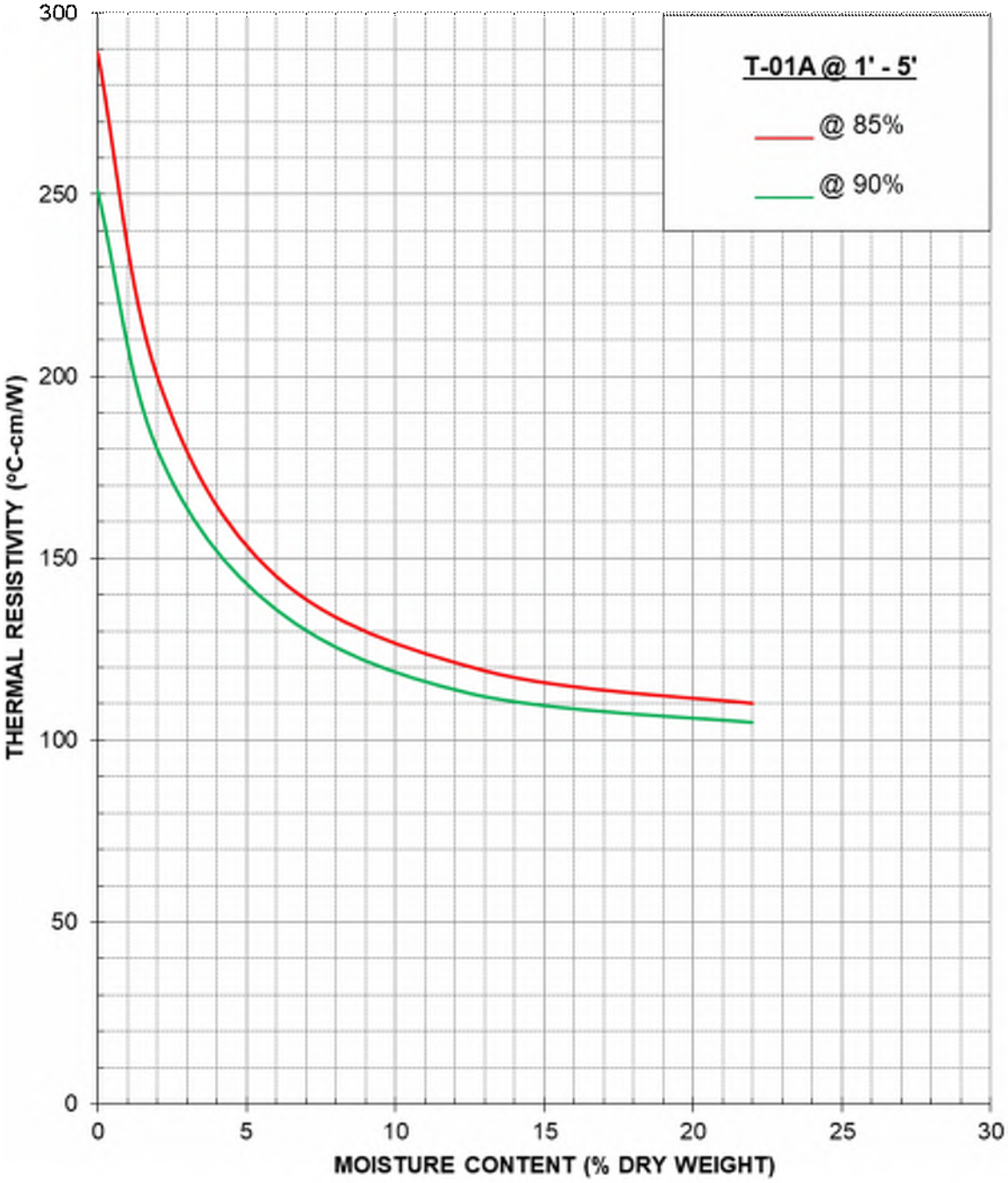
Rancho Viejo Solar Part 2 – Santa Fe, NM

Thermal Analysis of Native Soil Samples

March 2024

Figure 6

THERMAL DRYOUT CURVES



Terracon (Project No. 66225093)

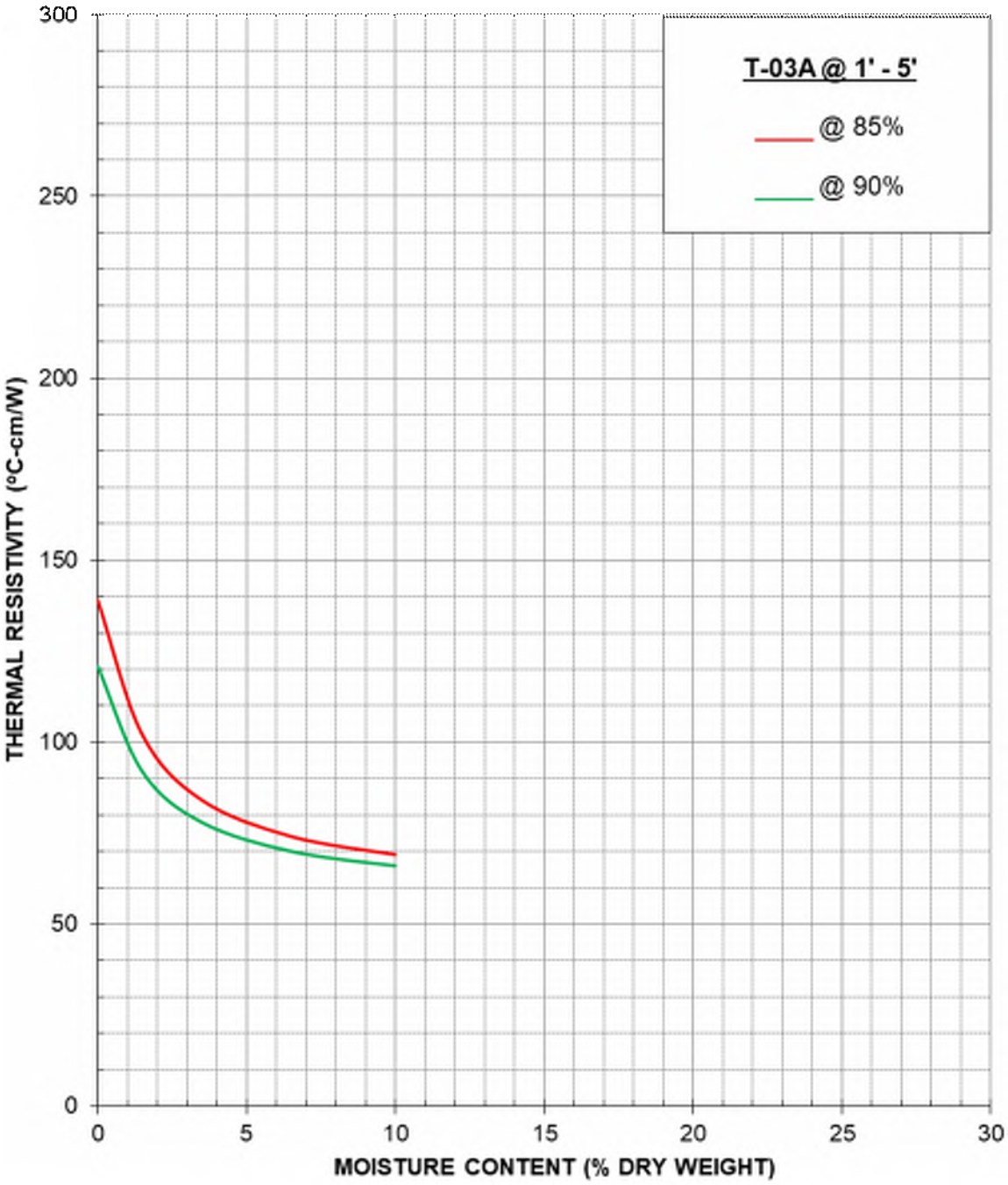
Rancho Viejo Solar Part 2 – Santa Fe, NM

Thermal Analysis of Native Soil Samples

March 2024

Figure 7

THERMAL DRYOUT CURVES



Terracon (Project No. 66225093)

Rancho Viejo Solar Part 2 – Santa Fe, NM

Thermal Analysis of Native Soil Samples

March 2024

Figure 8

APPENDIX D

FIELD ELECTRICAL RESISTIVITY TESTING

Exploration Plan – Field Electrical Resistivity Locations

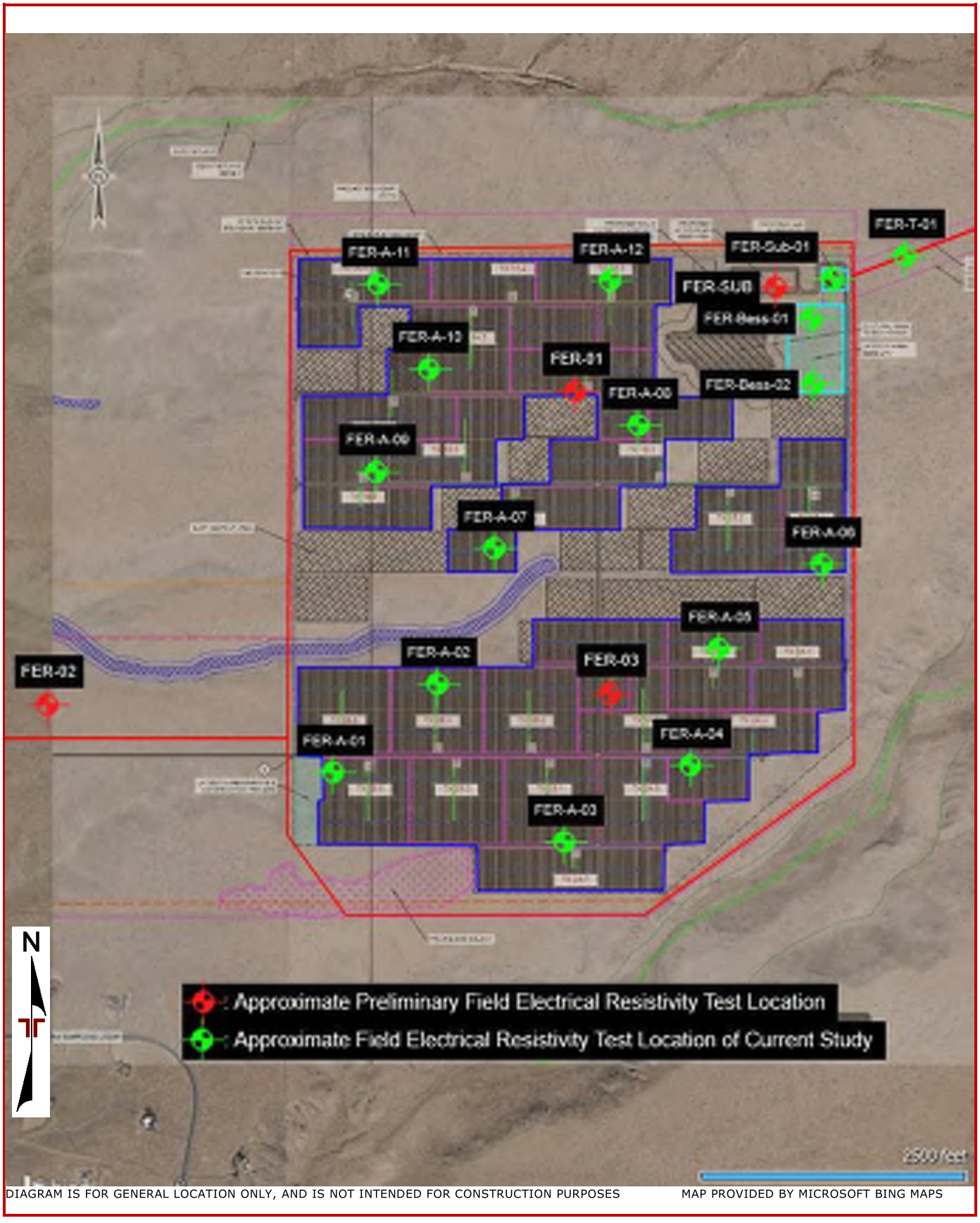


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan – Field Electrical Resistivity Locations

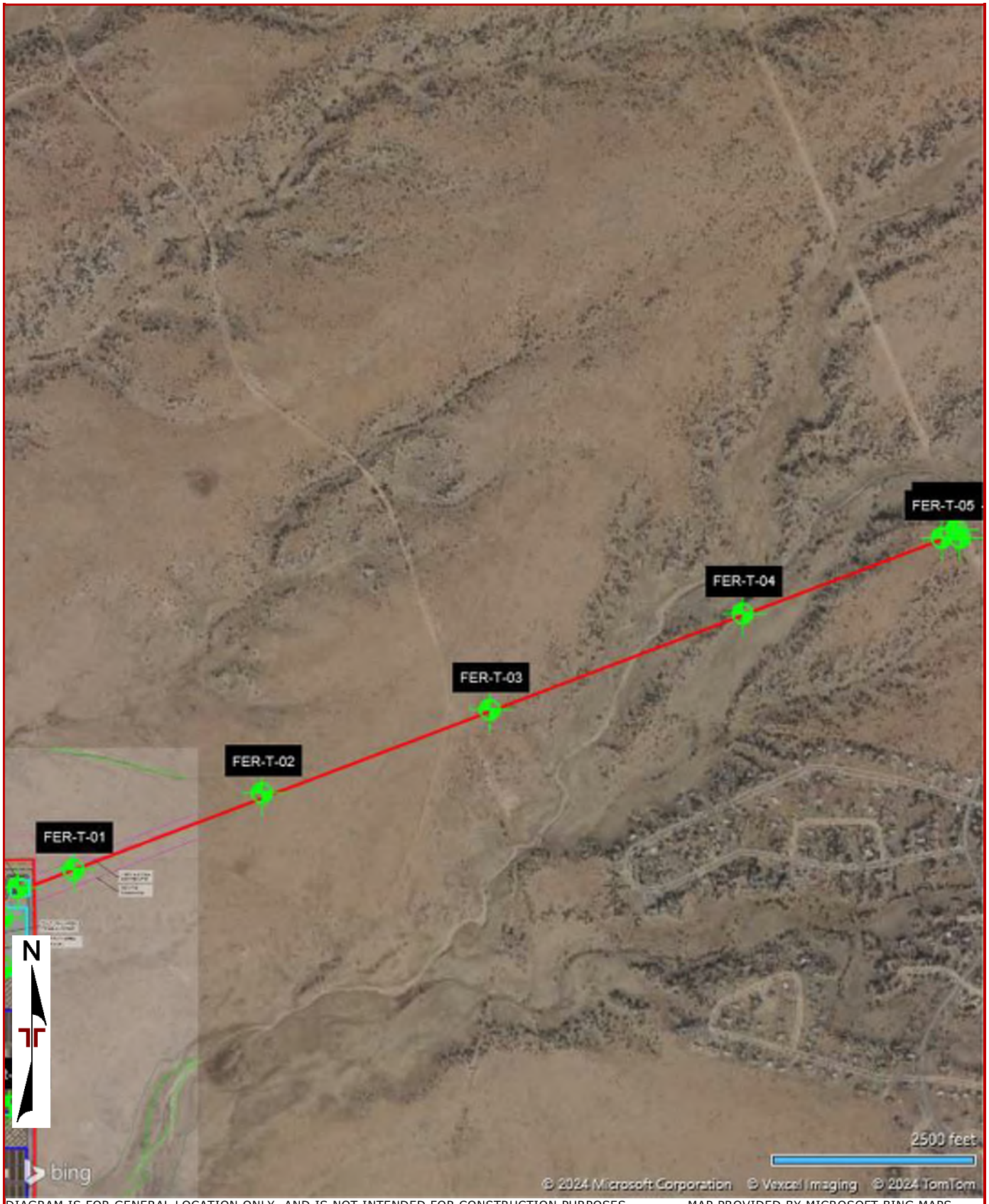


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan – Field Electrical Resistivity Locations

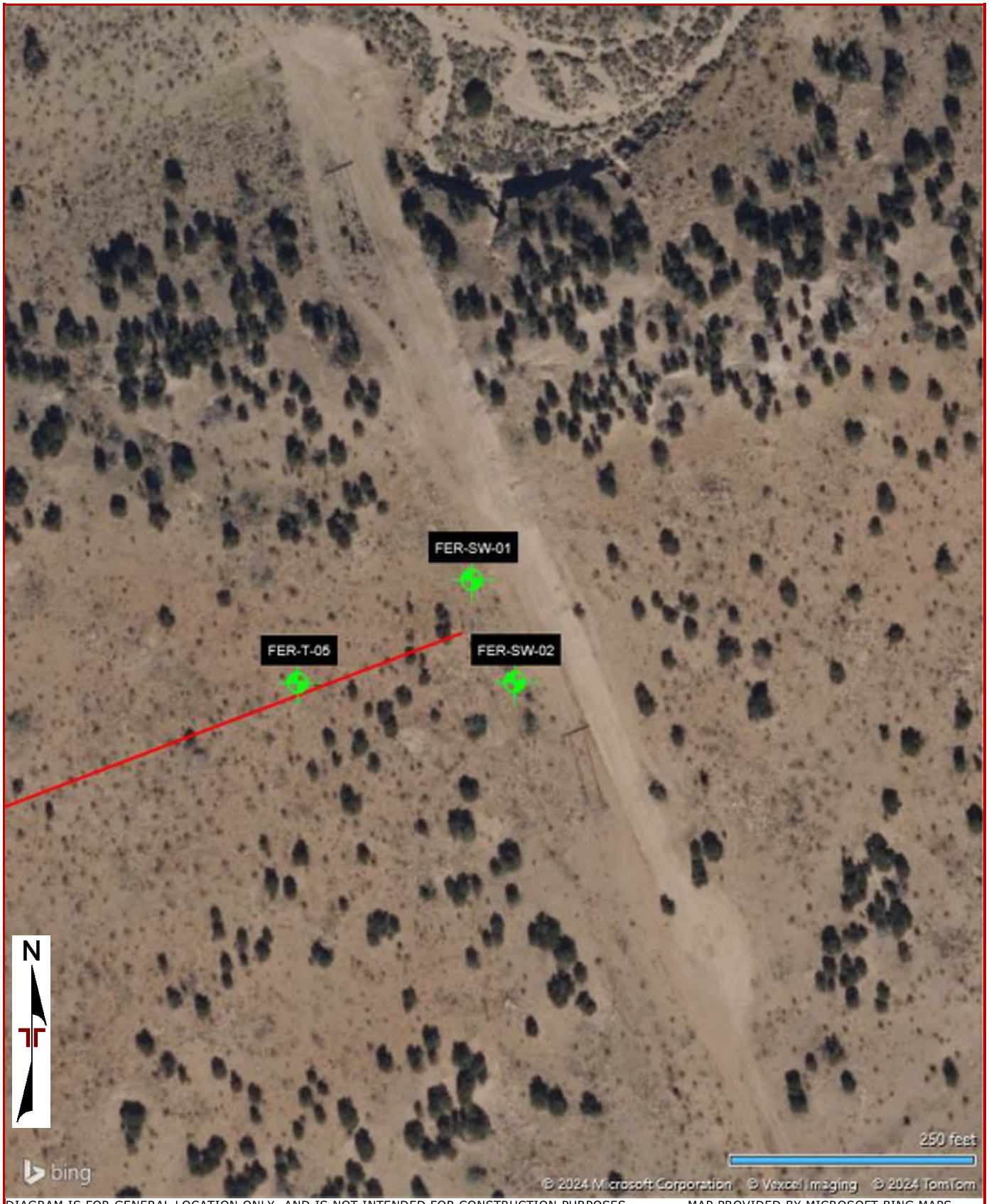


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

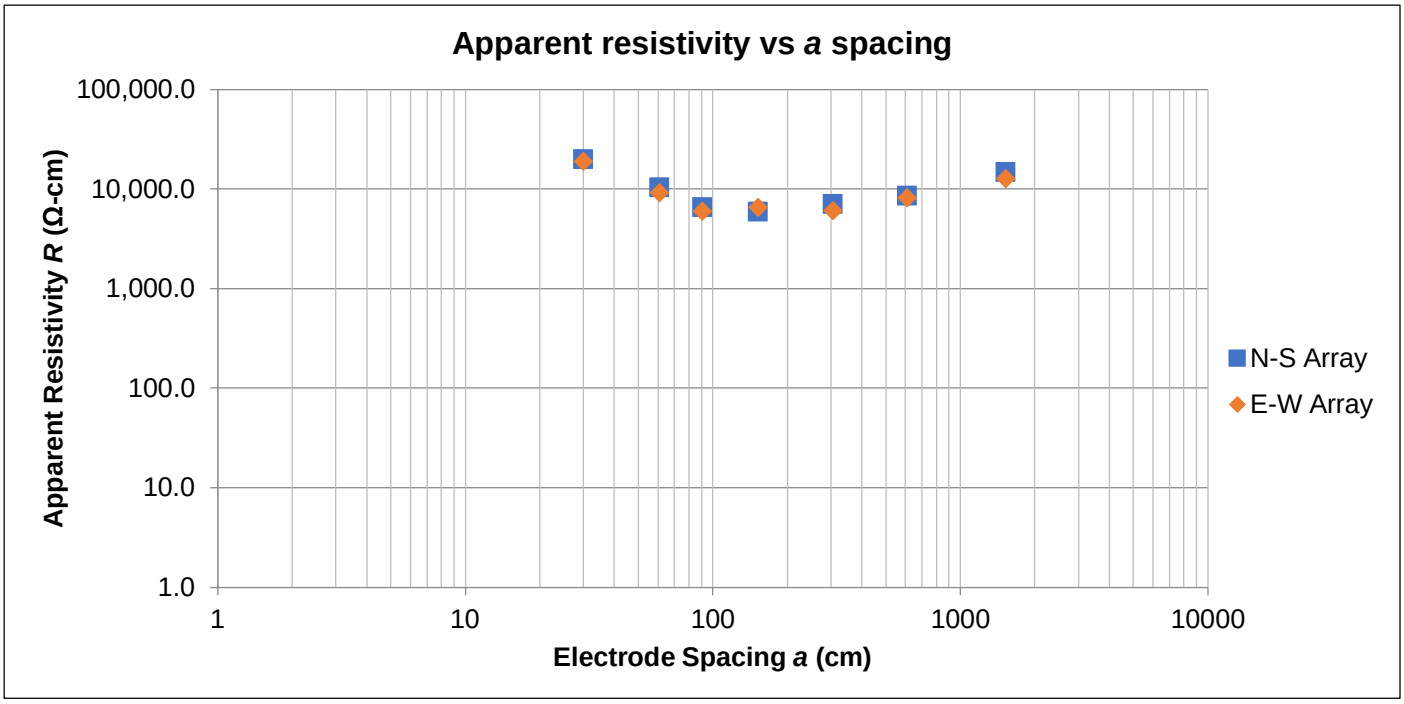
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-01: 35.540916, -106.017053**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 9, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	81.15	20130	77.16	19140
2	61	6	15	25.15	10570	22.18	9320
3	91	6	15	11.16	6670	10.20	6100
5	152	6	15	6.16	5980	6.83	6630
10	305	13	33	3.65	7140	3.15	6160
20	610	13	33	2.26	8710	2.15	8280
50	1524	13	33	1.55	14890	1.35	12940



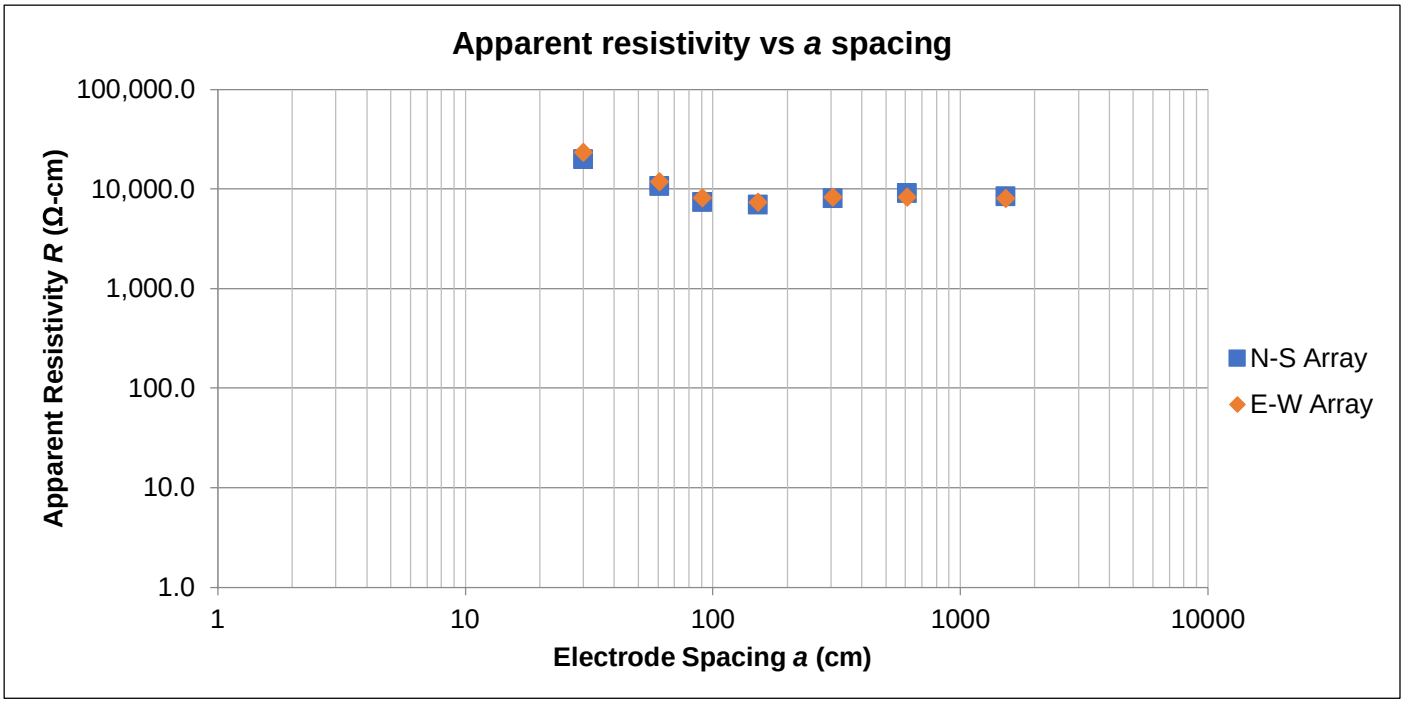
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-02: 35.543195, -106.01375**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 9, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	81.80	20290	96.00	23810
2	61	6	15	25.70	10800	28.70	12060
3	91	6	15	12.50	7470	13.90	8310
5	152	6	15	7.24	7030	7.69	7470
10	305	13	33	4.17	8160	4.33	8460
20	610	13	33	2.39	9210	2.19	8420
50	1524	13	33	0.89	8540	0.85	8120



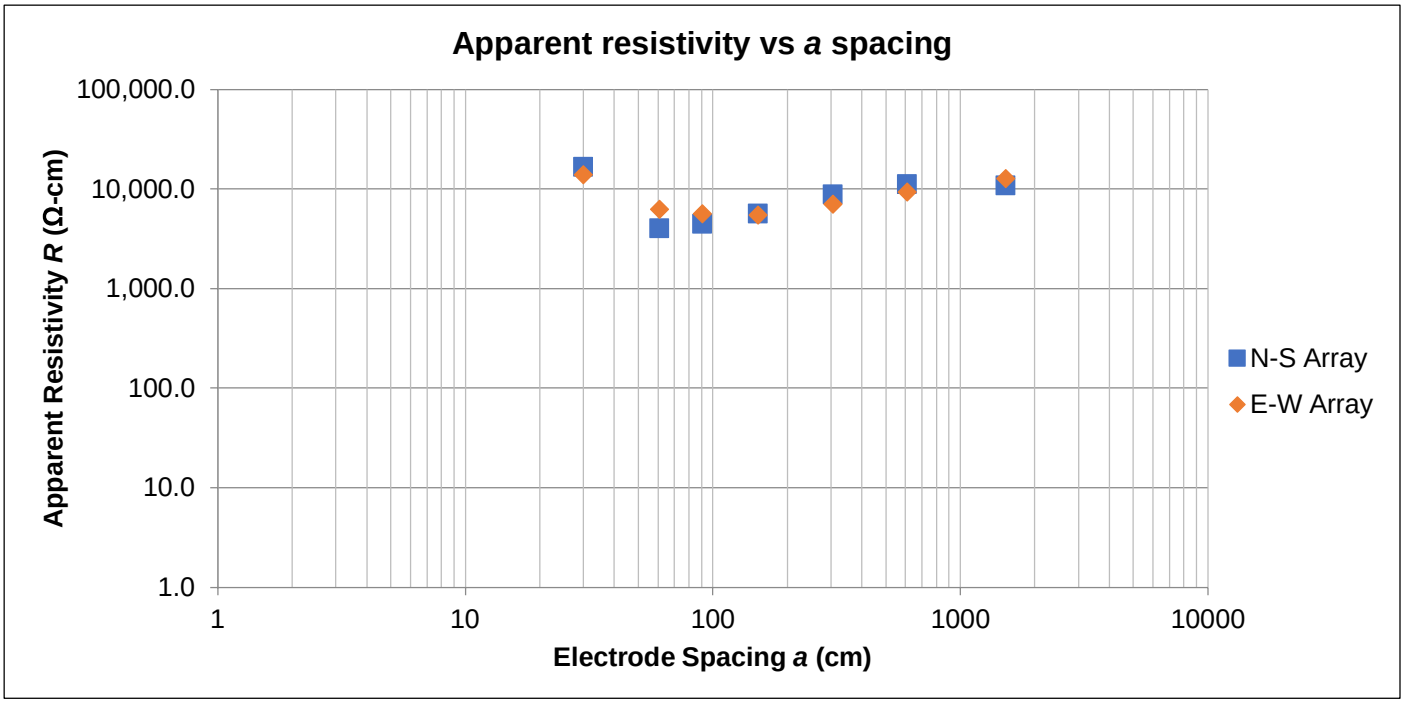
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-03: 35.539119, -106.009735**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 12, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	68.10	16890	56.80	14090
2	61	6	15	9.70	4080	15.10	6350
3	91	6	15	7.54	4510	9.53	5700
5	152	6	15	5.88	5710	5.73	5570
10	305	13	33	4.58	8950	3.67	7180
20	610	13	33	2.94	11310	2.44	9410
50	1524	13	33	1.15	10990	1.34	12830



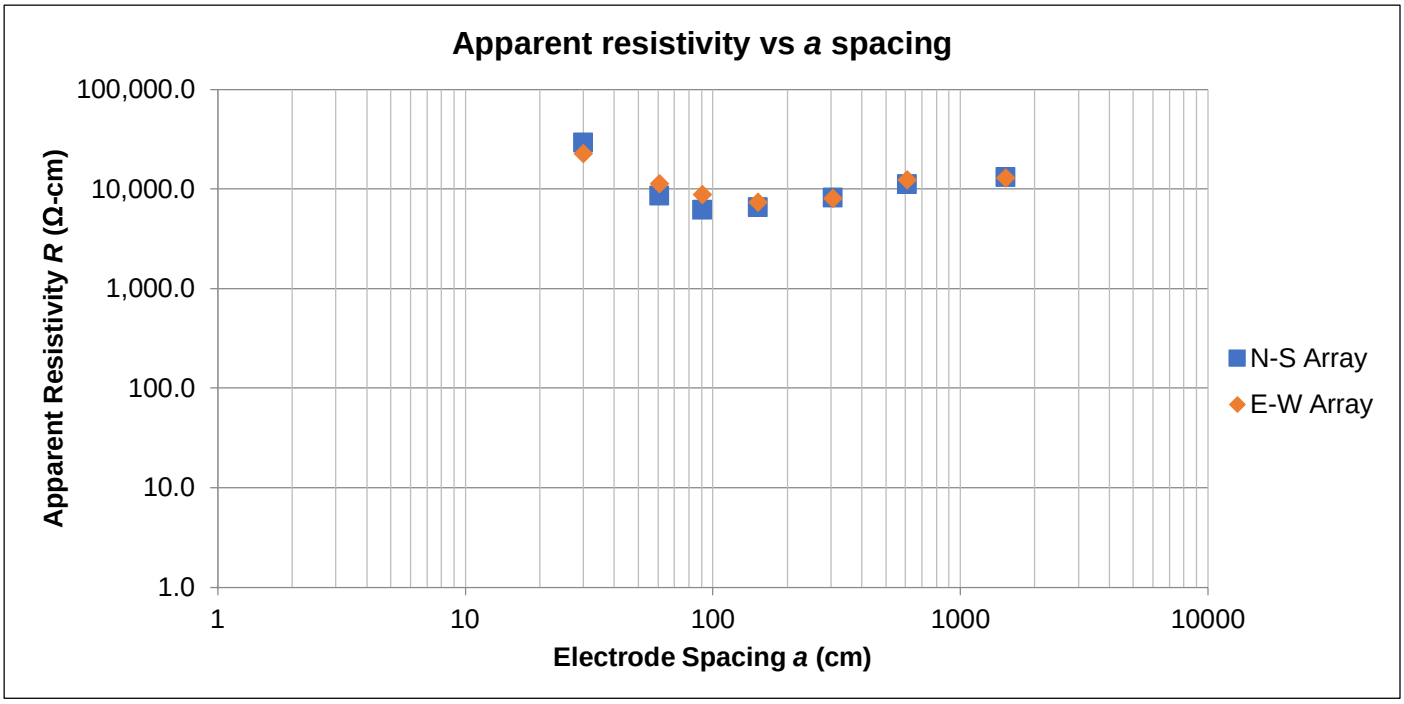
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-04: 35.541095, -106.00573**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 12, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	120.20	29820	93.30	23140
2	61	6	15	20.70	8700	27.50	11560
3	91	6	15	10.50	6280	14.90	8910
5	152	6	15	6.85	6650	7.68	7460
10	305	13	33	4.26	8320	4.15	8110
20	610	13	33	2.95	11370	3.24	12500
50	1524	13	33	1.39	13290	1.36	13050



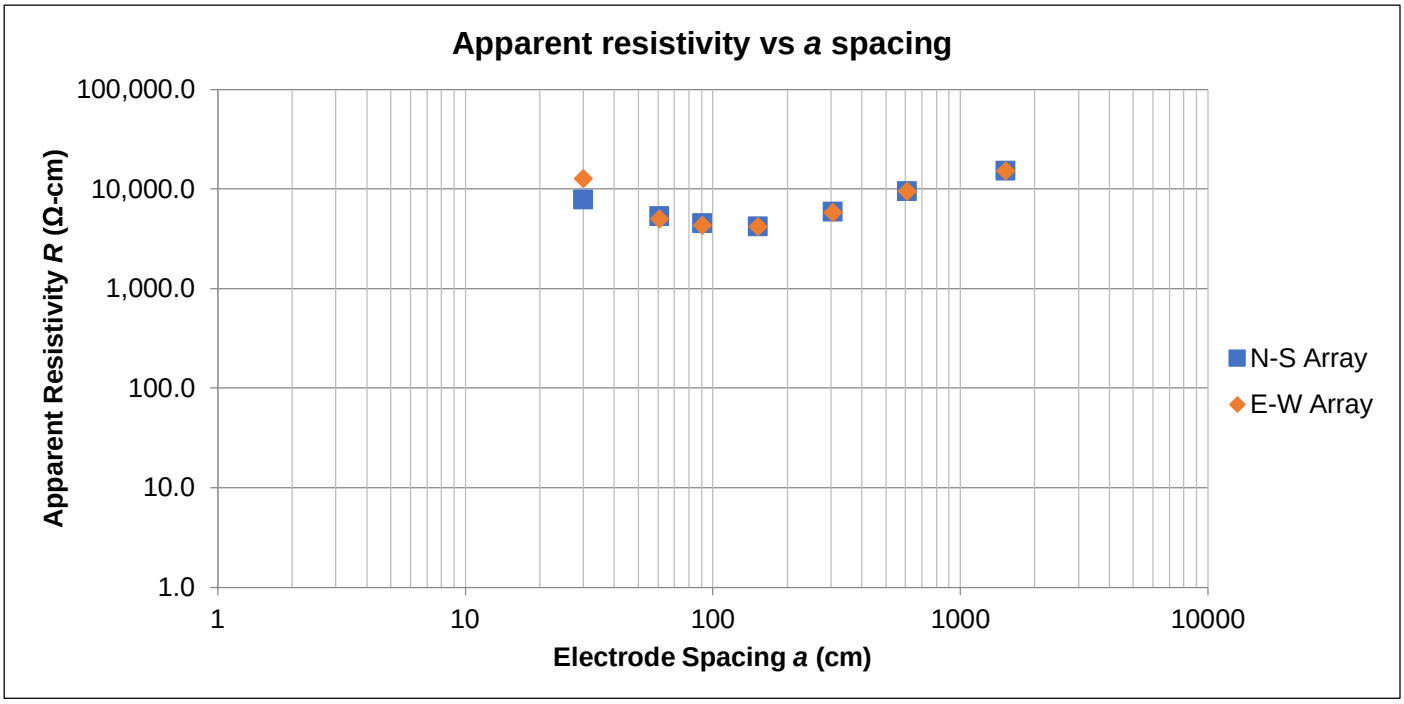
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-05: 35.544106, -106.004845**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 12, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	32.00	7940	52.20	12950
2	61	6	15	12.90	5420	12.10	5090
3	91	6	15	7.68	4590	7.31	4370
5	152	6	15	4.37	4250	4.37	4240
10	305	13	33	3.08	6010	3.02	5900
20	610	13	33	2.49	9600	2.51	9670
50	1524	13	33	1.62	15530	1.62	15480



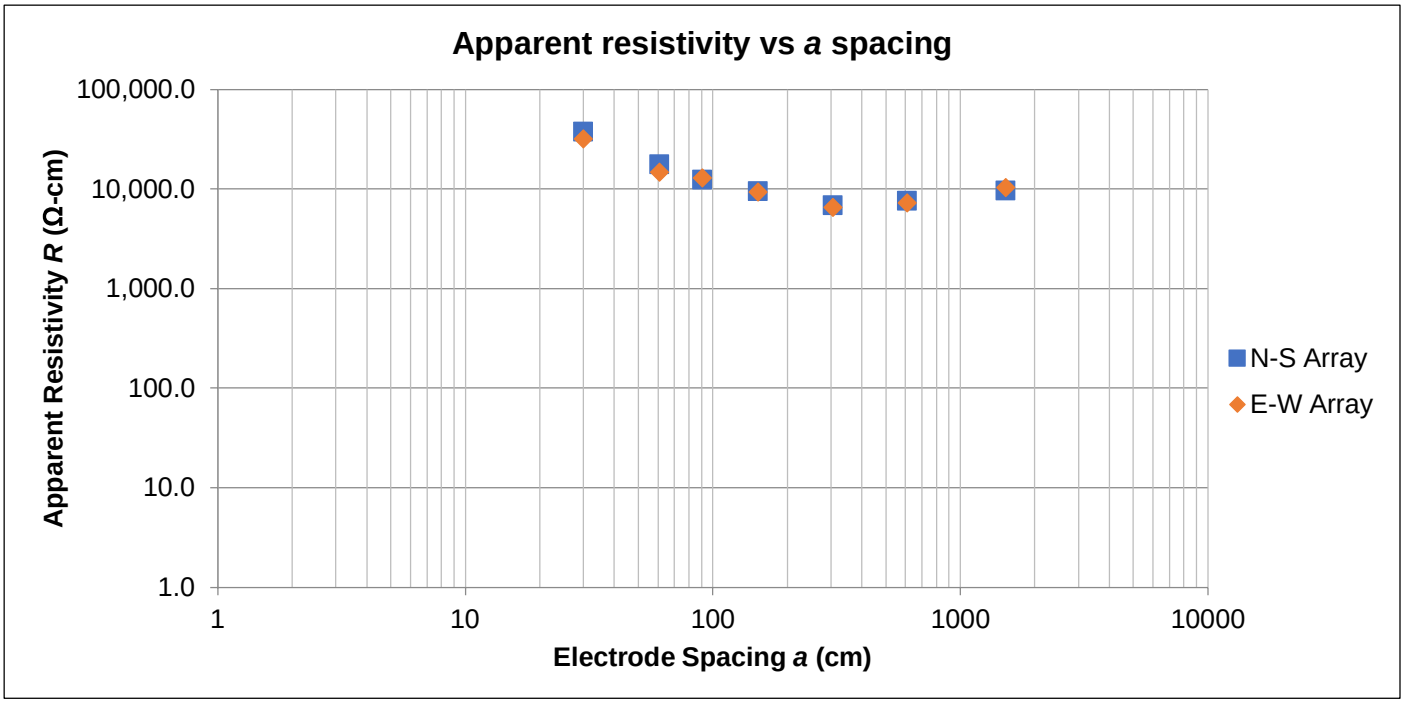
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-06: 35.546276, -106.00157**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 12, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	153.00	37950	129.90	32220
2	61	6	15	42.50	17860	35.80	15050
3	91	6	15	20.90	12500	21.90	13090
5	152	6	15	9.82	9540	9.68	9400
10	305	13	33	3.57	6980	3.38	6600
20	610	13	33	1.99	7660	1.90	7310
50	1524	13	33	1.02	9730	1.10	10510



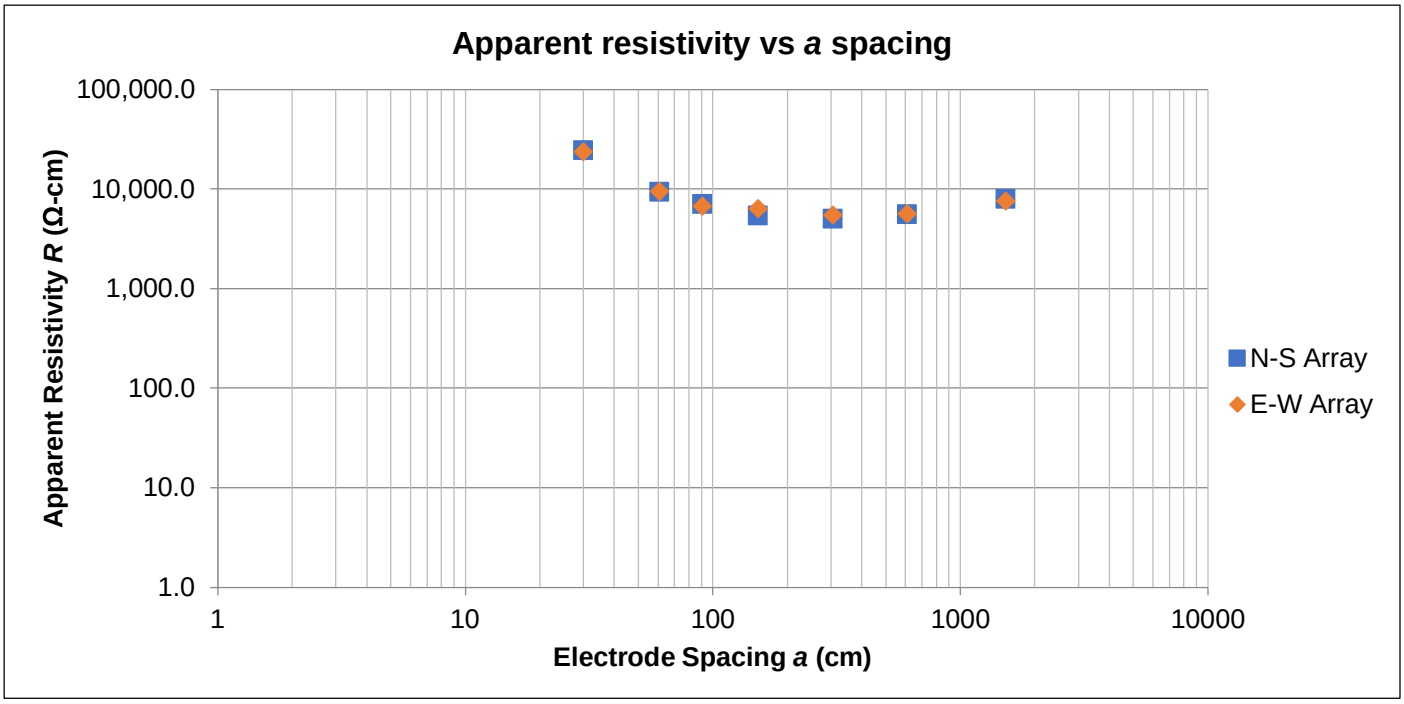
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-07: 35.546692, -106.01195**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 9, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	99.70	24730	96.80	24010
2	61	6	15	22.60	9500	22.70	9540
3	91	6	15	11.90	7110	11.50	6880
5	152	6	15	5.65	5490	6.60	6400
10	305	13	33	2.58	5050	2.85	5580
20	610	13	33	1.47	5660	1.49	5720
50	1524	13	33	0.85	8100	0.80	7700



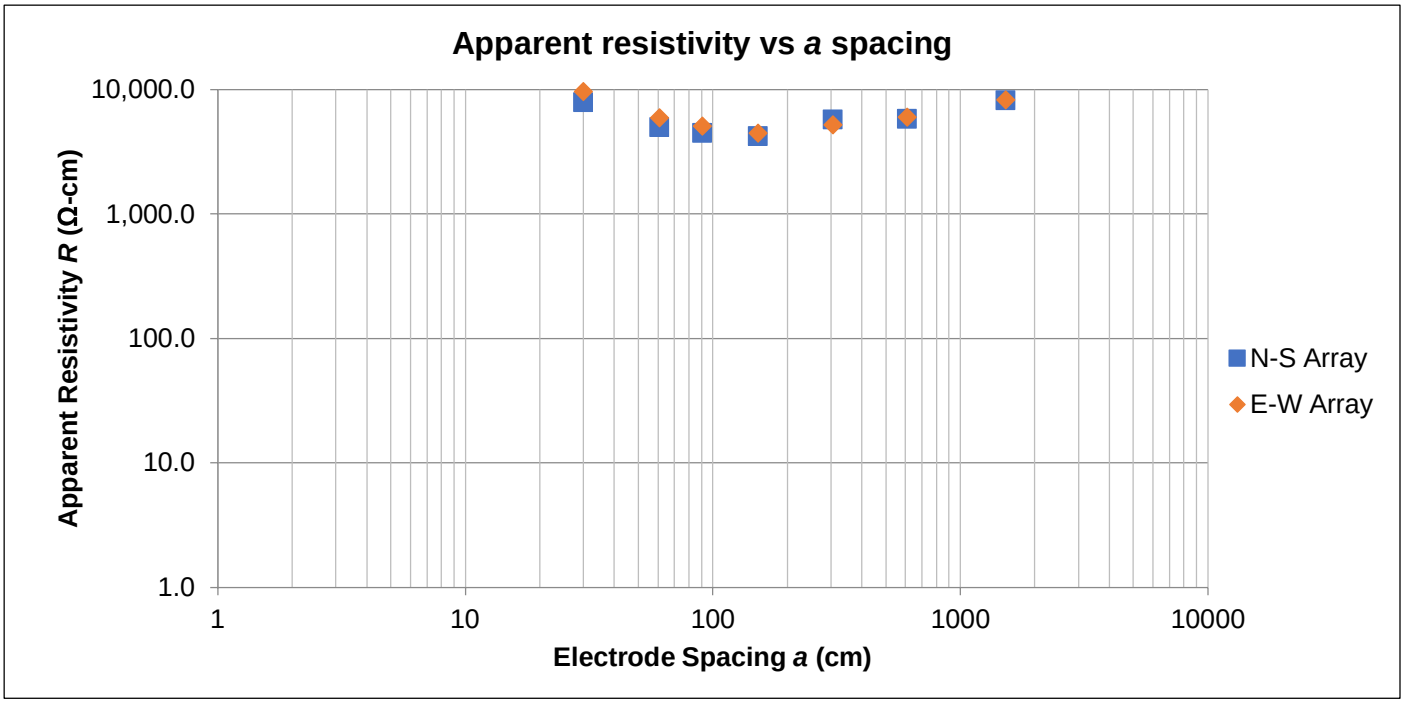
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-08: 35.549863, -106.00737**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 9, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	32.00	7940	39.10	9700
2	61	6	15	11.90	5000	14.30	6010
3	91	6	15	7.54	4510	8.63	5160
5	152	6	15	4.37	4250	4.63	4490
10	305	13	33	2.97	5810	2.68	5240
20	610	13	33	1.52	5870	1.58	6100
50	1524	13	33	0.86	8210	0.87	8330



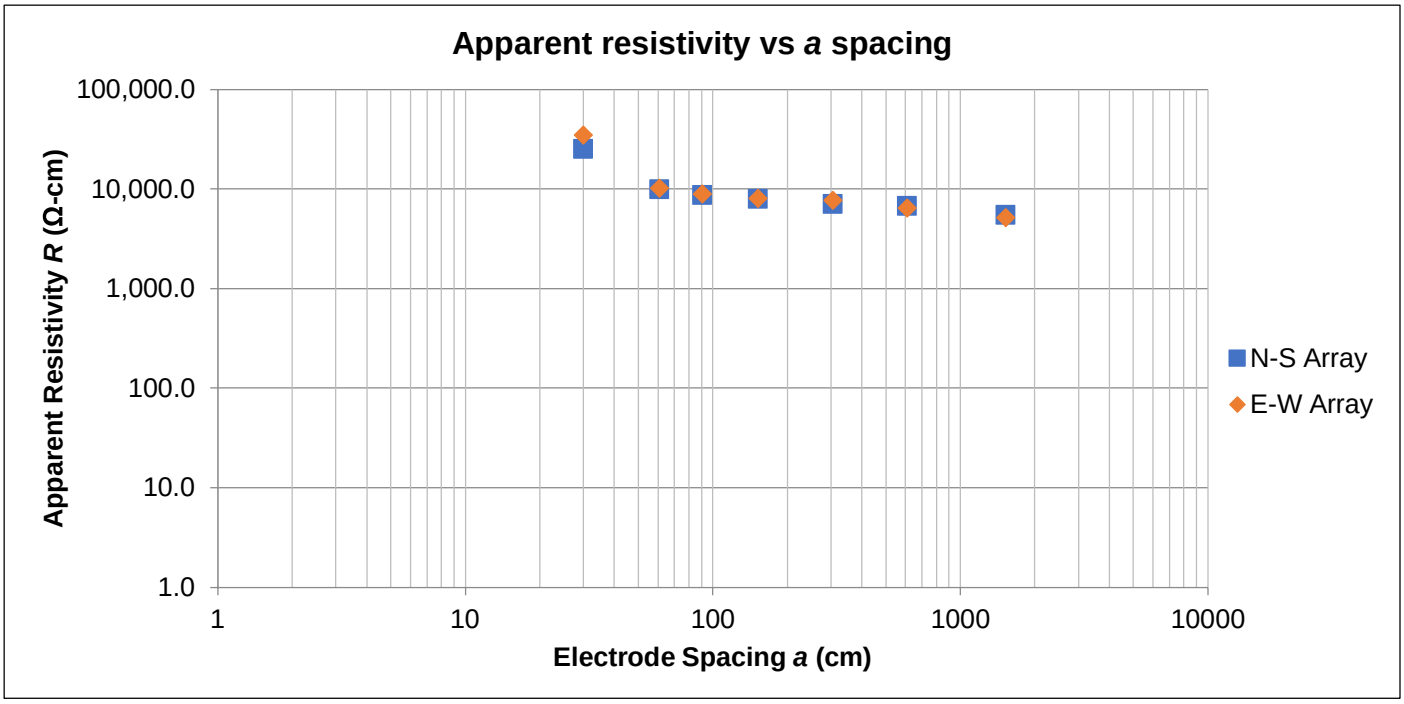
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-09: 35.548657, -106.015689**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 9, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	103.40	25650	141.90	35200
2	61	6	15	23.90	10050	24.70	10380
3	91	6	15	14.70	8790	15.10	9030
5	152	6	15	8.28	8040	8.35	8110
10	305	13	33	3.64	7110	3.97	7760
20	610	13	33	1.78	6840	1.70	6530
50	1524	13	33	0.58	5550	0.55	5240



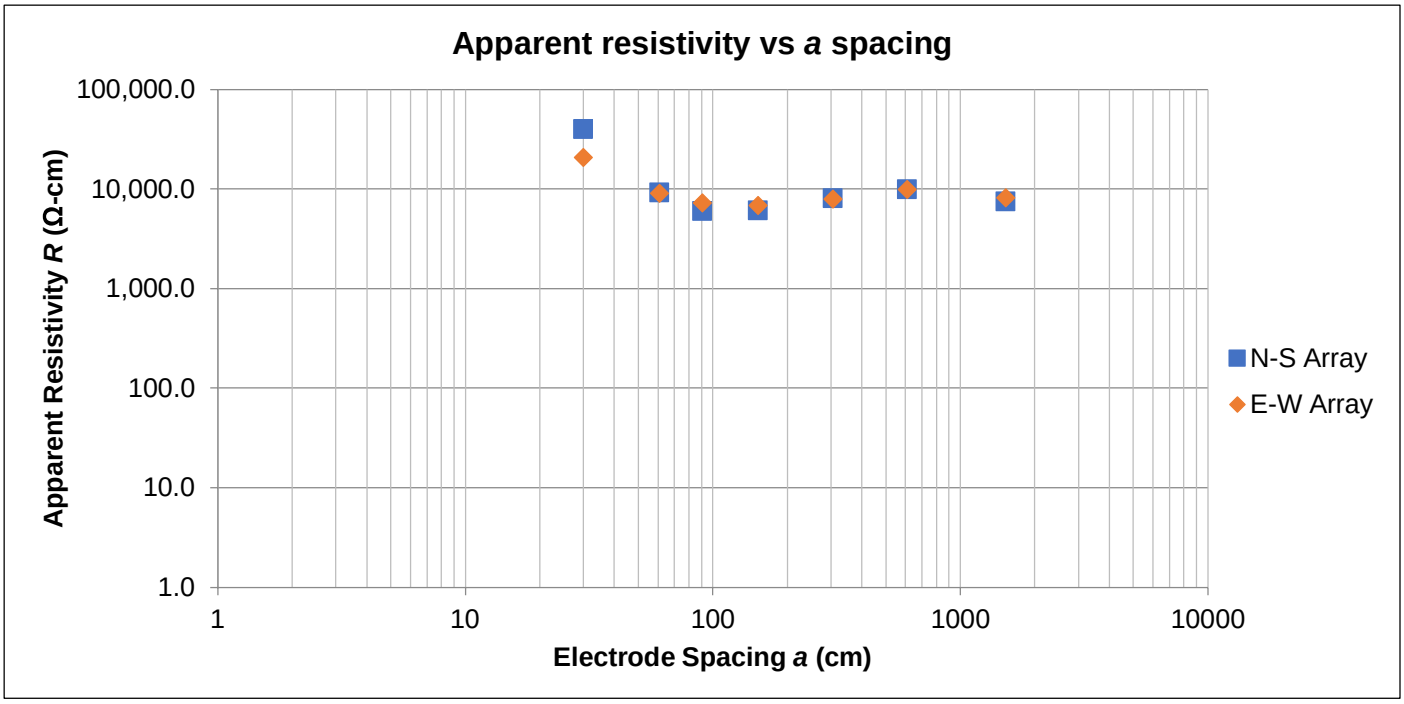
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-10: 35.551307, -106.014021**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 9, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	163.80	40630	85.10	21110
2	61	6	15	22.30	9370	22.00	9250
3	91	6	15	10.20	6100	12.40	7410
5	152	6	15	6.39	6200	7.13	6930
10	305	13	33	4.20	8200	4.13	8070
20	610	13	33	2.59	9990	2.60	10010
50	1524	13	33	0.79	7570	0.86	8250



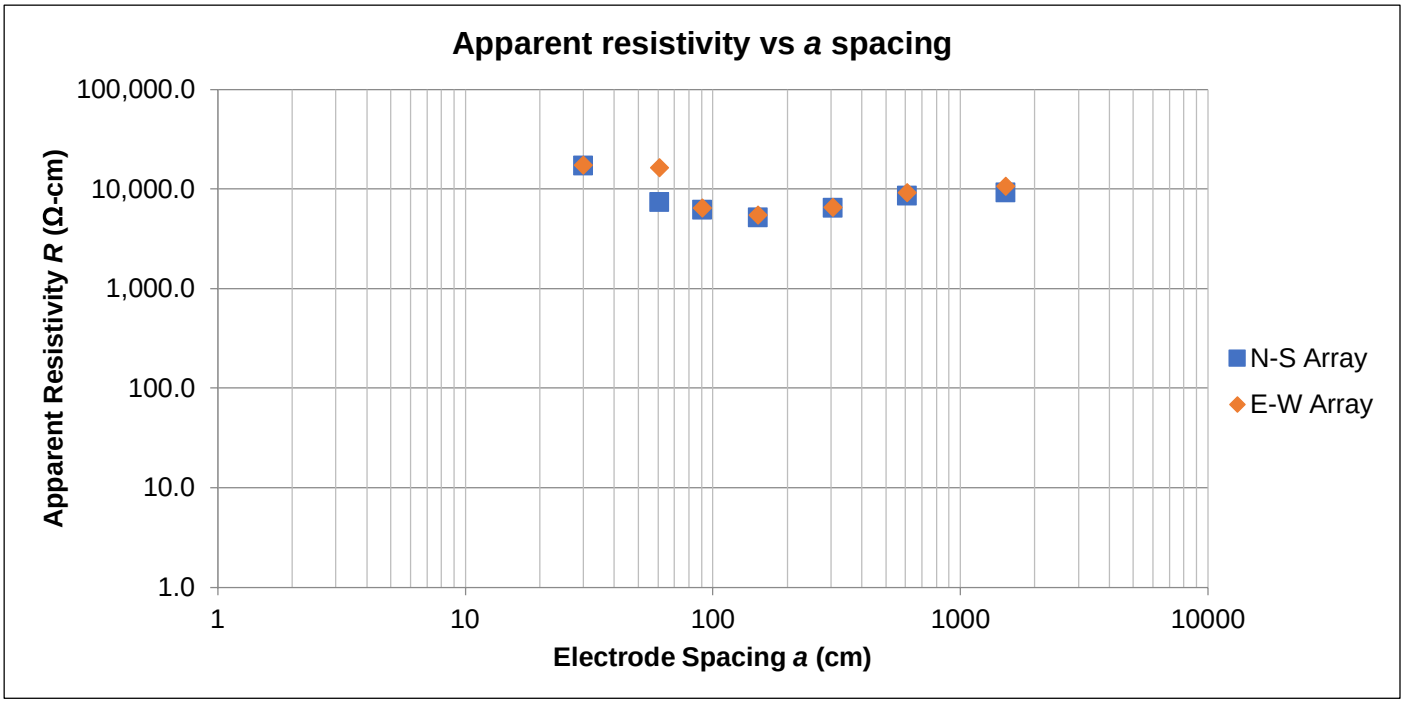
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-11: 35.553501, -106.015633**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 9, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	69.60	17260	70.90	17590
2	61	6	15	17.70	7440	39.30	16520
3	91	6	15	10.40	6220	10.90	6520
5	152	6	15	5.42	5260	5.74	5570
10	305	13	33	3.35	6540	3.39	6630
20	610	13	33	2.25	8670	2.42	9320
50	1524	13	33	0.97	9310	1.13	10870



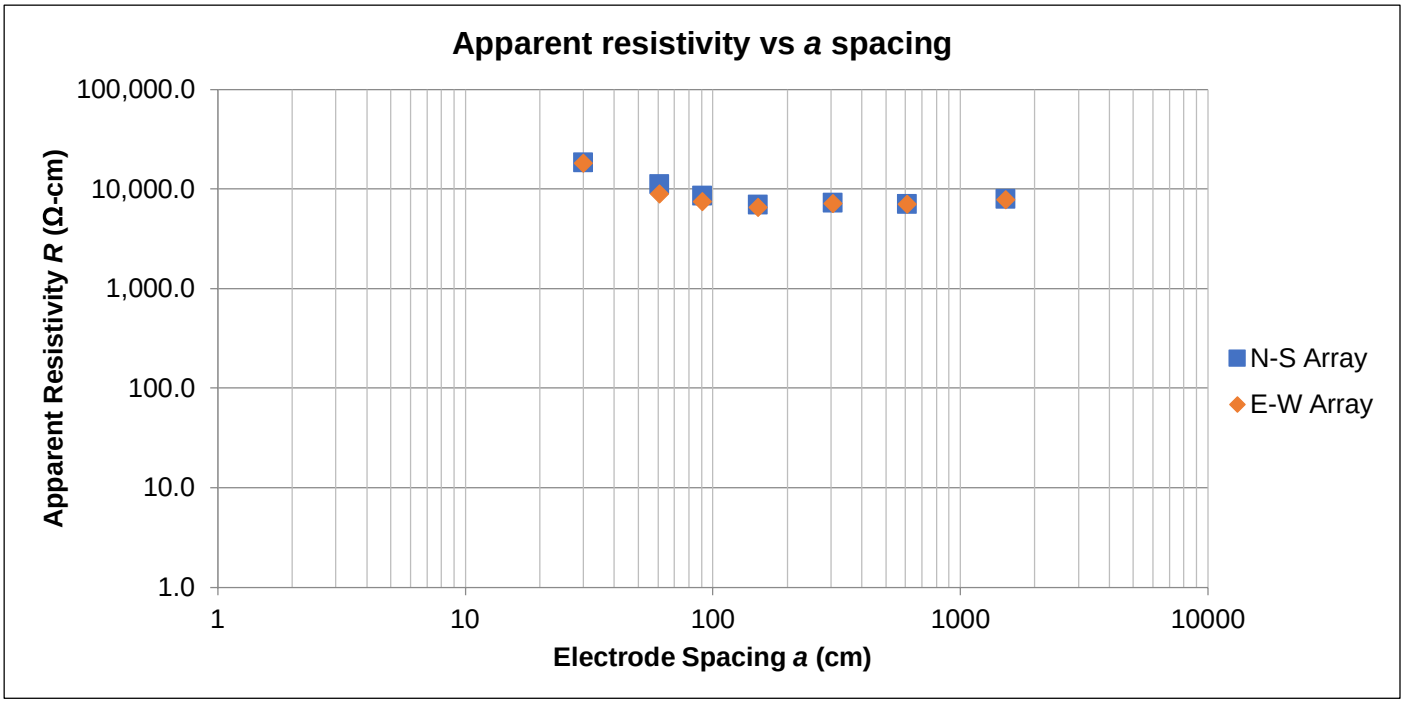
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-A-12: 35.553592, -106.00828**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	August 9, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	75.10	18630	73.90	18330
2	61	6	15	26.90	11310	21.40	9000
3	91	6	15	14.50	8670	12.60	7530
5	152	6	15	7.20	6990	6.84	6640
10	305	13	33	3.77	7370	3.73	7300
20	610	13	33	1.86	7150	1.85	7130
50	1524	13	33	0.85	8100	0.83	7950



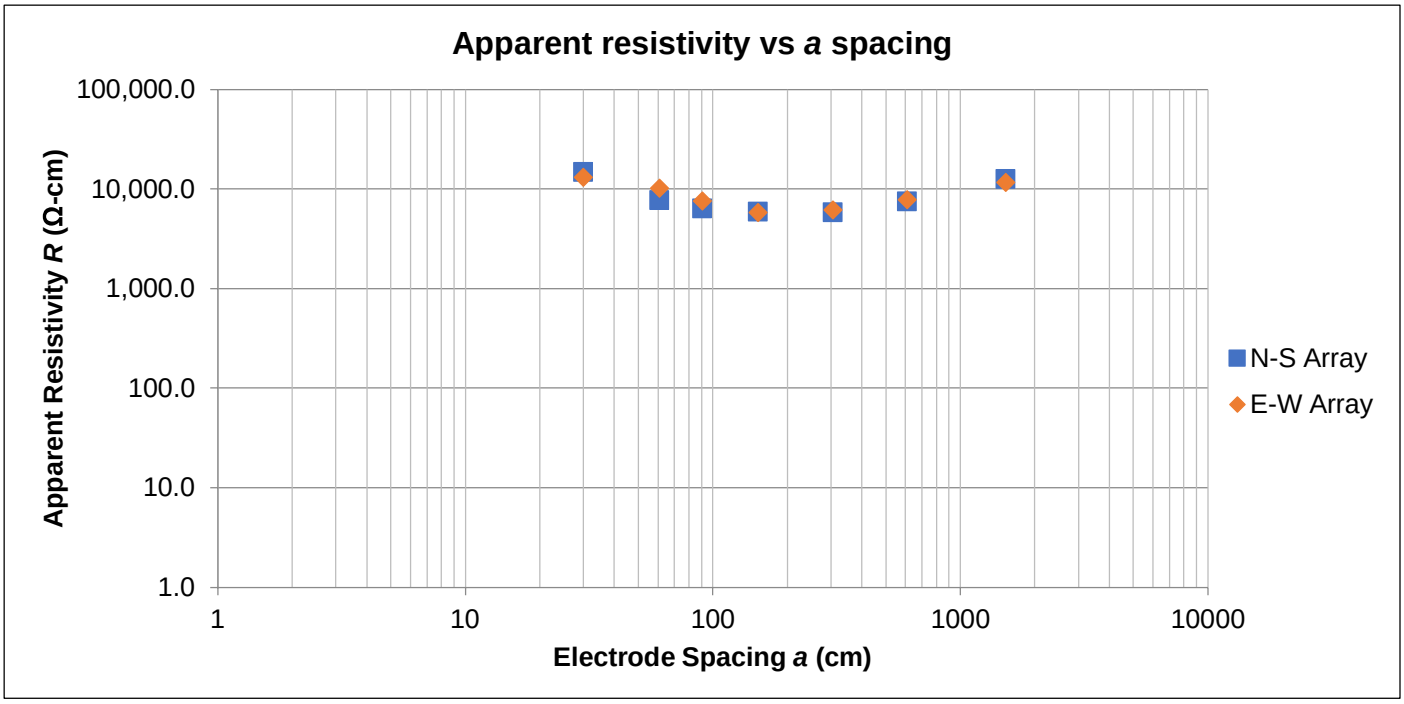
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-T-01: 35.553920, -106.000314**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	September 19, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	60.20	14930	53.60	13300
2	61	6	15	18.50	7780	24.50	10300
3	91	6	15	10.81	6460	12.90	7710
5	152	6	15	6.17	5990	6.08	5900
10	305	13	33	3.02	5910	3.19	6240
20	610	13	33	1.97	7570	2.06	7940
50	1524	13	33	1.32	12660	1.24	11880



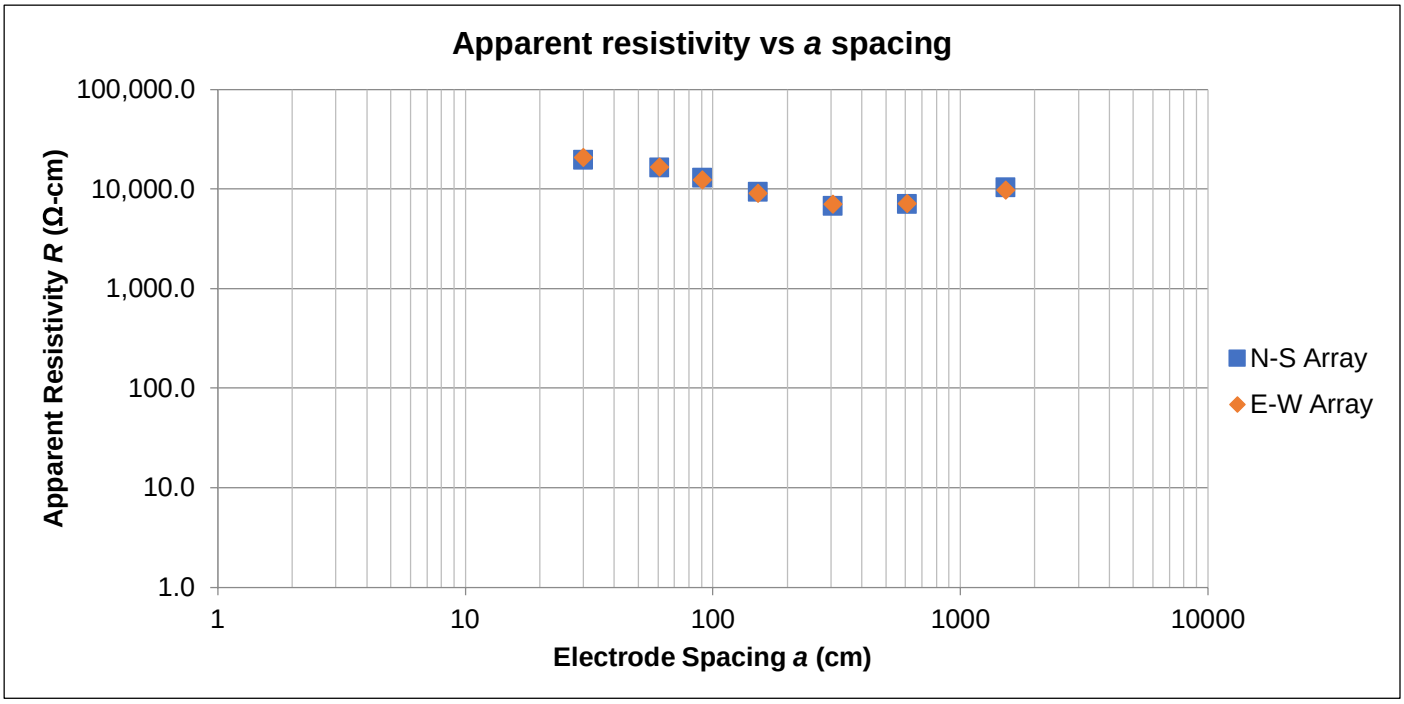
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-T-02: 35.556813, -105.991131**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	September 19, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	79.80	19790	85.00	21080
2	61	6	15	39.80	16730	40.20	16900
3	91	6	15	22.10	13210	20.90	12500
5	152	6	15	9.69	9410	9.51	9230
10	305	13	33	3.52	6870	3.64	7110
20	610	13	33	1.86	7170	1.87	7200
50	1524	13	33	1.10	10560	1.04	9960



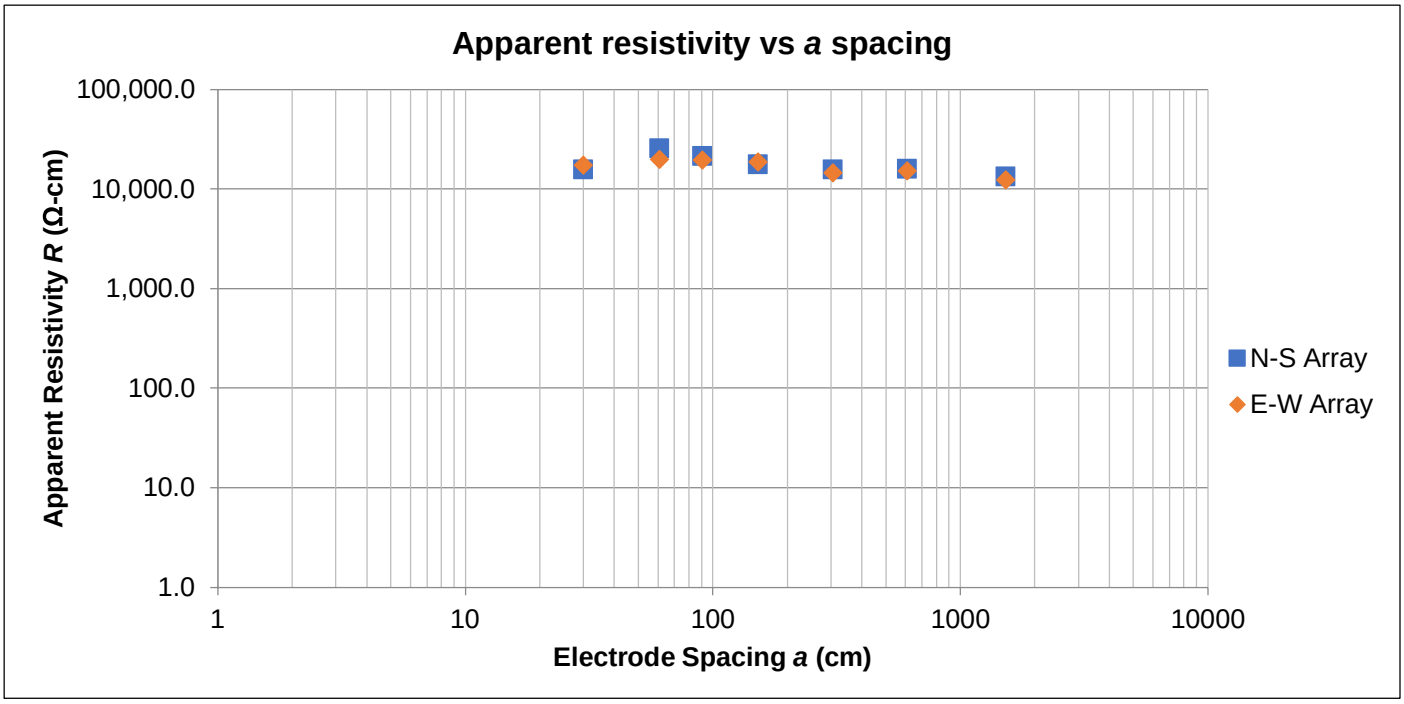
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-T-03: 35.559615, -105.98170**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	ED, MG
Test Date	September 19, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	64.50	16000	70.80	17560
2	61	6	15	61.70	25940	47.60	20010
3	91	6	15	36.20	21640	33.00	19730
5	152	6	15	18.50	17960	19.60	19030
10	305	13	33	8.10	15830	7.60	14860
20	610	13	33	4.20	16180	4.00	15410
50	1524	13	33	1.40	13420	1.30	12460



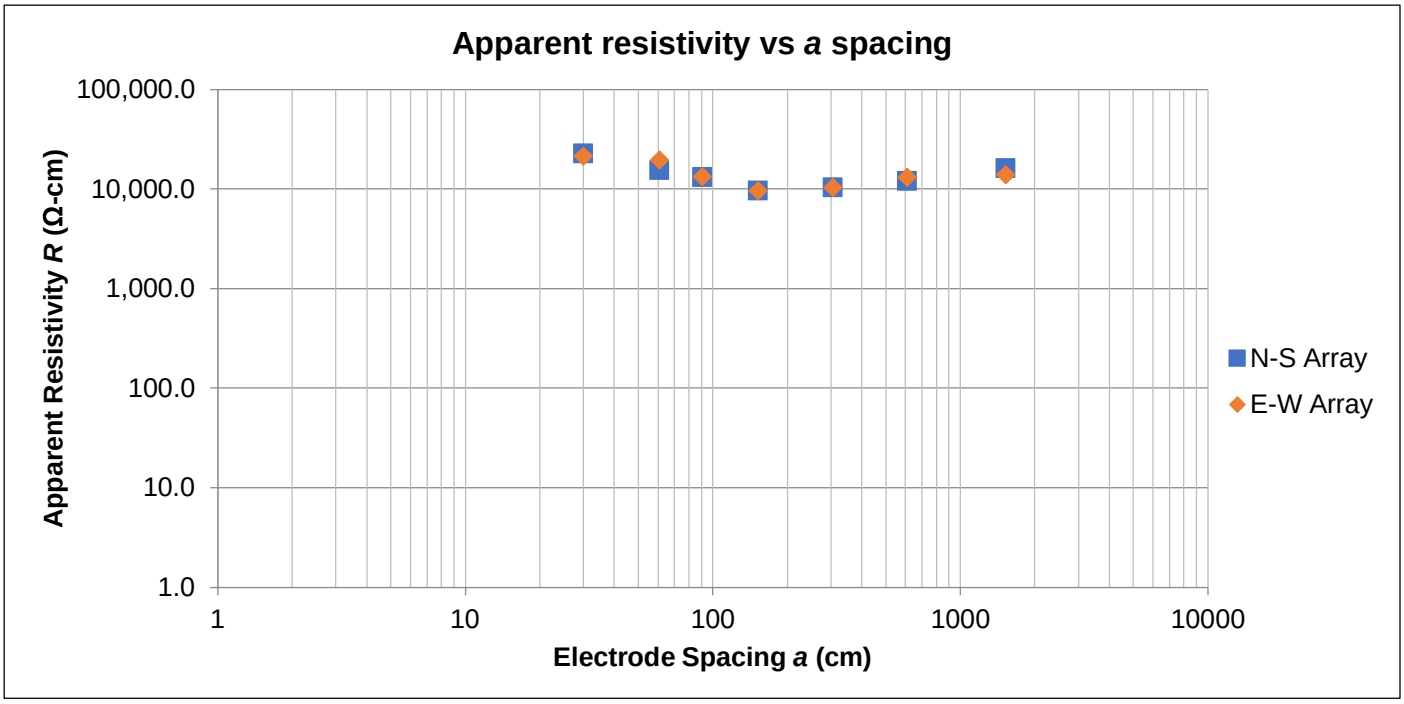
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-T-04: 35.562850, -105.971233**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	LA
Test Date	September 19, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	92.30	22900	87.00	21580
2	61	6	15	37.20	15640	47.00	19760
3	91	6	15	22.20	13270	22.50	13450
5	152	6	15	10.10	9810	10.00	9710
10	305	13	33	5.40	10560	5.38	10520
20	610	13	33	3.17	12210	3.47	13370
50	1524	13	33	1.70	16290	1.47	14090



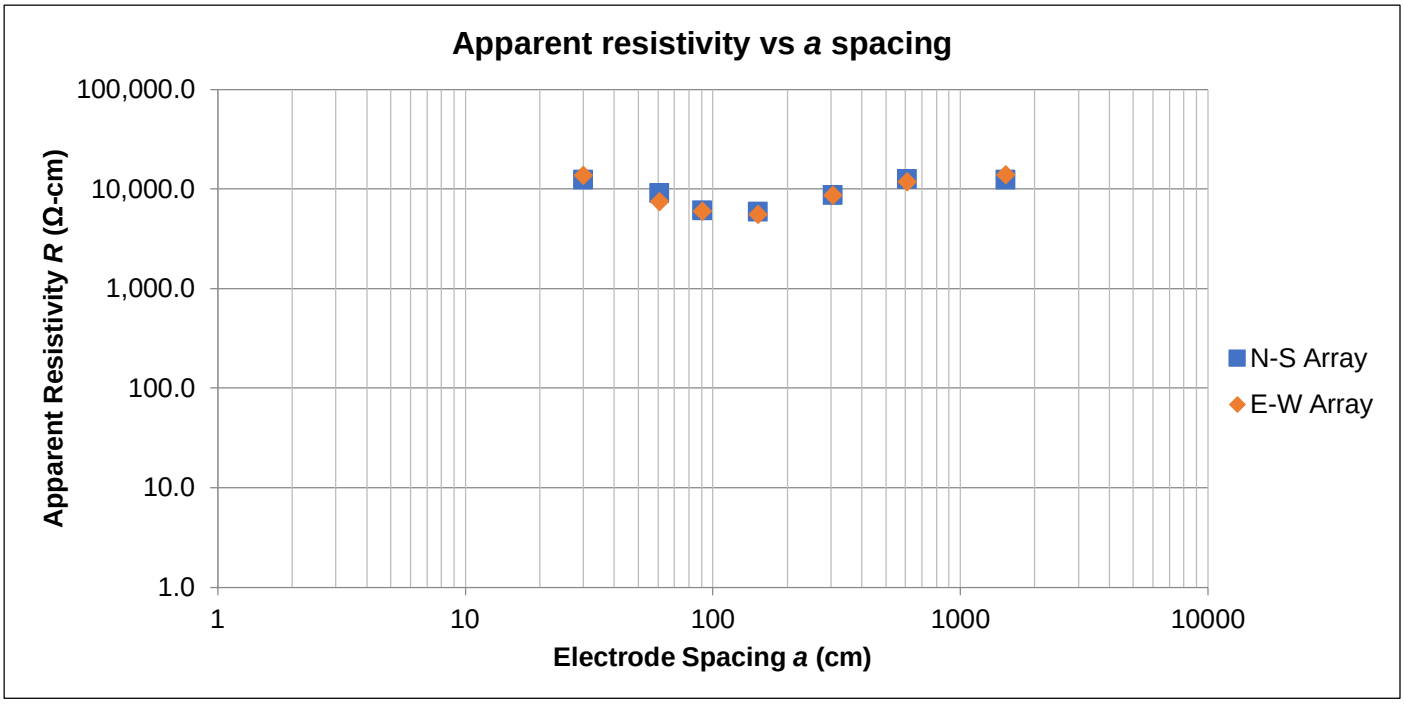
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-T-05: 35.565560, -105.963141**		
Instrument	LRI MiniRes Ultra	**Weather**	Sunny
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	1-Apr	**Tested By**	MG, SS
Test Date	September 19, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	50.50	12530	55.70	13820
2	61	6	15	21.80	9160	18.10	7610
3	91	6	15	10.30	6160	10.10	6040
5	152	6	15	6.20	6020	5.80	5630
10	305	13	33	4.50	8800	4.50	8800
20	610	13	33	3.30	12710	3.10	11940
50	1524	13	33	1.30	12460	1.48	14180



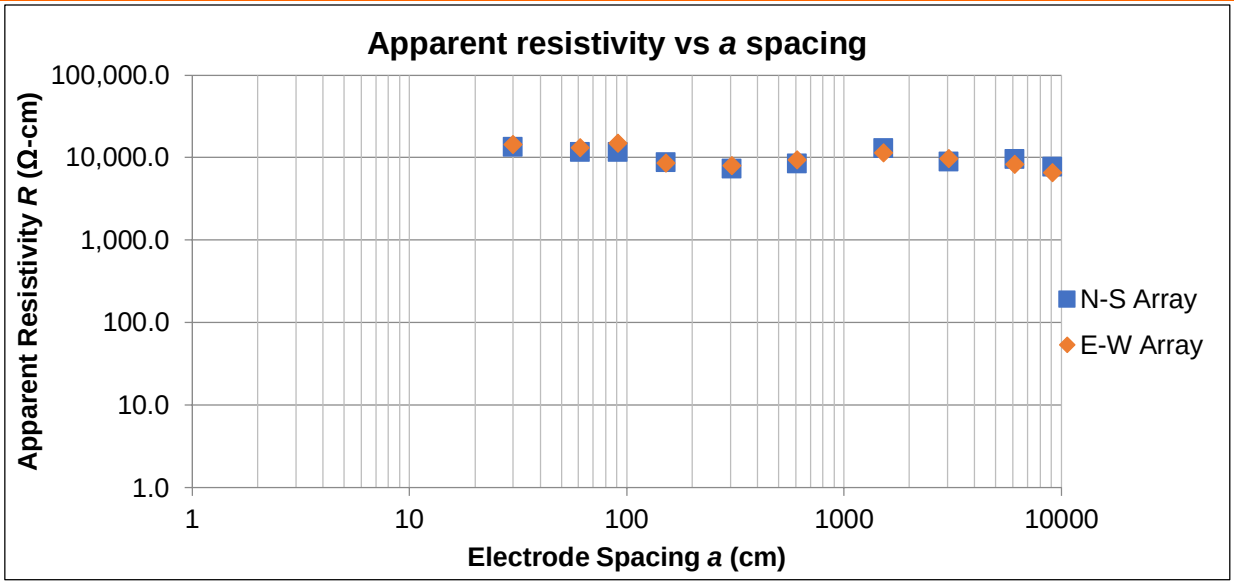
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-BESS-01: 35.552320, -106.001746**		
Instrument	LRI MiniRes Ultra	**Weather**	Cloudy
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	10-Jul	**Tested By**	SL
Test Date	September 20, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	55.10	13670	59.10	14660
2	61	6	15	28.10	11810	31.50	13240
3	91	6	15	19.80	11840	25.10	15010
5	152	6	15	9.18	8920	8.87	8620
10	305	13	33	3.81	7450	4.12	8060
20	610	13	33	2.22	8540	2.46	9460
50	1524	13	33	1.358	13010	1.215	11640
100	3048	14	36	0.468	8960	0.518	9920
200	6096	15	38	0.251	9610	0.218	8350
300	9144	16	41	0.135	7760	0.115	6610



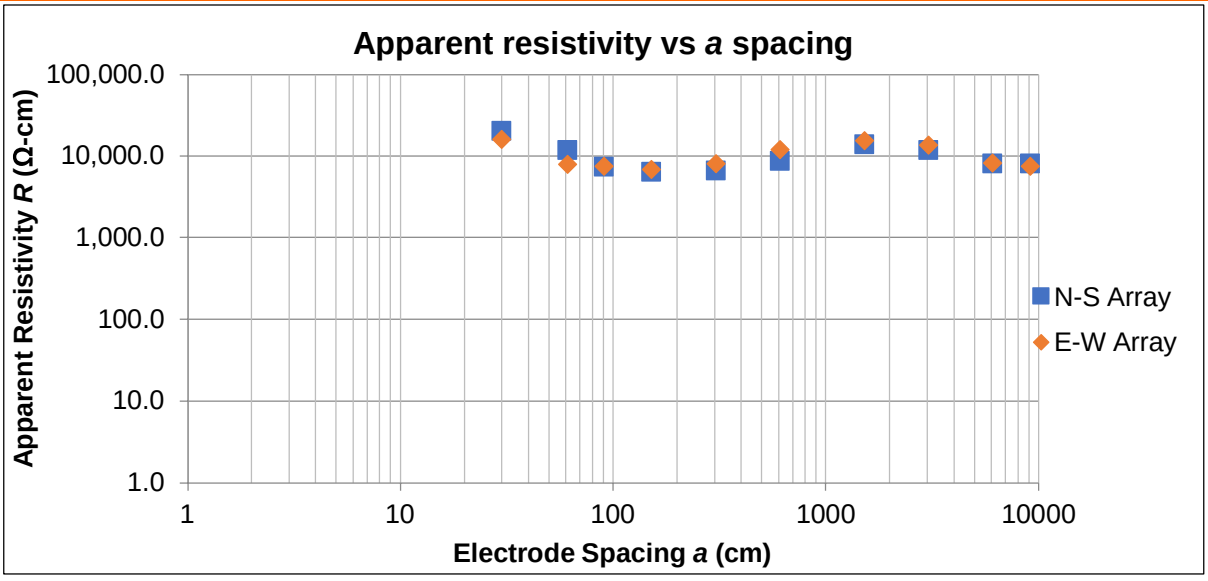
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-BESS-02: 35.553828, -106.002677**		
Instrument	LRI MiniRes Ultra	**Weather**	Cloudy
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	10-Jul	**Tested By**	SL
Test Date	September 20, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	81.80	20290	64.80	16070
2	61	6	15	28.10	11810	19.10	8030
3	91	6	15	12.50	7470	12.63	7550
5	152	6	15	6.62	6430	7.16	6950
10	305	13	33	3.42	6680	4.17	8140
20	610	13	33	2.27	8730	3.16	12170
50	1524	13	33	1.463	14020	1.618	15510
100	3048	14	36	0.618	11840	0.718	13750
200	6096	15	38	0.213	8160	0.216	8270
300	9144	16	41	0.143	8220	0.131	7530



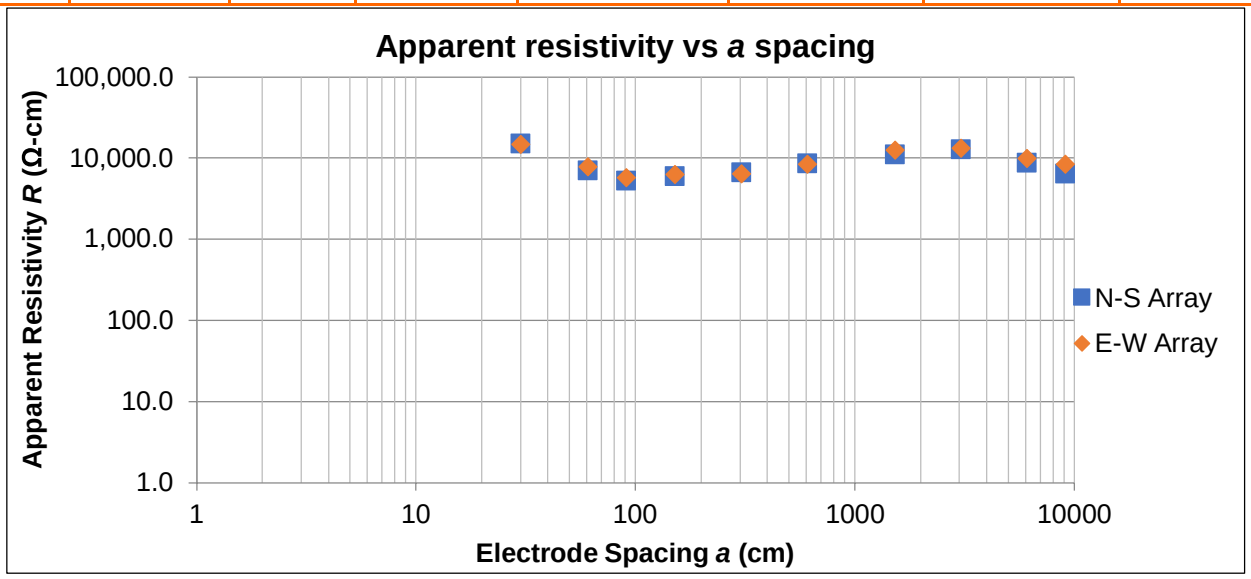
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-BW-01: 35.56568653, -105.9623908**		
Instrument	LRI MiniRes Ultra	**Weather**	Cloudy
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	10-Jul	**Tested By**	MG, SS
Test Date	September 20, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	61.00	15130	59.70	14810
2	61	6	15	16.90	7100	18.80	7900
3	91	6	15	8.90	5320	9.70	5800
5	152	6	15	6.19	6010	6.61	6420
10	305	13	33	3.41	6670	3.33	6510
20	610	13	33	2.27	8740	2.19	8440
50	1524	13	33	1.170	11210	1.336	12800
100	3048	14	36	0.674	12910	0.697	13350
200	6096	15	38	0.230	8810	0.264	10110
300	9144	16	41	0.113	6490	0.149	8560



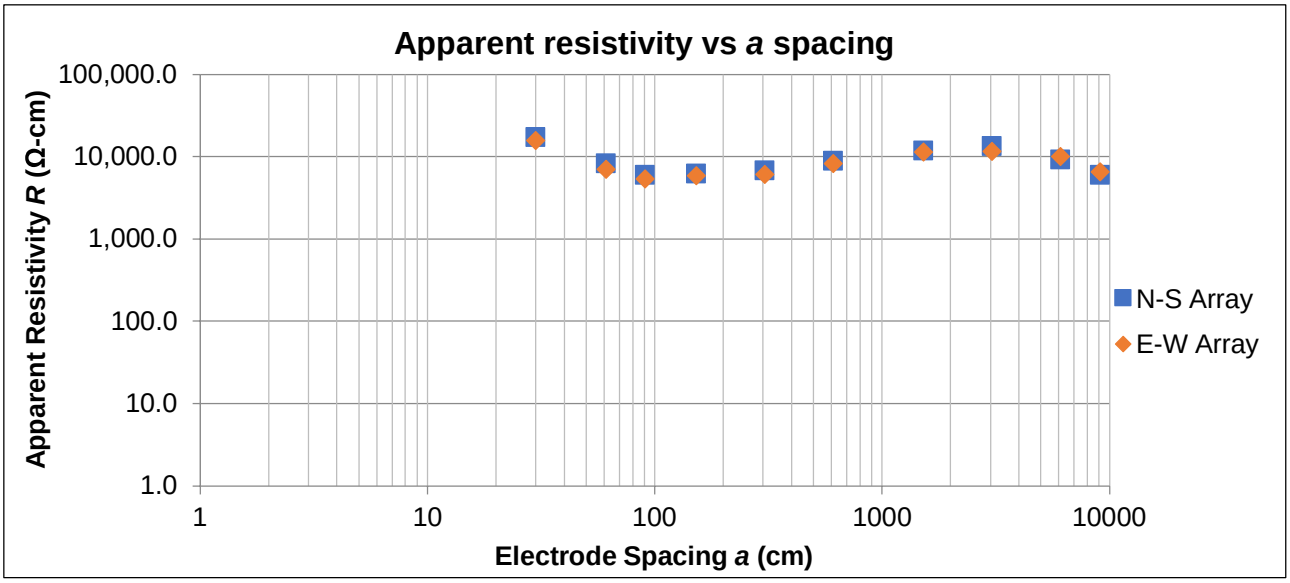
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-BW-02: 35.5654018, -105.9622446**		
Instrument	LRI MiniRes Ultra	**Weather**	Cloudy
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	10-Jul	**Tested By**	SL
Test Date	September 20, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	70.15	17400	64.10	15900
2	61	6	15	20.15	8470	17.10	7190
3	91	6	15	10.21	6100	9.16	5470
5	152	6	15	6.51	6320	6.19	6010
10	305	13	33	3.51	6860	3.16	6170
20	610	13	33	2.35	9060	2.20	8480
50	1524	13	33	1.251	11990	1.215	11640
100	3048	14	36	0.713	13660	0.615	11780
200	6096	15	38	0.243	9310	0.268	10270
300	9144	16	41	0.106	6090	0.115	6610



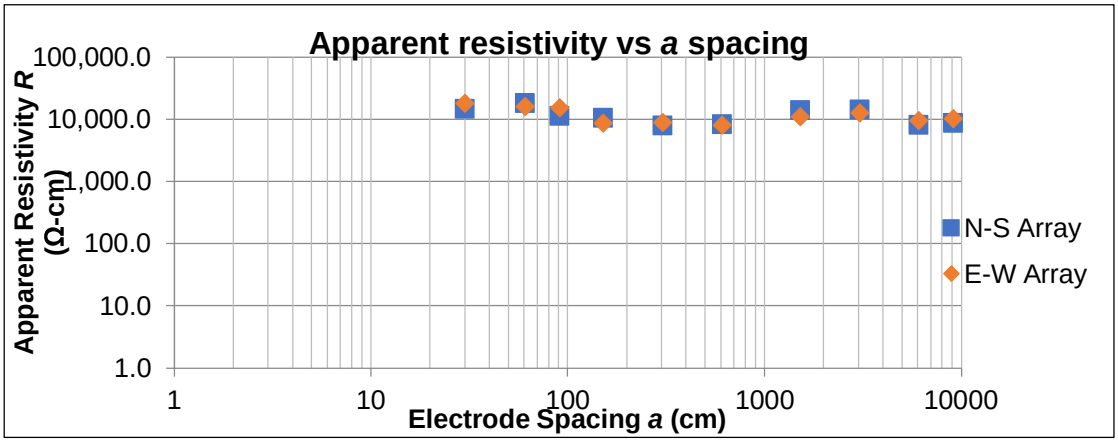
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Albuquerque, NM
December 2023 ■ Terracon Project No.66225093

Array Loc.	**FER-SUB-01: 35.552903, -105.003589**		
Instrument	LRI MiniRes Ultra	**Weather**	Cloudy
Serial #	SN-332	**Ground Cond.**	Dry, moderate vegetation
Cal. Check	10-Jul	**Tested By**	SL
Test Date	September 20, 2023	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	60.81	15080	75.50	18730
2	61	6	15	44.50	18710	39.15	16460
3	91	6	15	19.16	11450	26.12	15620
5	152	6	15	11.16	10840	9.16	8900
10	305	13	33	4.16	8120	4.62	9030
20	610	13	33	2.20	8470	2.16	8310
50	1524	13	33	1.486	14240	1.168	11190
100	3048	14	36	0.765	14650	0.684	13100
200	6096	15	38	0.215	8240	0.254	9730
300	9144	16	41	0.156	8960	0.185	10630



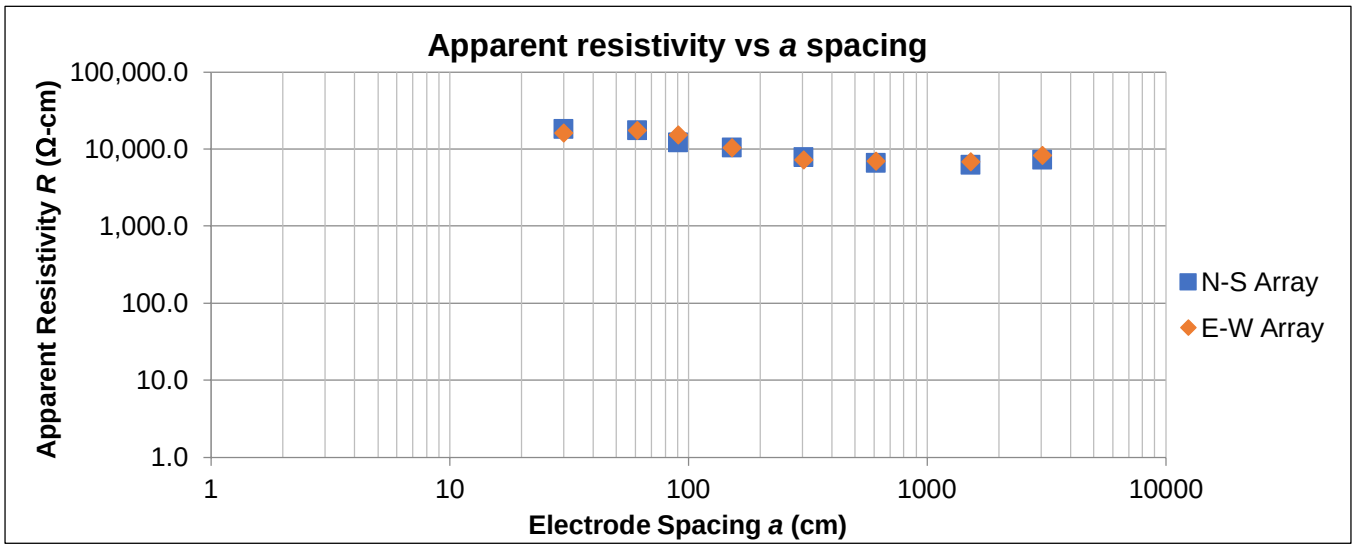
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Santa Fe, New Mexico
September 23, 2022 ■ Terracon Project No.66225093

Array Loc.	**FER-01** : 35.55098, -106.00957		
Instrument	MiniRes Ultra	**Weather**	Sunny 92°F
Serial #		**Ground Cond.**	dry, low vegetation
Cal. Check	1-Sep	**Tested By**	KD
Test Date	August 25, 2022	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	73.70	18280	65.60	16270
2	61	6	15	41.80	17570	41.90	17610
3	91	6	15	20.40	12200	25.70	15360
5	152	6	15	10.80	10490	10.70	10390
10	305	12	30	4.000	7790	3.700	7210
20	610	12	30	1.700	6540	1.800	6930
50	1524	12	30	0.653	6260	0.711	6810
100	3048	12	30	0.380	7280	0.434	8310



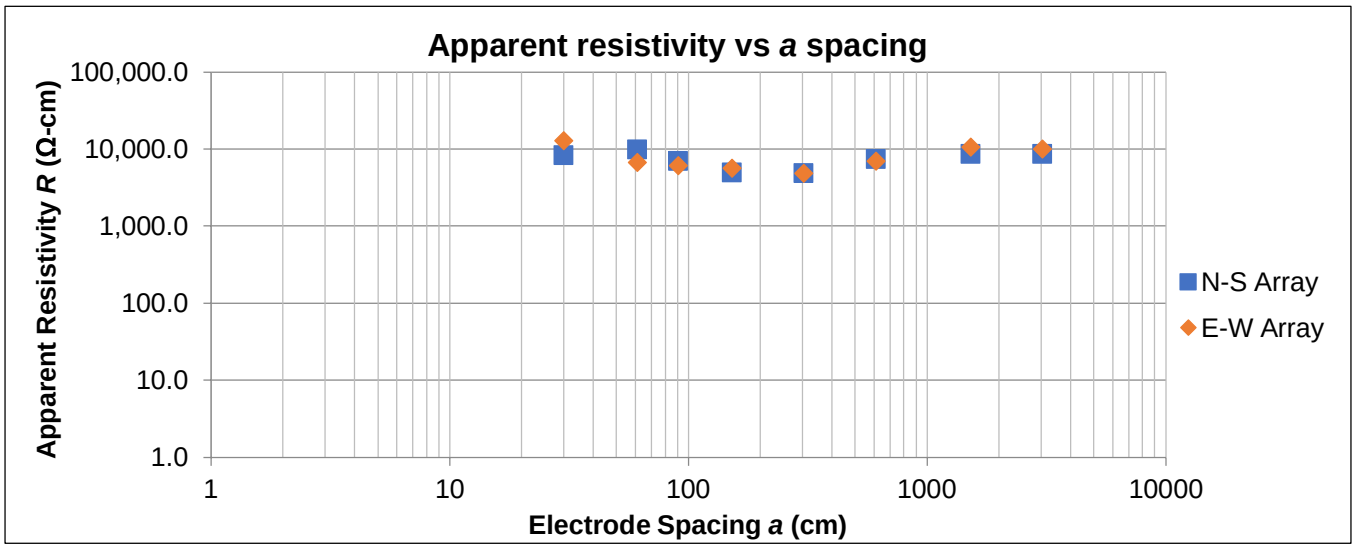
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Santa Fe, New Mexico
September 23, 2022 ■ Terracon Project No.66225093

Array Loc.	**FER-02** : 35.54262, -106.02614		
Instrument	MiniRes Ultra	**Weather**	Sunny 88°F
Serial #		**Ground Cond.**	dry, low vegetation
Cal. Check	1-Sep	**Tested By**	KD
Test Date	August 25, 2022	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	33.40	8290	52.10	12920
2	61	6	15	23.60	9920	16.00	6730
3	91	6	15	11.70	6990	10.20	6100
5	152	6	15	5.10	4950	5.80	5630
10	305	12	30	2.500	4870	2.500	4870
20	610	12	30	1.900	7310	1.800	6930
50	1524	12	30	0.900	8620	1.100	10540
100	3048	12	30	0.445	8520	0.528	10110



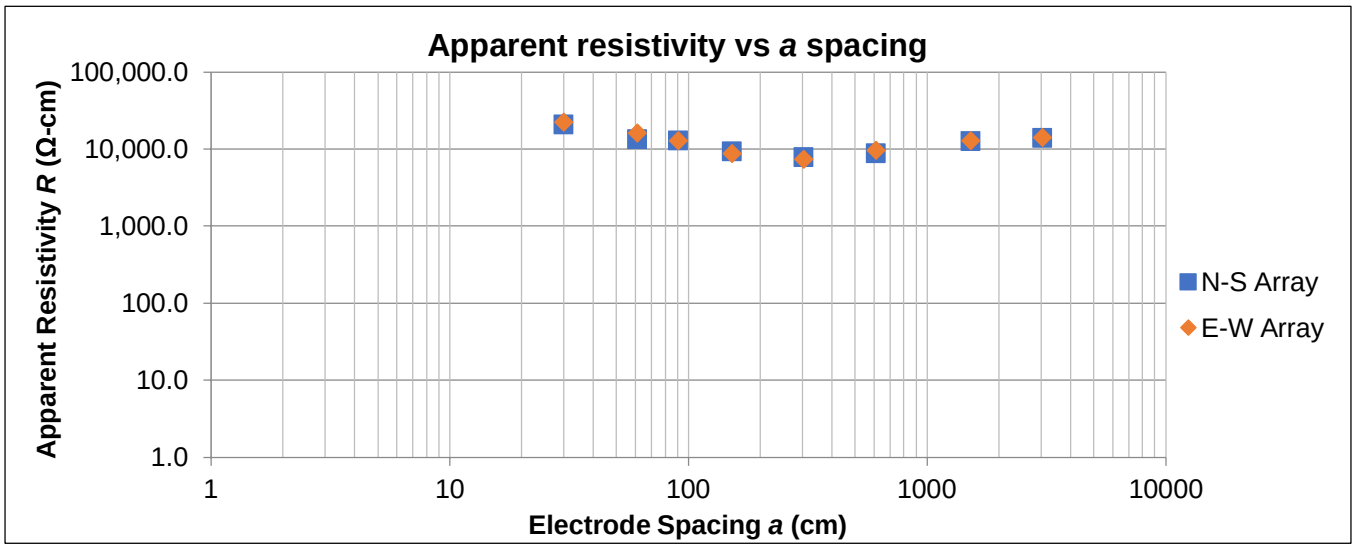
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Santa Fe, New Mexico
September 23, 2022 ■ Terracon Project No.66225093

Array Loc.	**FER-03** : 35.54299, -106.00820		
Instrument	MiniRes Ultra	**Weather**	Sunny 89°F
Serial #		**Ground Cond.**	dry, low vegetation
Cal. Check	1-Sep	**Tested By**	KD
Test Date	August 25, 2022	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts			

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	82.90	20560	90.90	22550
2	61	6	15	31.70	13320	38.20	16060
3	91	6	15	21.50	12850	21.40	12790
5	152	6	15	9.60	9320	9.10	8840
10	305	12	30	4.000	7790	3.800	7400
20	610	12	30	2.300	8850	2.500	9620
50	1524	12	30	1.326	12710	1.338	12820
100	3048	12	30	0.723	13850	0.736	14100



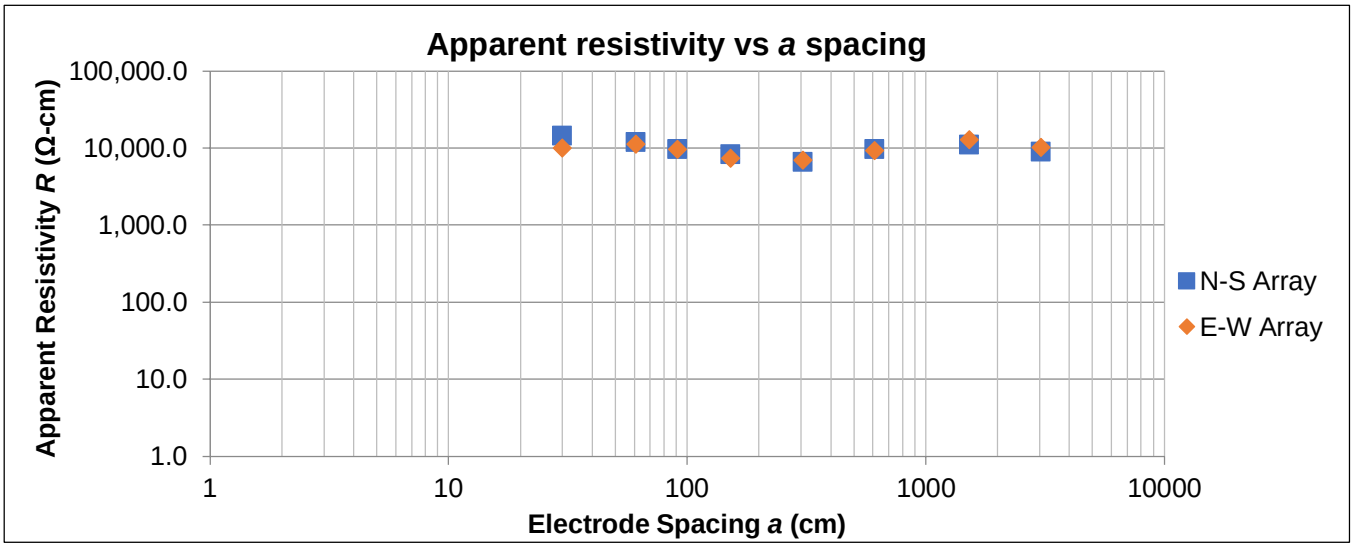
FIELD ELECTRICAL RESISTIVITY TEST DATA

Rancho Viejo Solar ■ Santa Fe, New Mexico
September 23, 2022 ■ Terracon Project No.66225093

Array Loc.	**FER-SUB** : 35.55342, -106.00314		
Instrument	MiniRes Ultra	**Weather**	Sunny 92°F
Serial #		**Ground Cond.**	dry, low vegetation
Cal. Check	1-Sep	**Tested By**	KD
Test Date	August 25, 2022	**Method**	Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012
Notes & Conflicts	Barbed wire fence on north side, array went under fence		

Apparent resistivity ρ is calculated as : $\rho = \dfrac{4\pi aR}{1 + \dfrac{2a}{\sqrt{a^2 + 4b^2}} - \dfrac{a}{\sqrt{a^2 + b^2}}}$

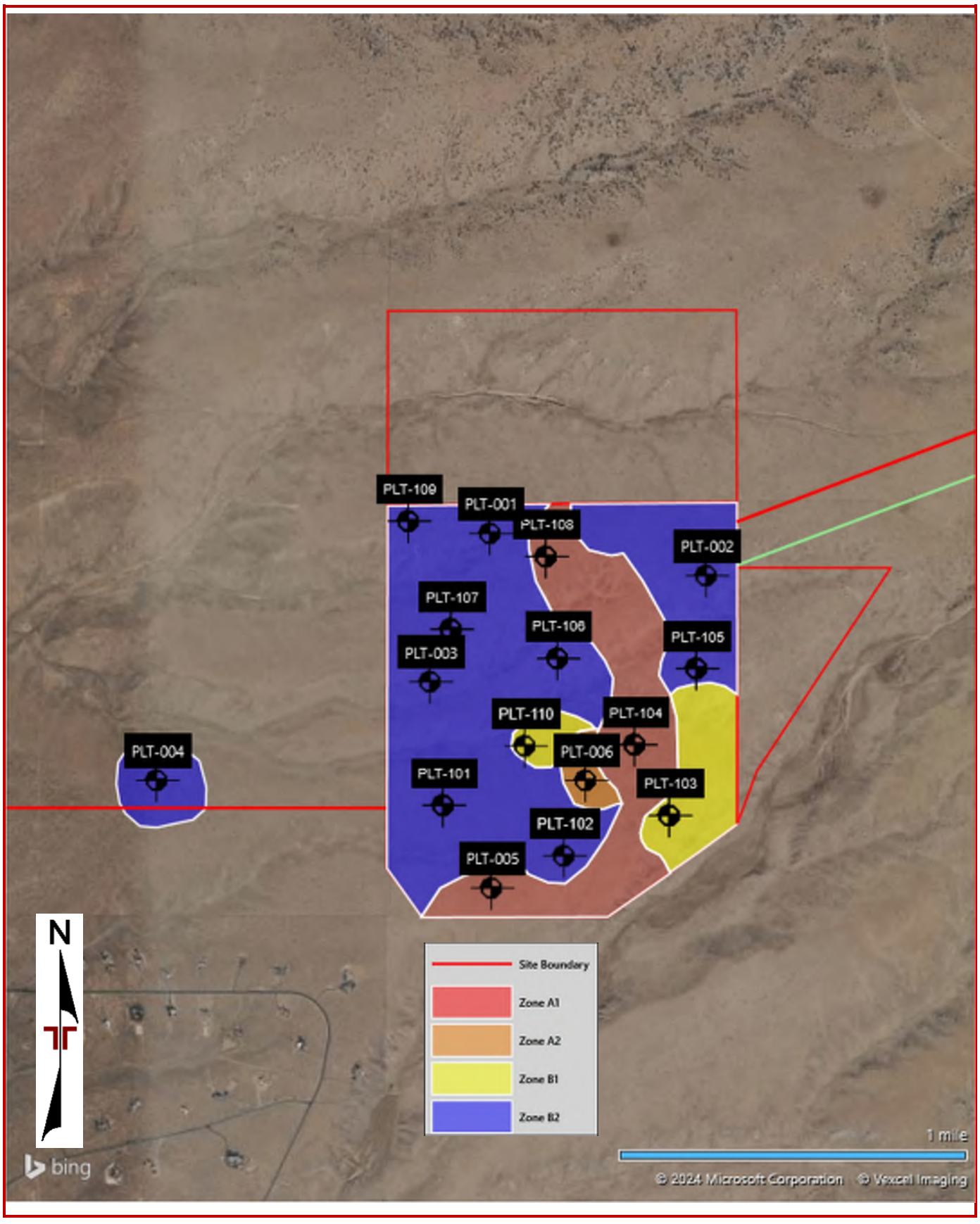
Electrode Spacing *a*		Electrode Depth *b*		N-S Test		E-W Test	
(feet)	(centimeters)	(inches)	(centimeters)	Measured Resistance *R*	Apparent Resistivity ρ	Measured Resistance *R*	Apparent Resistivity ρ
				Ω	(Ω-cm)	Ω	(Ω-cm)
1	30	6	15	57.90	14360	40.30	10000
2	61	6	15	28.50	11980	26.70	11220
3	91	6	15	16.20	9690	16.00	9570
5	152	6	15	8.50	8250	7.60	7380
10	305	12	30	3.400	6620	3.600	7010
20	610	12	30	2.500	9620	2.400	9240
50	1524	12	30	1.160	11120	1.336	12800
100	3048	12	30	0.468	8960	0.536	10270
200	6096	13	33	0.225	8620	0.218	8350
300	9144	14	36	0.121	6950	0.122	7010



APPENDIX E

TEST PILE DRIVING DATA

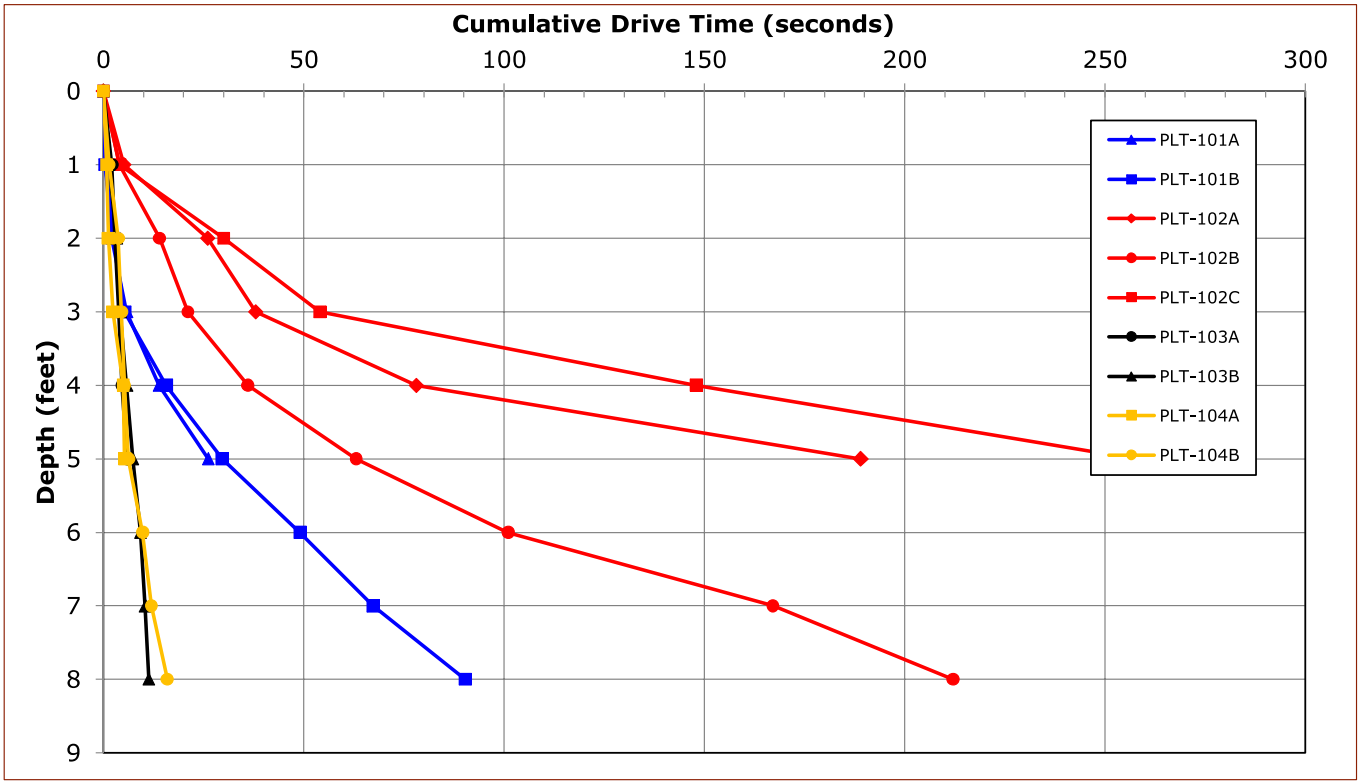
Pile Load Test Location – Zone Map



TEST PILE DRIVING RECORDS

Rancho Viejo Solar Facility

Terracon Project No. 66225093



Depth Range, feet	Cumulative Driving Time, seconds (See Note 1)								
	PLT-101A	PLT-101B	PLT-102A	PLT-102B	PLT-102C	PLT-103A	PLT-103B	PLT-104A	PLT-104B
0'	0	0	0	0	0	0	0	0	0
0' to 1'	0.5	0.4	5.0	4.0	4.0	2.1	1.4	0.8	1.4
1' to 2'	2.0	2.6	26.0	14.0	30.0	2.9	3.2	1.2	3.7
2' to 3'	5.8	5.3	38.0	21.0	54.0	3.8	4.2	2.3	4.5
3' to 4'	13.9	15.7	78.0	36.0	148.0	4.7	5.7	4.9	5.2
4' to 5'	26.1	29.6	189.0	63.0	258.0	5.9	7.3	5.3	6.2
5' to 6'		49.1		101.0			9.2		9.8
6' to 7'		67.3		167.0			10.4		11.9
7' to 8'		90.3		212.0			11.3		15.9
Install Date	**8/23/23**	**8/24/23**	**2/29/24**	**3/1/24**	**3/2/24**	**8/28/23**	**8/29/23**	**8/30/23**	**8/30/23**
Refusal	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**	**No**
Embedment Depth, ft.	**5**	**8**	**5**	**8**	**4.42**	**5**	**8**	**5**	**8**
Total Drive Time, sec.	**26.1**	**90.3**	**189.0**	**212.0**	**258.0**	**5.9**	**11.3**	**5.3**	**15.9**
Average, sec./ft.	**5.2**	**11.3**	**37.8**	**26.5**	**58.4**	**1.2**	**1.4**	**1.1**	**2.0**

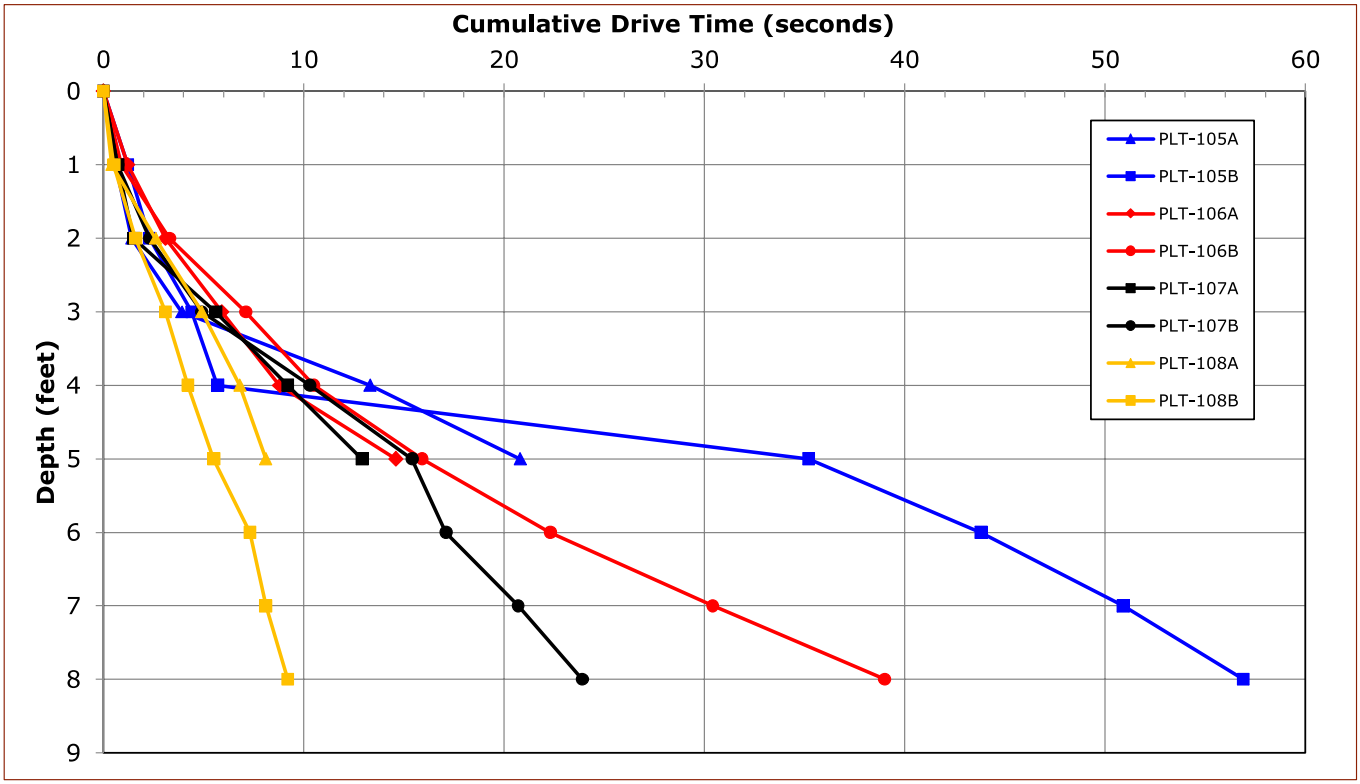
NOTES:

1. Piles advanced with a Gayk HRE4000 hydraulic hammer.
2. PLT-102 installed with a Vermeer PD10 hydraulic hammer.

TEST PILE DRIVING RECORDS

Rancho Viejo Solar Facility

Terracon Project No. 66225093



Depth Range, feet	Cumulative Driving Time, seconds (See Note 1)								
	PLT-105A	PLT-105B	PLT-106A	PLT-106B	PLT-107A	PLT-107B	PLT-108A	PLT-108B	
0'	0	0	0	0	0	0	0	0	
0' to 1'	0.6	1.2	1.2	0.9	0.7	0.7	0.4	0.5	
1' to 2'	1.4	2.3	3.1	3.3	1.5	2.3	2.6	1.6	
2' to 3'	3.9	4.4	5.9	7.1	5.6	4.9	4.9	3.1	
3' to 4'	13.3	5.7	8.8	10.5	9.2	10.3	6.8	4.2	
4' to 5'	20.8	35.2	14.6	15.9	12.9	15.4	8.1	5.5	
5' to 6'		43.8		22.3		17.1		7.3	
6' to 7'		50.9		30.4		20.7		8.1	
7' to 8'		56.9		39.0		23.9		9.2	
Install Date	**8/23/23**	**8/24/23**	**8/25/23**	**8/26/23**	**8/27/23**	**8/28/23**	**8/29/23**	**8/30/23**	
Refusal	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	
Embedment Depth, ft.	**5**	**8**	**5**	**8**	**5**	**8**	**5**	**8**	
Total Drive Time, sec.	**20.8**	**56.9**	**14.6**	**39.0**	**12.9**	**23.9**	**8.1**	**9.2**	
Average, sec./ft.	**4.2**	**7.1**	**2.9**	**4.9**	**2.6**	**3.0**	**1.6**	**1.2**	

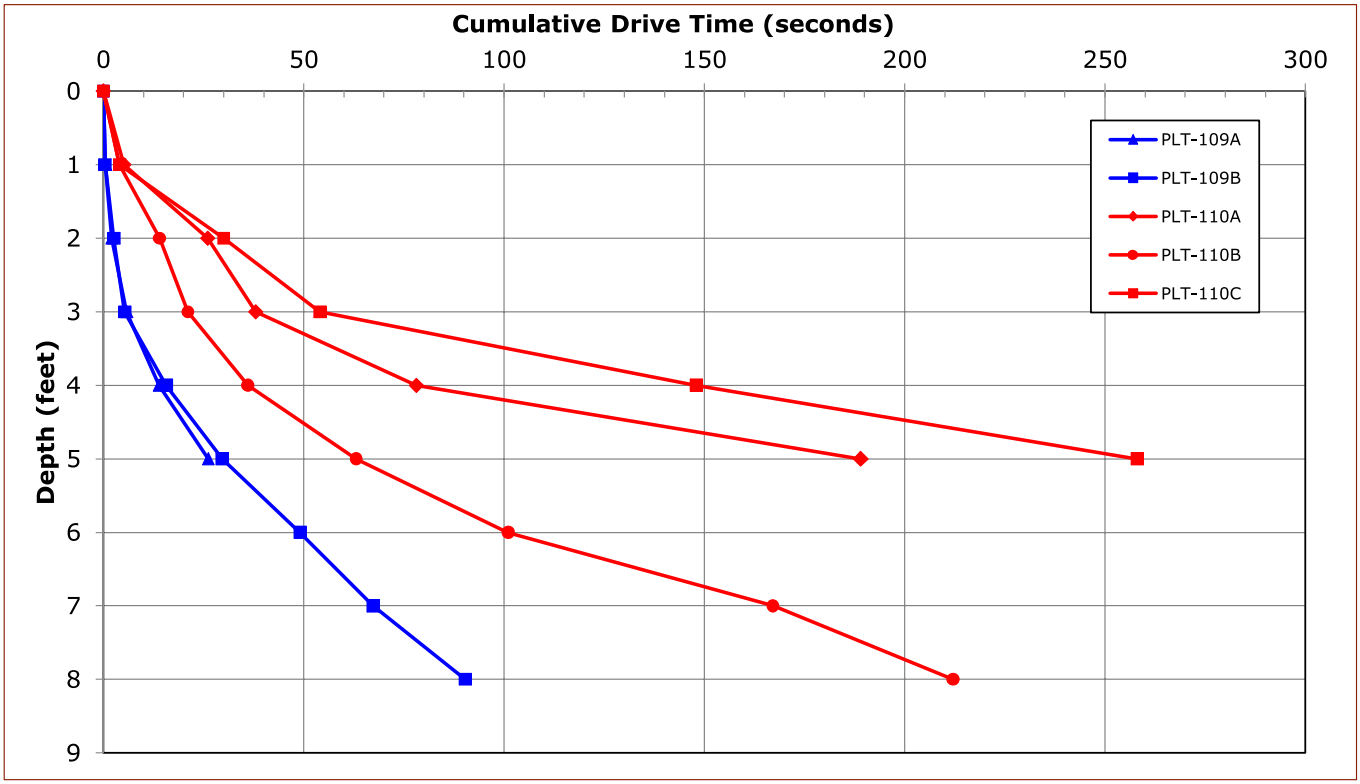
NOTES:

1. Piles advanced with a Gayk HRE4000 hydraulic hammer.

TEST PILE DRIVING RECORDS

Rancho Viejo Solar Facility

Terracon Project No. 66225093



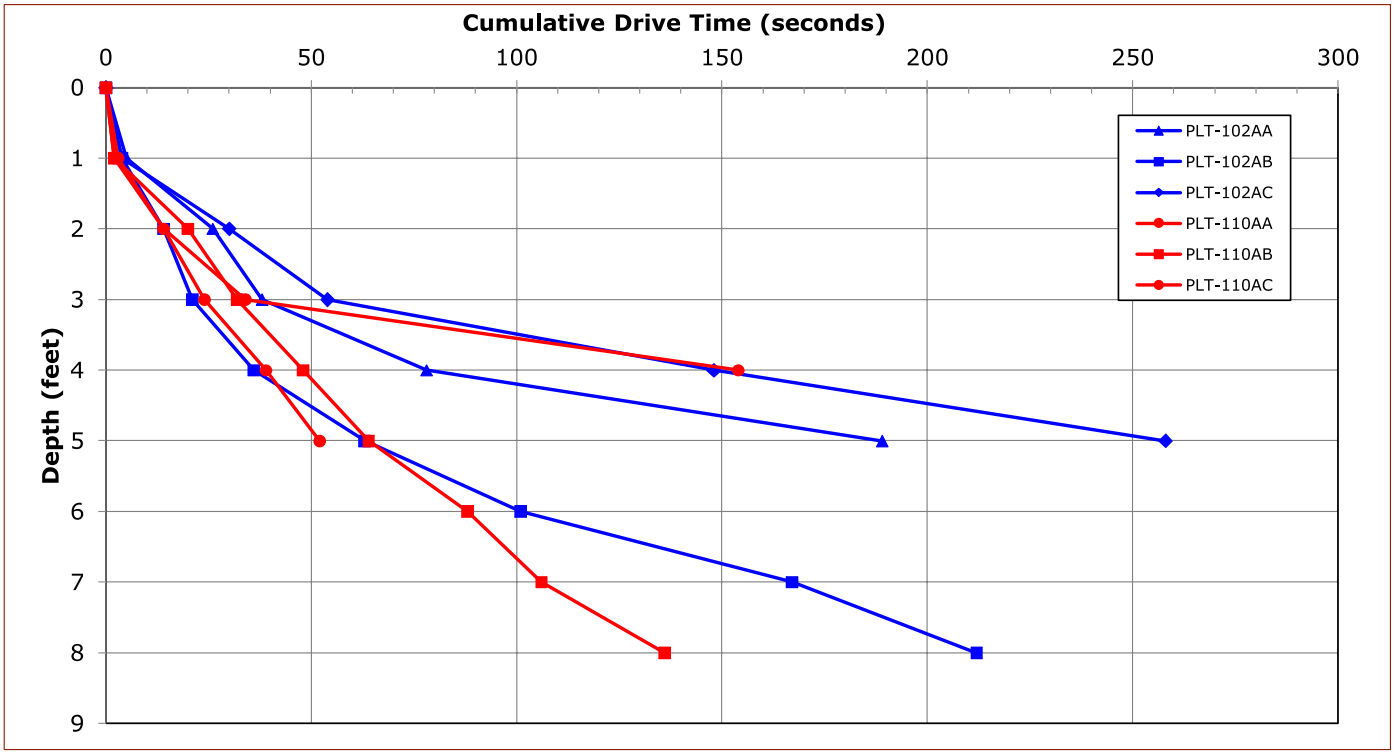
Depth Range, feet	Cumulative Driving Time, seconds (See Note 1)								
	PLT-109A	PLT-109B	PLT-110A	PLT-110B	PLT-110C				
0'	0	0	0	0	0				
0' to 1'	0.5	0.4	5.0	4.0	4.0				
1' to 2'	2.0	2.6	26.0	14.0	30.0				
2' to 3'	5.8	5.3	38.0	21.0	54.0				
3' to 4'	13.9	15.7	78.0	36.0	148.0				
4' to 5'	26.1	29.6	189.0	63.0	258.0				
5' to 6'		49.1		101.0					
6' to 7'		67.3		167.0					
7' to 8'		90.3		212.0					
Install Date	**8/23/23**	**8/24/23**	**3/3/24**	**3/4/24**	**3/5/24**				
Refusal	**No**	**No**	**No**	**No**	**Yes**				
Embedment Depth, ft.	**5**	**8**	**5**	**8**	**3.83**				
Total Drive Time, sec.	**26.1**	**90.3**	**189.0**	**212.0**	**258.0**				
Average, sec./ft.	**5.2**	**11.3**	**37.8**	**26.5**	**67.4**				

NOTES:

1. Piles advanced with a Gayk HRE4000 hydraulic hammer.
2. PLT-110 advanced with a Vermeer PD10 hydraulic hammer.

TEST PILE DRIVING RECORDS

Rancho Viejo Solar Facility
Terracon Project No. 66225093



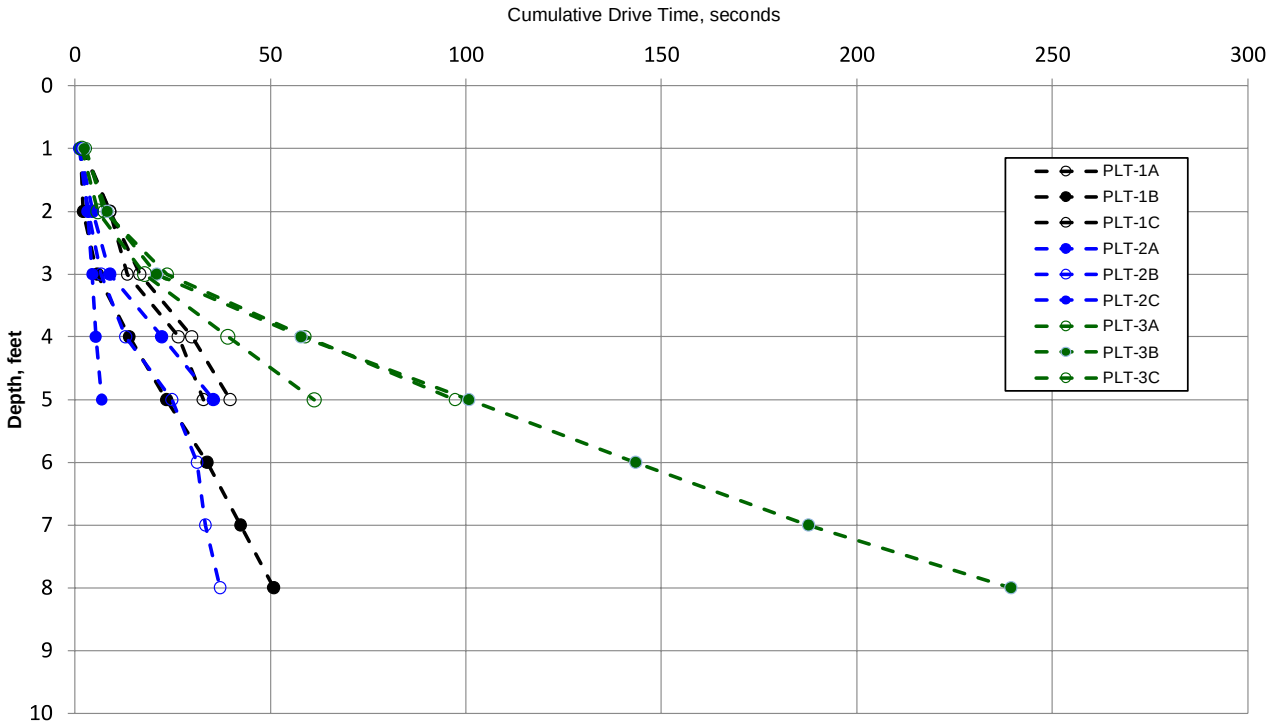
Depth Range, feet	Cumulative Driving Time, seconds (See Note 1)								
	PLT-102AA	PLT-102AB	PLT-102AC	PLT-110AA	PLT-110AB	PLT-110AC			
0'	0	0	0	0	0	0			
0' to 1'	5.0	4.0	4.0	2.0	2.0	3.0			
1' to 2'	26.0	14.0	30.0	14.0	20.0	14.0			
2' to 3'	38.0	21.0	54.0	24.0	32.0	34.0			
3' to 4'	78.0	36.0	148.0	39.0	48.0	154.0			
4' to 5'	189.0	63.0	258.0	52.0	64.0				
5' to 6'		101.0			88.0				
6' to 7'		167.0			106.0				
7' to 8'		212.0			136.0				
Install Date	**2/29/24**	**3/1/24**	**3/2/24**	**3/3/24**	**3/4/24**	**3/5/24**			
Refusal	**No**	**No**	**Yes**	**No**	**No**	**Yes**			
Embedment Depth, ft.	**5**	**8**	**4.42**	**5**	**8**	**3.83**			
Total Drive Time, sec.	**189.0**	**212.0**	**258.0**	**52.0**	**136.0**	**154.0**			
Average, sec./ft.	**37.8**	**26.5**	**58.4**	**10.4**	**17.0**	**40.2**			

NOTES:

1. Piles advanced with a Vermeer PD10 hydraulic hammer.

TEST PILE DRIVING RECORDS

Rancho Viejo Solar Facility - 66225093



Depth, feet	Cumulative Driving Time, seconds								
	PLT-1A	PLT-1B	PLT-1C	PLT-2A	PLT-2B	PLT-2C	PLT-3A	PLT-3B	PLT-3C
1	2.1	1.4	1.8	1.3	1.2	1.1	2.7	2.4	1.7
2	8.9	2.1	8.9	4.5	3.4	3.2	7.4	8.2	5.9
3	16.6	5.7	13.4	8.9	6.7	4.4	23.6	20.9	17.8
4	29.8	13.9	26.4	22.2	12.9	5.3	58.9	57.8	39.1
5	39.7	23.4	32.8	35.4	24.8	6.8	97.2	100.7	61.2
6		33.8			31.2			143.4	
7		42.4			33.3			187.6	
8		50.8			37.1			239.4	
Note:									
Embedment Depth, ft	**5**	**8**	**5**	**5**	**8**	**5**	**5**	**8**	**5**
Total Drive Time, sec	**39.7**	**50.8**	**32.8**	**35.4**	**37.1**	**6.8**	**97.2**	**239.4**	**61.2**
Average, sec/ft	**7.9**	**6.4**	**6.6**	**7.1**	**4.6**	**1.4**	**19.4**	**29.9**	**12.2**

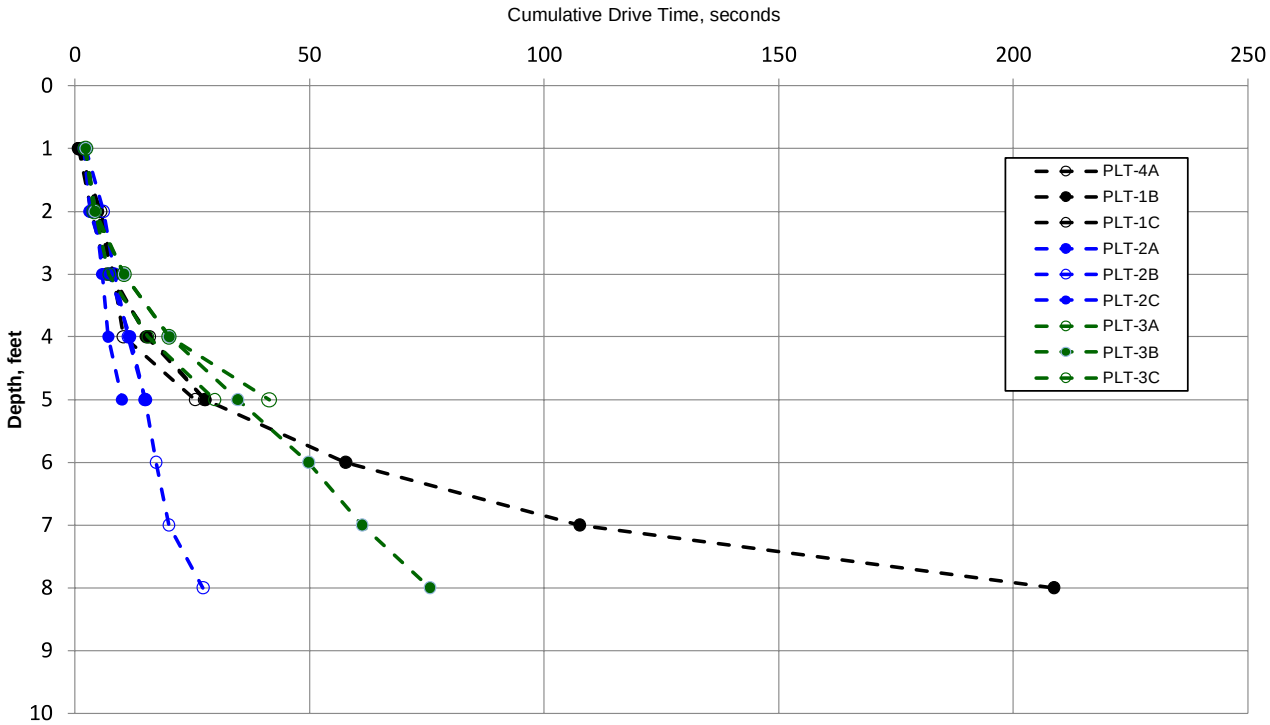
NOTES:

Piles advanced with a track mounted GAYK-HRE 4000 on July 26, 2022.

Terracon

TEST PILE DRIVING RECORDS

Rancho Viejo Solar Facility - 66225093



Depth, feet	Cumulative Driving Time, seconds								
	PLT-4A	PLT-1B	PLT-1C	PLT-2A	PLT-2B	PLT-2C	PLT-3A	PLT-3B	PLT-3C
1	0.8	0.9	0.7	1.9	2.3	2.1	2.1	2.3	2.2
2	3.5	4.9	5.5	3.2	6.1	4.3	4.3	4.3	4.1
3	6.8	7.9	8.1	7.4	8.4	5.8	7.2	10.5	10.4
4	15.9	15.2	10.3	11.6	11.3	7.1	15.5	20.1	20.0
5	27.6	27.8	25.6	15.0	14.9	10.0	29.8	34.7	41.4
6		57.7			17.3			49.8	
7		107.6			20.0			61.2	
8		208.7			27.3			75.7	
Note:									
Embedment Depth, ft	**5**	**8**	**5**	**5**	**8**	**5**	**5**	**8**	**5**
Total Drive Time, sec	**27.6**	**208.7**	**25.6**	**15.0**	**27.3**	**10.0**	**29.8**	**75.7**	**41.4**
Average, sec/ft	**5.5**	**26.1**	**5.1**	**3.0**	**3.4**	**2.0**	**6.0**	**9.5**	**8.3**

NOTES:

Piles advanced with a track mounted GAYK-HRE 4000 on July 26, 2022.

Terracon

APPENDIX F

PILE LOAD TESTING RESULTS – AXIAL COMPRESSIVE LOAD

Compression Load Test Result for PLT-102C

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillion Ed junior

Test Date and Representative

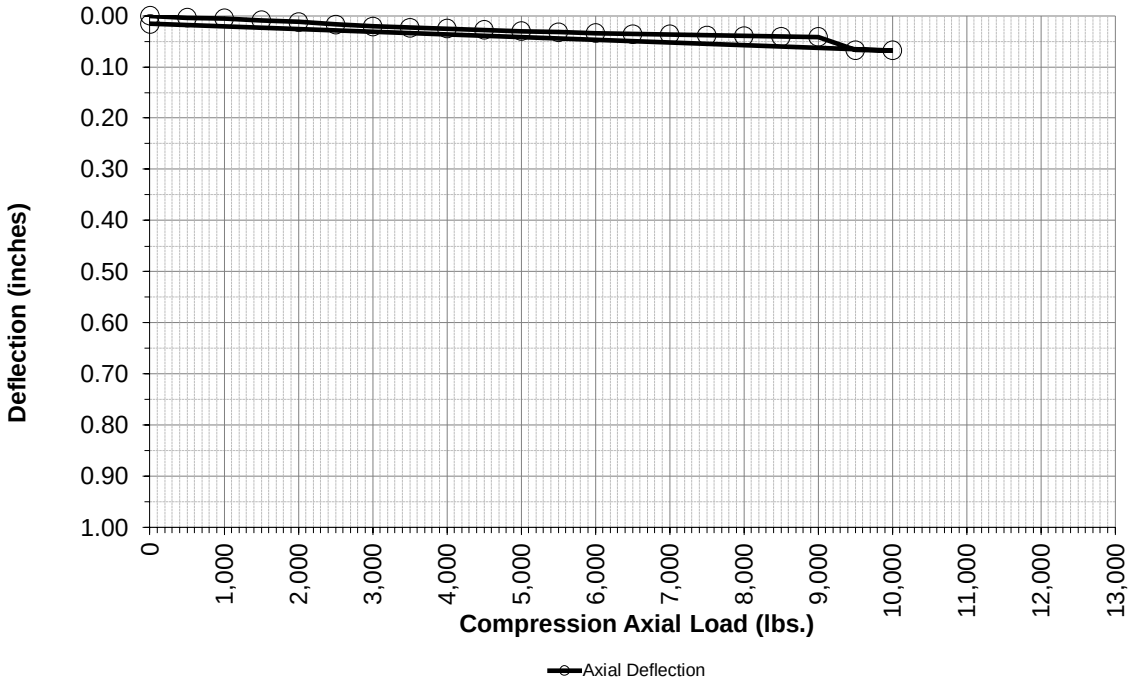
Tested By Terracon Rep:	ED/AR
Date Tested:	3/11/2024

Pile Information

Pile ID:	PLT-102C
Latitude [deg.]:	35.53980
Longitude [deg.]:	-106.00941
Pile Type:	W6X9
Pile Embedment Depth [in.]:	60
Pile Diameter [in.]:	6.5
Pile Stick-Up [in.]:	24
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	0

Compression Test Results

% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
5%	500	0.004	
10%	1,000	0.006	
15%	1,500	0.009	
20%	2,000	0.013	
25%	2,500	0.017	
30%	3,000	0.021	
35%	3,500	0.024	
40%	4,000	0.026	
45%	4,500	0.028	
50%	5,000	0.030	
55%	5,500	0.032	
60%	6,000	0.034	
65%	6,500	0.036	
70%	7,000	0.037	
75%	7,500	0.038	
80%	8,000	0.040	
85%	8,500	0.041	
90%	9,000	0.042	
95%	9,500	0.067	
100%	10,000	0.068	
0%	0	0.016	



Compression Load Test Result for PLT-110C

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillion Ed junior

Test Date and Representative

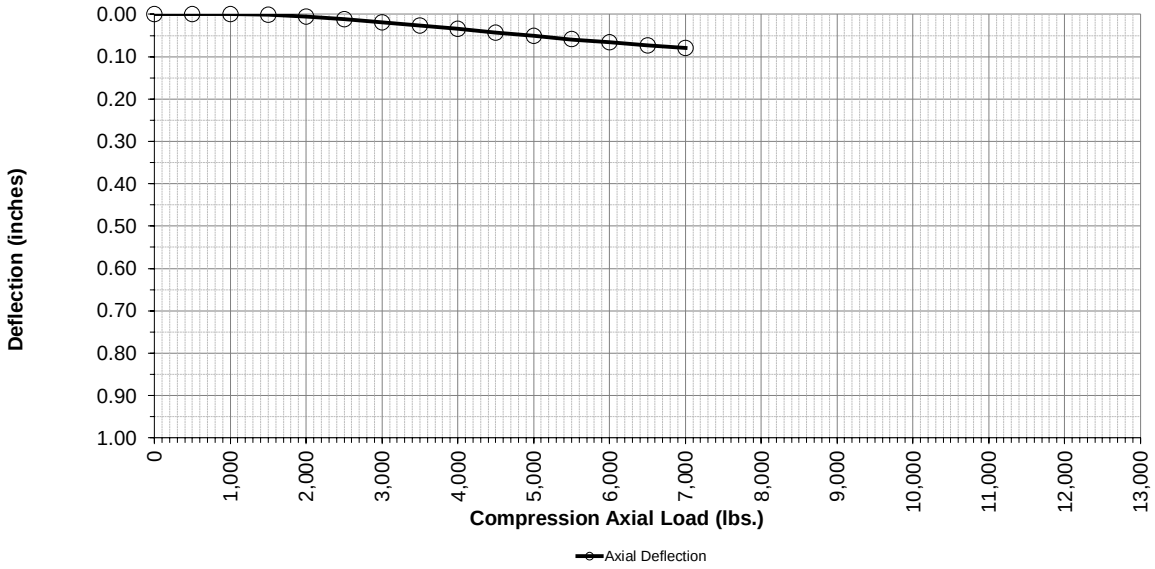
Tested By Terracon Rep:	ED/AR
Date Tested:	3/11/2024

Pile Information

Pile ID:	PLT-110C
Latitude [deg.]:	35.54438
Longitude [deg.]:	-106.01141
Pile Type:	W6X9
Pile Embedment Depth [in.]:	60
Pile Diameter [in.]:	6.5
Pile Stick-Up [in.]:	24
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	0

Compression Test Results

% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
5%	500	0.000	
10%	1,000	0.000	
15%	1,500	0.002	
20%	2,000	0.005	
25%	2,500	0.012	
30%	3,000	0.019	
35%	3,500	0.026	
40%	4,000	0.035	
45%	4,500	0.044	
50%	5,000	0.052	
55%	5,500	0.059	
60%	6,000	0.067	
65%	6,500	0.074	
70%	7,000	0.080	
75%	7,500		
80%	8,000		
85%	8,500		
90%	9,000		
95%	9,500		
100%	10,000		
0%	0		No return value - compression pile deformed



Compression Load Test Result for PLT-001C

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Custom Scale 25lb

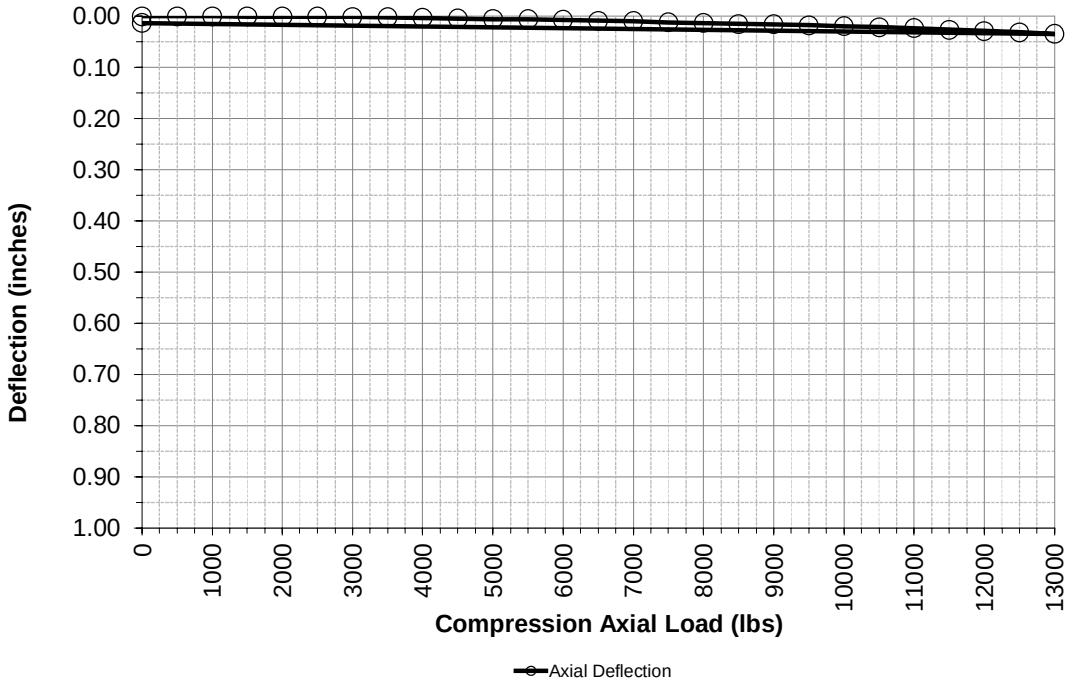
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-001C
Latitude:	35.55334
Longitude:	-106.01315
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	13000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	32.8

Compression Test Results			
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	0.000	
8%	1000	0.000	
12%	1500	0.001	
15%	2000	0.001	
19%	2500	0.001	
23%	3000	0.002	
27%	3500	0.003	
31%	4000	0.004	
35%	4500	0.005	
38%	5000	0.006	
42%	5500	0.006	
46%	6000	0.007	
50%	6500	0.009	
54%	7000	0.010	
58%	7500	0.012	
62%	8000	0.014	
65%	8500	0.015	
69%	9000	0.016	
73%	9500	0.018	
77%	10000	0.020	
81%	10500	0.022	
85%	11000	0.024	
88%	11500	0.027	
92%	12000	0.029	
96%	12500	0.032	
100%	13000	0.035	
0%	0	0.014	



Compression Load Test Result for PLT-002C

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Custom Scale 25lb

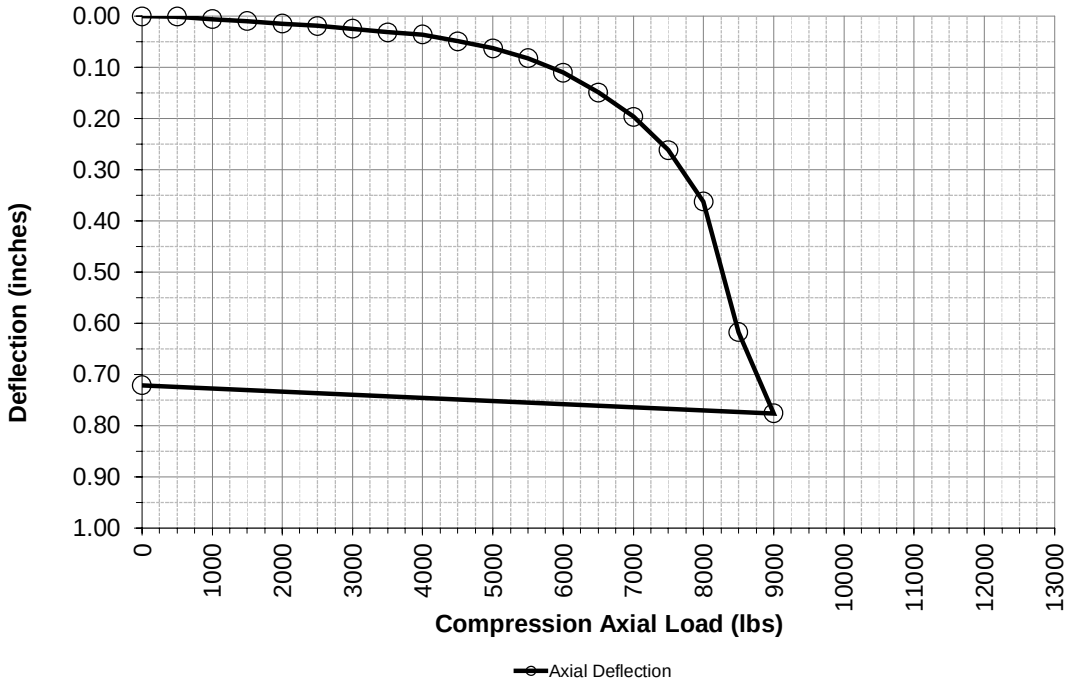
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-002C
Latitude:	35.55151
Longitude:	-106.00214
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	13000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	37.1

Compression Test Results			
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	0.001	
8%	1000	0.006	
12%	1500	0.010	
15%	2000	0.015	
19%	2500	0.019	
23%	3000	0.025	
27%	3500	0.032	
31%	4000	0.036	
35%	4500	0.049	
38%	5000	0.063	
42%	5500	0.083	
46%	6000	0.110	
50%	6500	0.149	
54%	7000	0.197	
58%	7500	0.262	
62%	8000	0.362	
65%	8500	0.618	
69%	9000	0.776	
73%	9500		
77%	10000		
81%	10500		
85%	11000		
88%	11500		
92%	12000		
96%	12500		
100%	13000		
0%	0	0.721	



Compression Load Test Result for PLT-003C

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Custom Scale 25lb

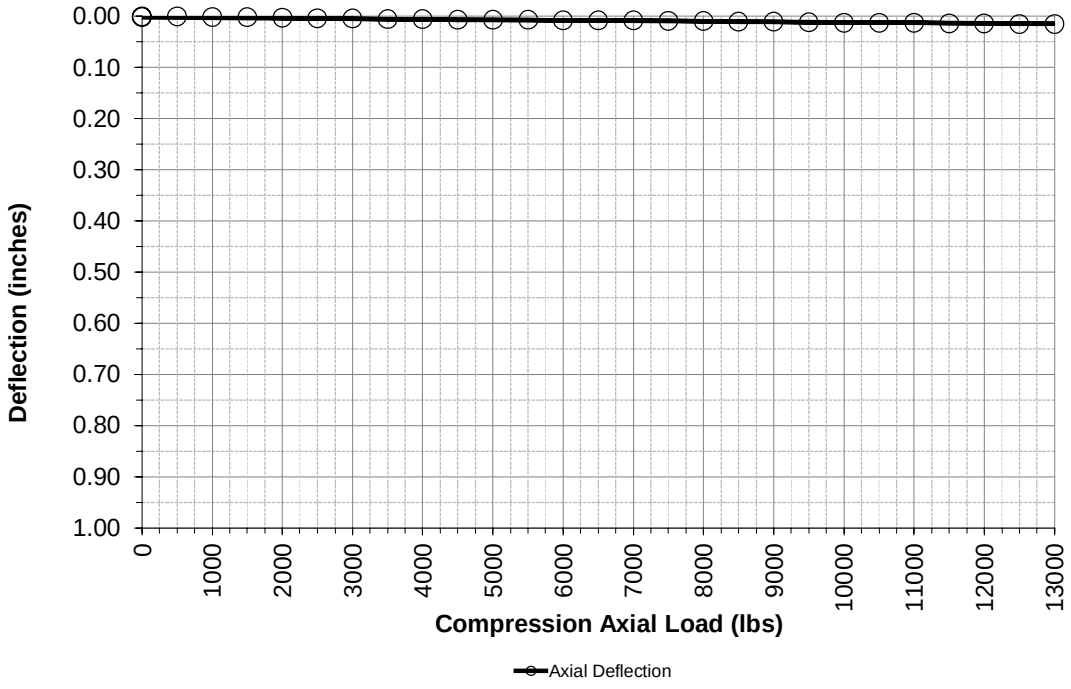
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-003C
Latitude:	35.54711
Longitude:	-106.01618
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	13000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	61.2

Compression Test Results			
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	0.001	
8%	1000	0.002	
12%	1500	0.002	
15%	2000	0.003	
19%	2500	0.004	
23%	3000	0.005	
27%	3500	0.006	
31%	4000	0.006	
35%	4500	0.007	
38%	5000	0.008	
42%	5500	0.008	
46%	6000	0.008	
50%	6500	0.008	
54%	7000	0.009	
58%	7500	0.009	
62%	8000	0.010	
65%	8500	0.011	
69%	9000	0.011	
73%	9500	0.012	
77%	10000	0.013	
81%	10500	0.013	
85%	11000	0.013	
88%	11500	0.014	
92%	12000	0.014	
96%	12500	0.015	
100%	13000	0.015	
0%	0	0.002	



Compression Load Test Result for PLT-004C

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Custom Scale 25lb

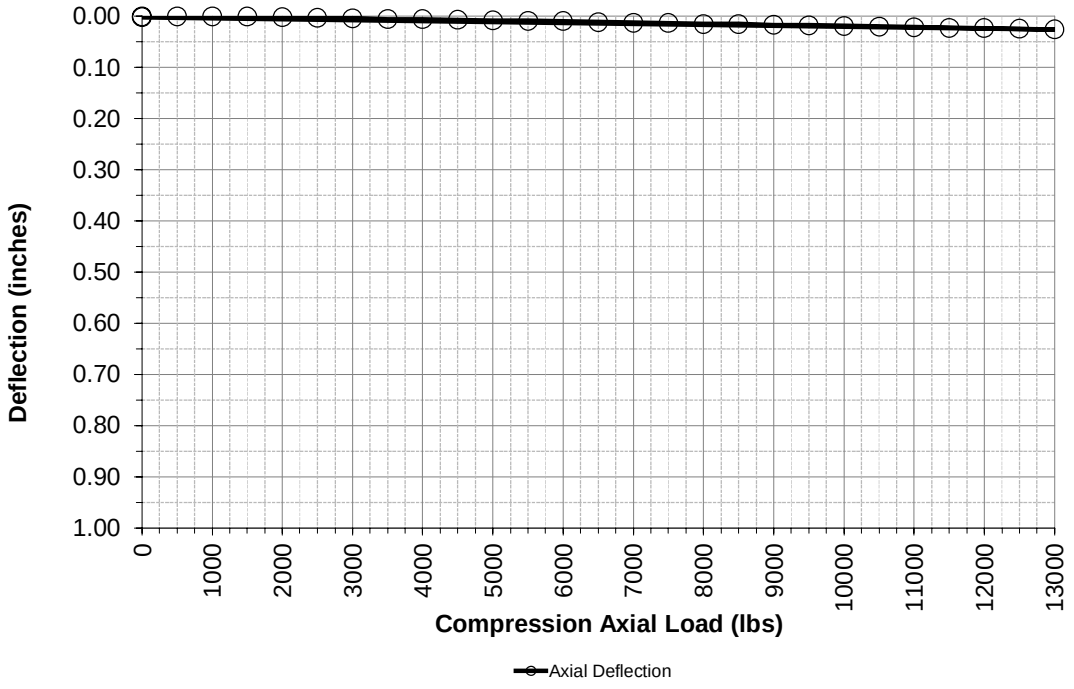
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-004C
Latitude:	35.54296
Longitude:	-106.03023
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	13000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	25.64

Compression Test Results			
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	0.000	
8%	1000	0.001	
12%	1500	0.001	
15%	2000	0.002	
19%	2500	0.004	
23%	3000	0.004	
27%	3500	0.006	
31%	4000	0.006	
35%	4500	0.008	
38%	5000	0.008	
42%	5500	0.009	
46%	6000	0.010	
50%	6500	0.012	
54%	7000	0.013	
58%	7500	0.014	
62%	8000	0.015	
65%	8500	0.016	
69%	9000	0.017	
73%	9500	0.018	
77%	10000	0.019	
81%	10500	0.020	
85%	11000	0.022	
88%	11500	0.023	
92%	12000	0.024	
96%	12500	0.025	
100%	13000	0.026	
0%	0	0.002	



Compression Load Test Result for PLT-005C

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Custom Scale 25lb

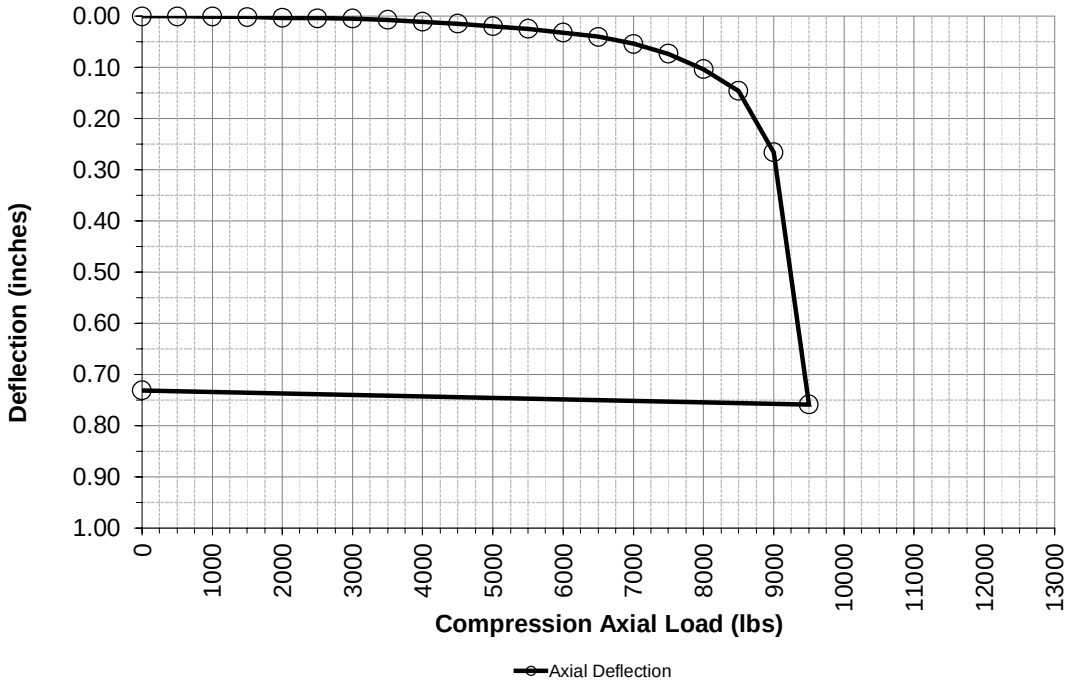
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-005C
Latitude:	35.53853
Longitude:	-106.01312
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	13000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	10

Compression Test Results			
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	0.000	
8%	1000	0.001	
12%	1500	0.002	
15%	2000	0.003	
19%	2500	0.004	
23%	3000	0.005	
27%	3500	0.007	
31%	4000	0.011	
35%	4500	0.015	
38%	5000	0.020	
42%	5500	0.025	
46%	6000	0.032	
50%	6500	0.041	
54%	7000	0.054	
58%	7500	0.073	
62%	8000	0.104	
65%	8500	0.146	
69%	9000	0.266	
73%	9500	0.759	
77%	10000		
81%	10500		
85%	11000		
88%	11500		
92%	12000		
96%	12500		
100%	13000		
0%	0	0.732	



Compression Load Test Result for PLT-006C

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Custom Scale 25lb

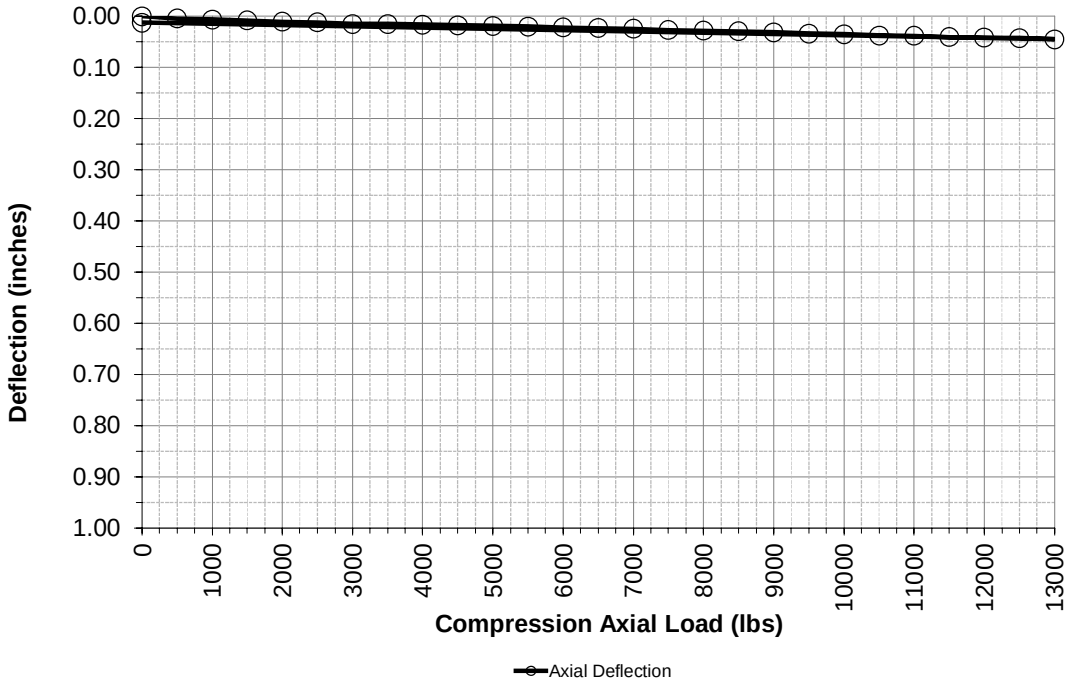
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/26/2022

Pile Information

Pile ID:	PLT-006C
Latitude:	35.54313
Longitude:	-106.00830
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	13000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	41.4

Compression Test Results			
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
4%	500	0.005	
8%	1000	0.007	
12%	1500	0.008	
15%	2000	0.011	
19%	2500	0.012	
23%	3000	0.015	
27%	3500	0.015	
31%	4000	0.017	
35%	4500	0.018	
38%	5000	0.019	
42%	5500	0.021	
46%	6000	0.022	
50%	6500	0.023	
54%	7000	0.025	
58%	7500	0.027	
62%	8000	0.029	
65%	8500	0.030	
69%	9000	0.032	
73%	9500	0.034	
77%	10000	0.036	
81%	10500	0.038	
85%	11000	0.039	
88%	11500	0.041	
92%	12000	0.042	
96%	12500	0.043	
100%	13000	0.046	
0%	0	0.013	



APPENDIX G
PILE LOAD TESTING RESULTS – AXIAL TENSILE LOAD

Tension Load Test Result for PLT-101A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

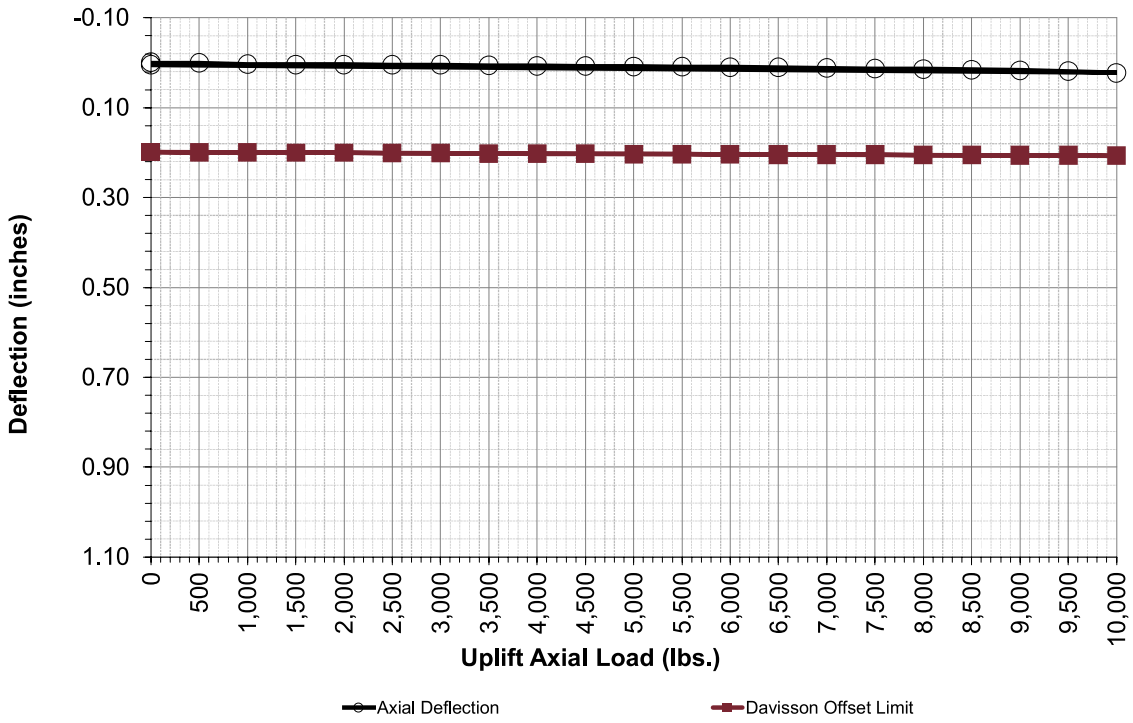
Test Date and Representative

Tested By Terracon Rep:	SL/MGB/ED
Date Tested:	9/23/2023

Pile Information

Pile ID:	PLT-101A
Latitude [deg.]:	35.54106
Longitude[deg.]:	-106.01558
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	90.3

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.001	0.000	0.200	
10%	1000	0.003	0.001	0.200	
15%	1500	0.004	0.001	0.200	
20%	2000	0.004	0.002	0.201	
25%	2500	0.005	0.002	0.201	
30%	3000	0.005	0.002	0.201	
35%	3500	0.006	0.003	0.202	
40%	4000	0.007	0.003	0.202	
45%	4500	0.008	0.003	0.203	
50%	5000	0.008	0.004	0.203	
55%	5500	0.009	0.004	0.203	
60%	6000	0.010	0.005	0.204	
65%	6500	0.011	0.005	0.204	
70%	7000	0.012	0.005	0.205	
75%	7500	0.013	0.006	0.205	
80%	8000	0.014	0.006	0.205	
85%	8500	0.015	0.007	0.206	
90%	9000	0.017	0.007	0.206	
95%	9500	0.019	0.007	0.207	
100%	10000	0.022	0.008	0.207	
0%	0	0.005	0.000	0.199	



Tension Load Test Result for PLT-101B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

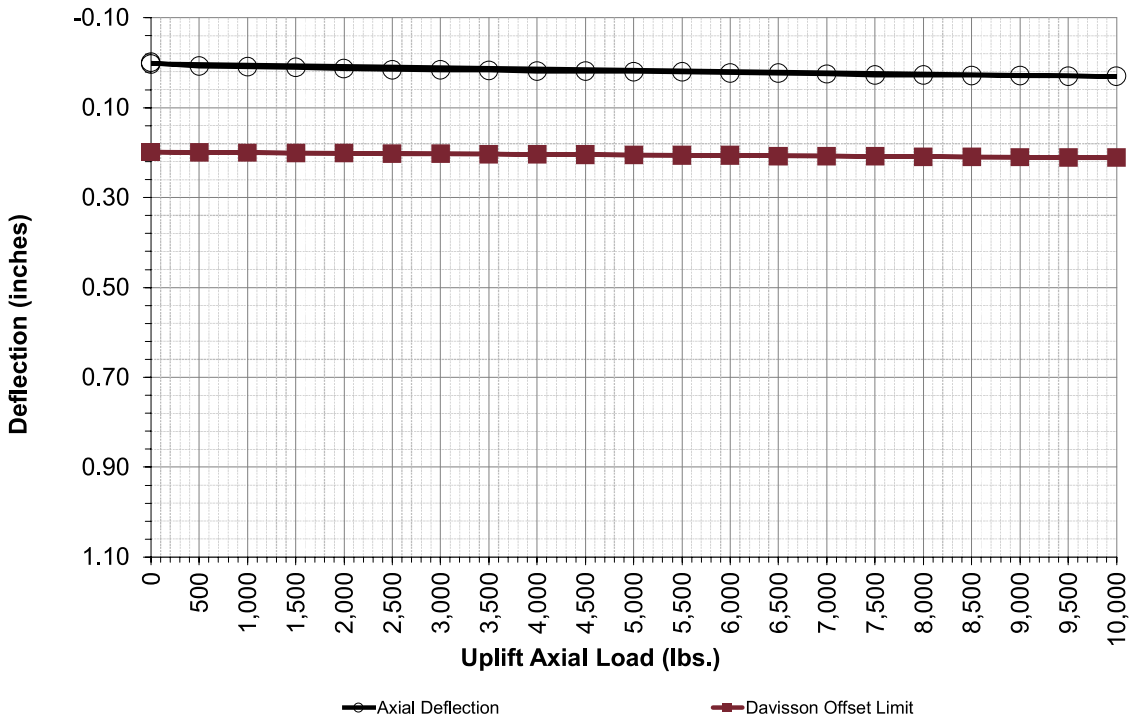
Test Date and Representative

Tested By Terracon Rep:	SL/MGB/ED
Date Tested:	9/23/2023

Pile Information

Pile ID:	PLT-101B
Latitude [deg.]:	35.54106
Longitude[deg.]:	-106.01558
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	26.1

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.008	0.001	0.200	
10%	1000	0.009	0.001	0.200	
15%	1500	0.011	0.002	0.201	
20%	2000	0.013	0.002	0.202	
25%	2500	0.015	0.003	0.202	
30%	3000	0.016	0.004	0.203	
35%	3500	0.017	0.004	0.203	
40%	4000	0.019	0.005	0.204	
45%	4500	0.019	0.006	0.205	
50%	5000	0.020	0.006	0.205	
55%	5500	0.021	0.007	0.206	
60%	6000	0.023	0.007	0.207	
65%	6500	0.024	0.008	0.207	
70%	7000	0.026	0.009	0.208	
75%	7500	0.027	0.009	0.208	
80%	8000	0.028	0.010	0.209	
85%	8500	0.028	0.010	0.210	
90%	9000	0.029	0.011	0.210	
95%	9500	0.030	0.012	0.211	
100%	10000	0.030	0.012	0.212	
0%	0	0.002	0.000	0.199	



Tension Load Test Result for PLT-102A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

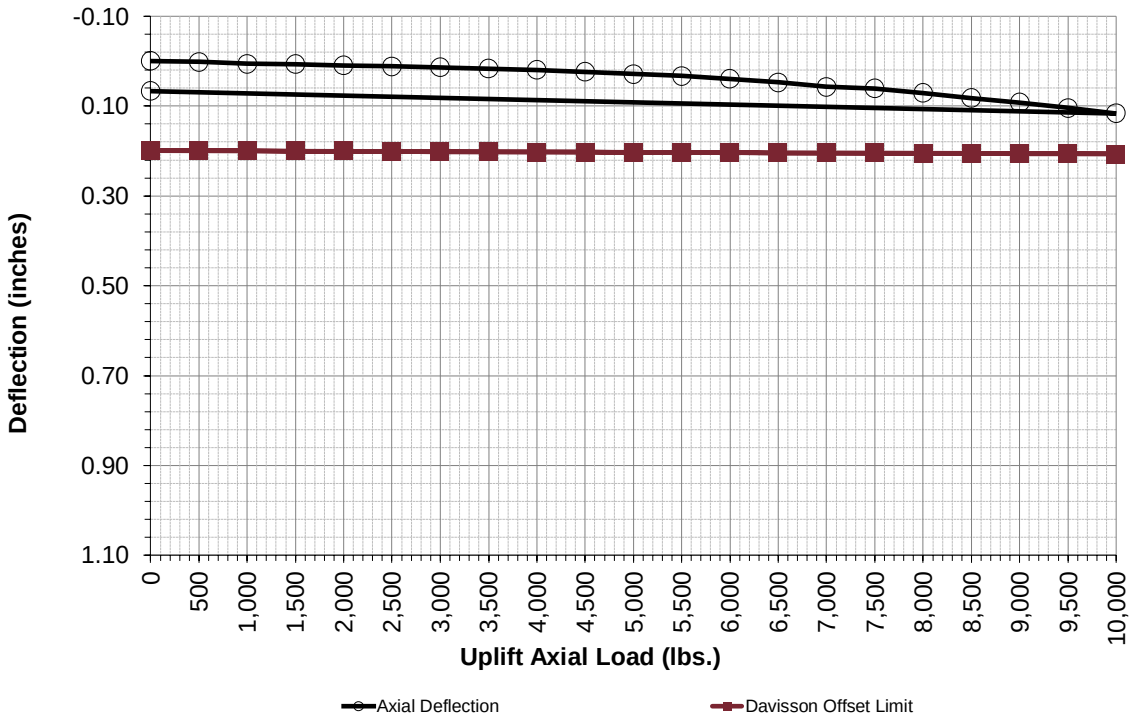
Test Date and Representative

Tested By Terracon Rep:	ED/TS
Date Tested:	3/7/2024

Pile Information

Pile ID:	PLT-102A
Latitude [deg.]:	35.53980
Longitude[deg.]:	-106.00941
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	0

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.002	0.000	0.200	
10%	1000	0.006	0.001	0.200	
15%	1500	0.007	0.001	0.200	
20%	2000	0.010	0.002	0.201	
25%	2500	0.012	0.002	0.201	
30%	3000	0.014	0.002	0.201	
35%	3500	0.017	0.003	0.202	
40%	4000	0.020	0.003	0.202	
45%	4500	0.024	0.003	0.203	
50%	5000	0.029	0.004	0.203	
55%	5500	0.033	0.004	0.203	
60%	6000	0.039	0.005	0.204	
65%	6500	0.047	0.005	0.204	
70%	7000	0.057	0.005	0.205	
75%	7500	0.061	0.006	0.205	
80%	8000	0.071	0.006	0.205	
85%	8500	0.083	0.007	0.206	
90%	9000	0.092	0.007	0.206	
95%	9500	0.104	0.007	0.207	
100%	10000	0.116	0.008	0.207	
0%	0	0.067	0.000	0.199	



Tension Load Test Result for PLT-102B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

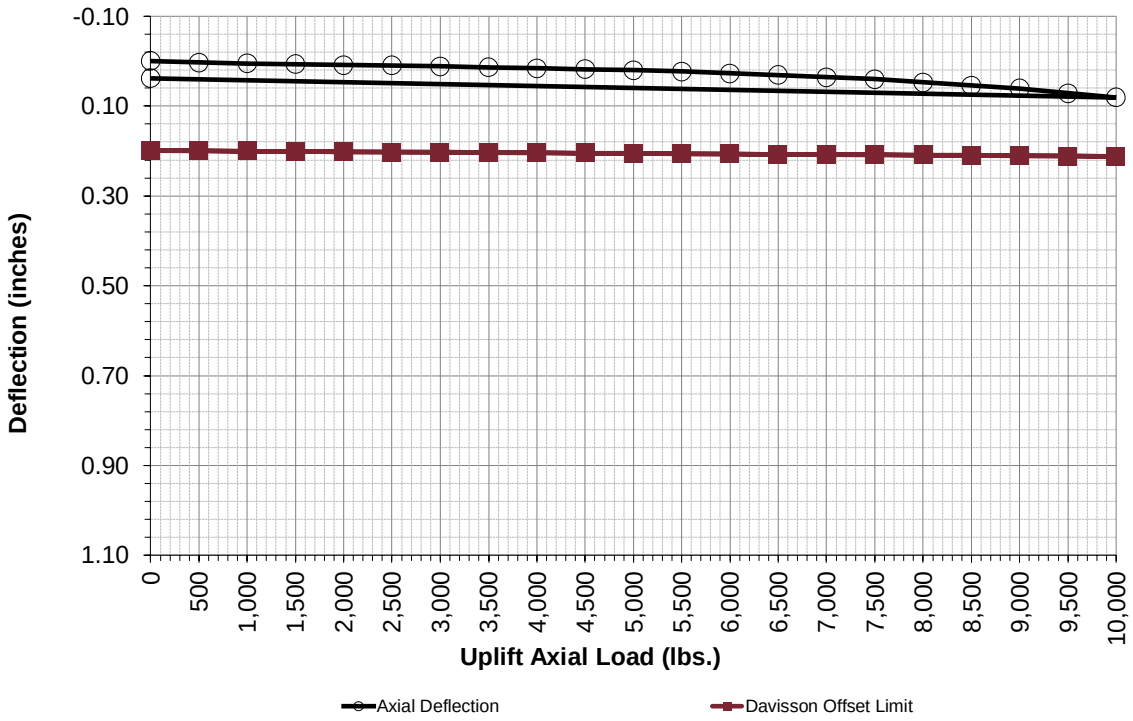
Test Date and Representative

Tested By Terracon Rep:	ED/TS
Date Tested:	3/7/2024

Pile Information

Pile ID:	PLT-102B
Latitude [deg.]:	35.53980
Longitude[deg.]:	-106.00941
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	0

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.003	0.001	0.200	
10%	1000	0.005	0.001	0.200	
15%	1500	0.007	0.002	0.201	
20%	2000	0.009	0.002	0.202	
25%	2500	0.010	0.003	0.202	
30%	3000	0.012	0.004	0.203	
35%	3500	0.014	0.004	0.203	
40%	4000	0.016	0.005	0.204	
45%	4500	0.018	0.006	0.205	
50%	5000	0.020	0.006	0.205	
55%	5500	0.023	0.007	0.206	
60%	6000	0.027	0.007	0.207	
65%	6500	0.031	0.008	0.207	
70%	7000	0.036	0.009	0.208	
75%	7500	0.041	0.009	0.208	
80%	8000	0.047	0.010	0.209	
85%	8500	0.055	0.010	0.210	
90%	9000	0.061	0.011	0.210	
95%	9500	0.072	0.012	0.211	
100%	10000	0.081	0.012	0.212	
0%	0	0.038	0.000	0.199	



Tension Load Test Result for PLT-103A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

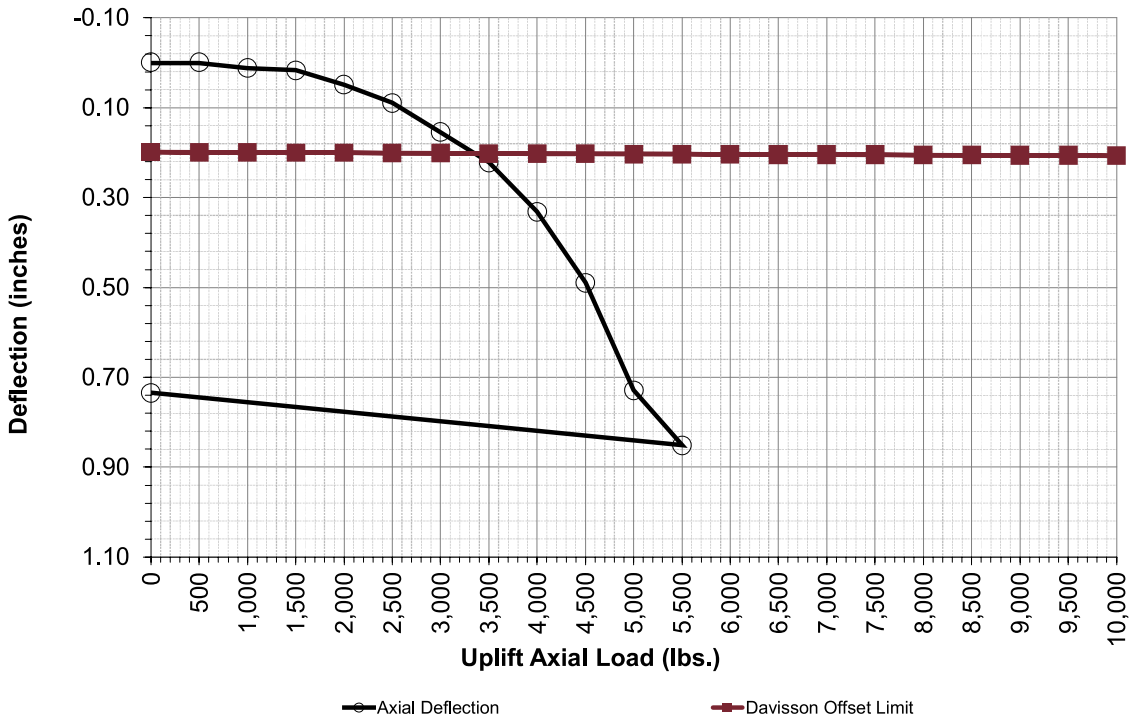
Test Date and Representative

Tested By Terracon Rep:	SL/SS
Date Tested:	9/27/2023

Pile Information

Pile ID:	PLT-103A
Latitude [deg.]:	35.54149
Longitude[deg.]:	106.00401
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	5.8

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.000	0.000	0.200	
10%	1000	0.012	0.001	0.200	
15%	1500	0.017	0.001	0.200	
20%	2000	0.049	0.002	0.201	
25%	2500	0.090	0.002	0.201	
30%	3000	0.155	0.002	0.201	
35%	3500	0.222	0.003	0.202	
40%	4000	0.332	0.003	0.202	
45%	4500	0.490	0.003	0.203	
50%	5000	0.729	0.004	0.203	
55%	5500	0.852	0.004	0.203	
60%	6000		0.005	0.204	
65%	6500		0.005	0.204	
70%	7000		0.005	0.205	
75%	7500		0.006	0.205	
80%	8000		0.006	0.205	
85%	8500		0.007	0.206	
90%	9000		0.007	0.206	
95%	9500		0.007	0.207	
100%	10000		0.008	0.207	
0%	0	0.735	0.000	0.199	



Tension Load Test Result for PLT-103B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

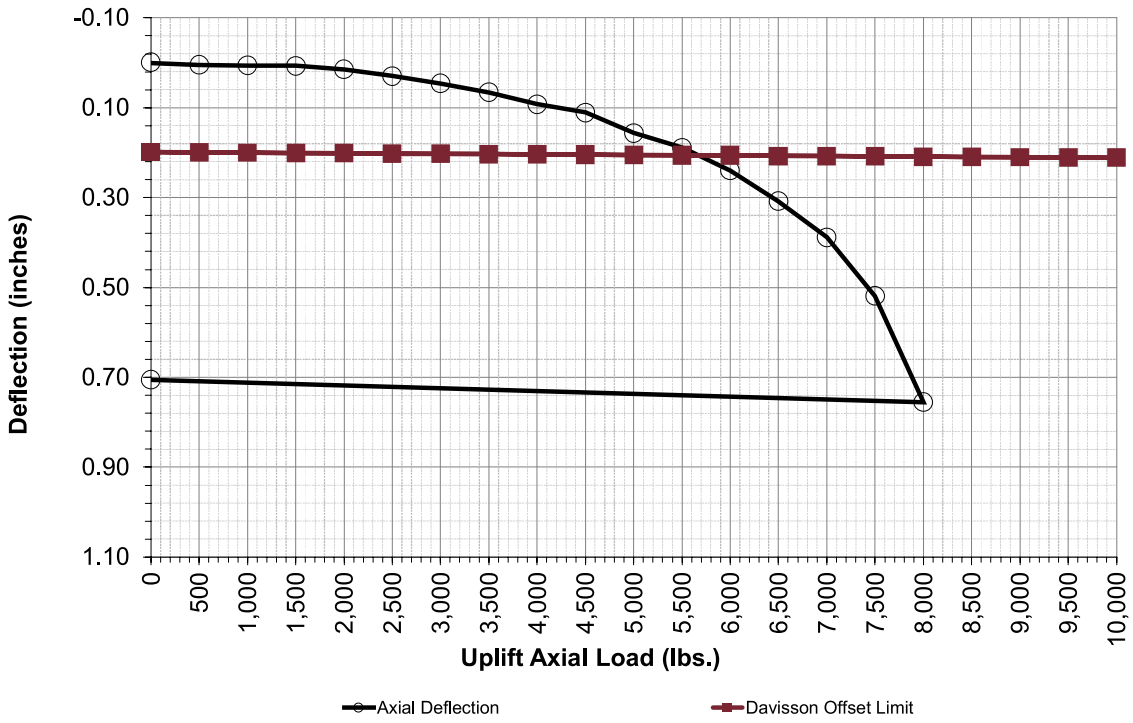
Test Date and Representative

Tested By Terracon Rep:	SL/SS
Date Tested:	9/27/2023

Pile Information

Pile ID:	PLT-103B
Latitude [deg.]:	35.54149
Longitude[deg.]:	106.00401
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	11.3

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.005	0.001	0.200	
10%	1000	0.006	0.001	0.200	
15%	1500	0.007	0.002	0.201	
20%	2000	0.015	0.002	0.202	
25%	2500	0.030	0.003	0.202	
30%	3000	0.046	0.004	0.203	
35%	3500	0.066	0.004	0.203	
40%	4000	0.092	0.005	0.204	
45%	4500	0.111	0.006	0.205	
50%	5000	0.156	0.006	0.205	
55%	5500	0.189	0.007	0.206	
60%	6000	0.240	0.007	0.207	
65%	6500	0.308	0.008	0.207	
70%	7000	0.388	0.009	0.208	
75%	7500	0.519	0.009	0.208	
80%	8000	0.755	0.010	0.209	
85%	8500		0.010	0.210	
90%	9000		0.011	0.210	
95%	9500		0.012	0.211	
100%	10000		0.012	0.212	
0%	0	0.706	0.000	0.199	



Tension Load Test Result for PLT-104A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

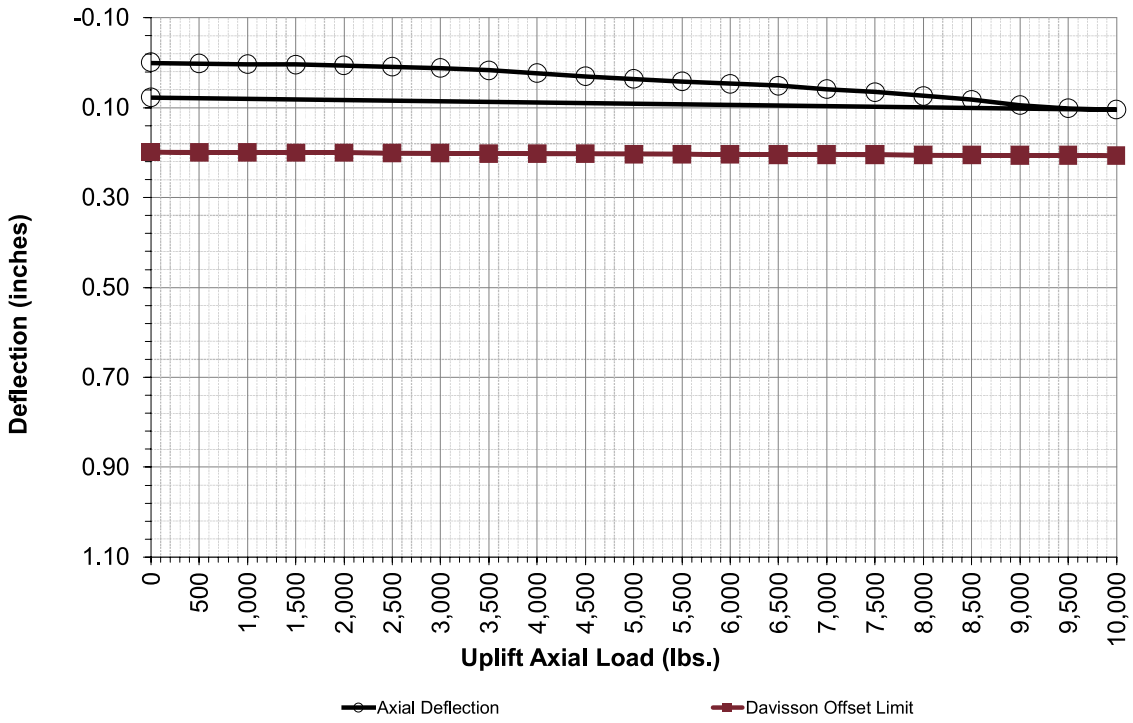
Test Date and Representative

Tested By Terracon Rep:	SL/SS
Date Tested:	9/27/2023

Pile Information

Pile ID:	PLT-104A
Latitude [deg.]:	35.54444
Longitude[deg.]:	106.00578
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	5.3

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.002	0.000	0.200	
10%	1000	0.003	0.001	0.200	
15%	1500	0.004	0.001	0.200	
20%	2000	0.006	0.002	0.201	
25%	2500	0.009	0.002	0.201	
30%	3000	0.012	0.002	0.201	
35%	3500	0.017	0.003	0.202	
40%	4000	0.023	0.003	0.202	
45%	4500	0.031	0.003	0.203	
50%	5000	0.036	0.004	0.203	
55%	5500	0.042	0.004	0.203	
60%	6000	0.047	0.005	0.204	
65%	6500	0.051	0.005	0.204	
70%	7000	0.059	0.005	0.205	
75%	7500	0.065	0.006	0.205	
80%	8000	0.074	0.006	0.205	
85%	8500	0.082	0.007	0.206	
90%	9000	0.095	0.007	0.206	
95%	9500	0.102	0.007	0.207	
100%	10000	0.105	0.008	0.207	
0%	0	0.078	0.000	0.199	



Tension Load Test Result for PLT-104B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

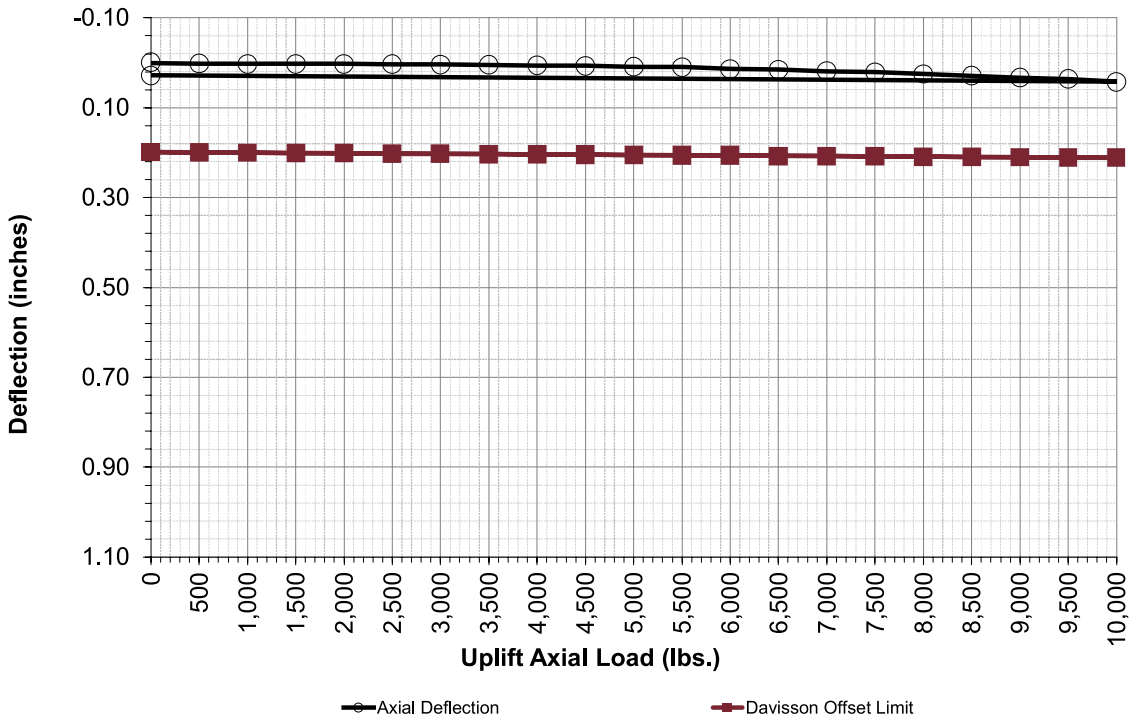
Test Date and Representative

Tested By Terracon Rep:	SL/SS
Date Tested:	9/27/2023

Pile Information

Pile ID:	PLT-104B
Latitude [deg.]:	35.54444
Longitude[deg.]:	106.00578
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	16

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.002	0.001	0.200	
10%	1000	0.003	0.001	0.200	
15%	1500	0.003	0.002	0.201	
20%	2000	0.003	0.002	0.202	
25%	2500	0.003	0.003	0.202	
30%	3000	0.004	0.004	0.203	
35%	3500	0.005	0.004	0.203	
40%	4000	0.006	0.005	0.204	
45%	4500	0.007	0.006	0.205	
50%	5000	0.009	0.006	0.205	
55%	5500	0.010	0.007	0.206	
60%	6000	0.014	0.007	0.207	
65%	6500	0.015	0.008	0.207	
70%	7000	0.019	0.009	0.208	
75%	7500	0.021	0.009	0.208	
80%	8000	0.026	0.010	0.209	
85%	8500	0.029	0.010	0.210	
90%	9000	0.034	0.011	0.210	
95%	9500	0.036	0.012	0.211	
100%	10000	0.042	0.012	0.212	
0%	0	0.028	0.000	0.199	



Tension Load Test Result for PLT-105A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

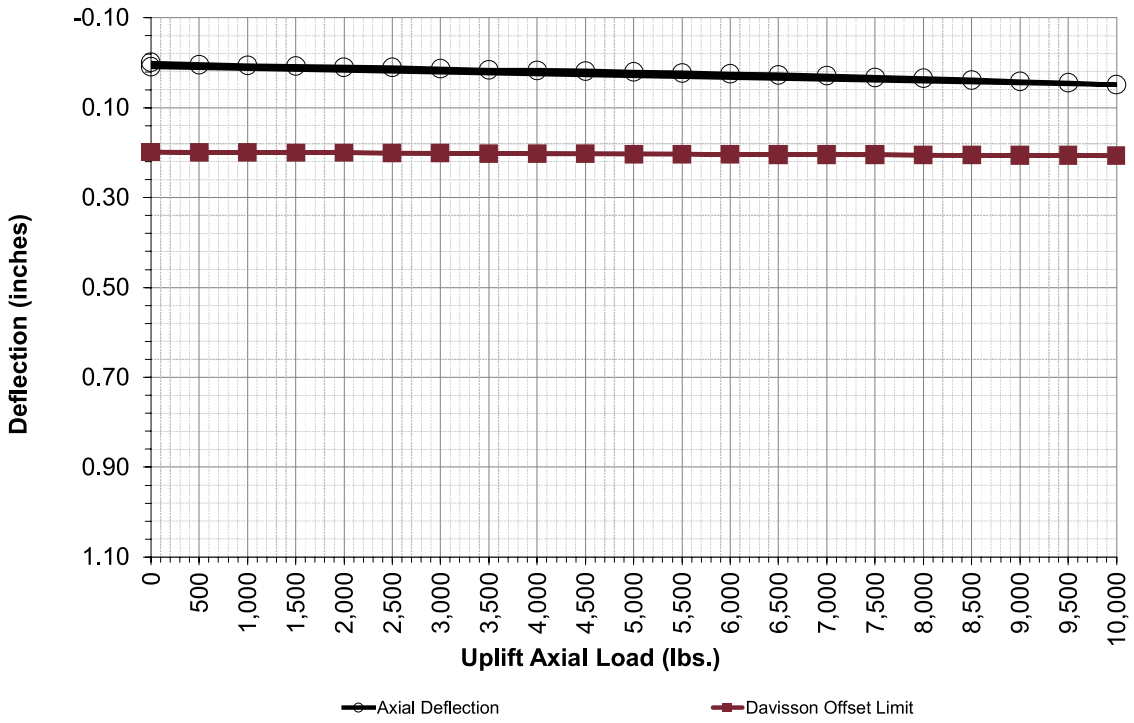
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-105A
Latitude [deg.]:	35.54761
Longitude[deg.]:	106.00262
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	20.8

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.004	0.000	0.200	
10%	1000	0.006	0.001	0.200	
15%	1500	0.008	0.001	0.200	
20%	2000	0.010	0.002	0.201	
25%	2500	0.011	0.002	0.201	
30%	3000	0.013	0.002	0.201	
35%	3500	0.016	0.003	0.202	
40%	4000	0.017	0.003	0.202	
45%	4500	0.018	0.003	0.203	
50%	5000	0.020	0.004	0.203	
55%	5500	0.022	0.004	0.203	
60%	6000	0.025	0.005	0.204	
65%	6500	0.027	0.005	0.204	
70%	7000	0.029	0.005	0.205	
75%	7500	0.032	0.006	0.205	
80%	8000	0.035	0.006	0.205	
85%	8500	0.039	0.007	0.206	
90%	9000	0.042	0.007	0.206	
95%	9500	0.045	0.007	0.207	
100%	10000	0.049	0.008	0.207	
0%	0	0.009	0.000	0.199	



Tension Load Test Result for PLT-105B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

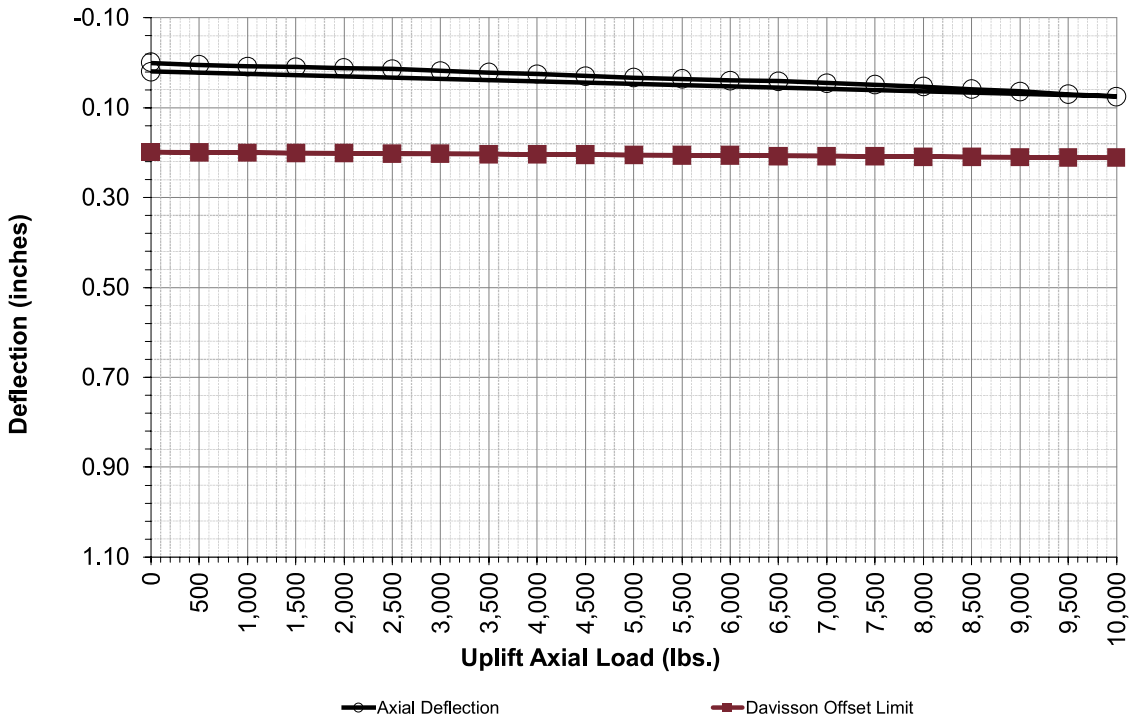
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-105B
Latitude [deg.]:	35.54761
Longitude[deg.]:	106.00262
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	57

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.005	0.001	0.200	
10%	1000	0.008	0.001	0.200	
15%	1500	0.010	0.002	0.201	
20%	2000	0.012	0.002	0.202	
25%	2500	0.014	0.003	0.202	
30%	3000	0.018	0.004	0.203	
35%	3500	0.022	0.004	0.203	
40%	4000	0.026	0.005	0.204	
45%	4500	0.030	0.006	0.205	
50%	5000	0.033	0.006	0.205	
55%	5500	0.036	0.007	0.206	
60%	6000	0.039	0.007	0.207	
65%	6500	0.041	0.008	0.207	
70%	7000	0.046	0.009	0.208	
75%	7500	0.049	0.009	0.208	
80%	8000	0.053	0.010	0.209	
85%	8500	0.059	0.010	0.210	
90%	9000	0.064	0.011	0.210	
95%	9500	0.070	0.012	0.211	
100%	10000	0.075	0.012	0.212	
0%	0	0.020	0.000	0.199	



Tension Load Test Result for PLT-106A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

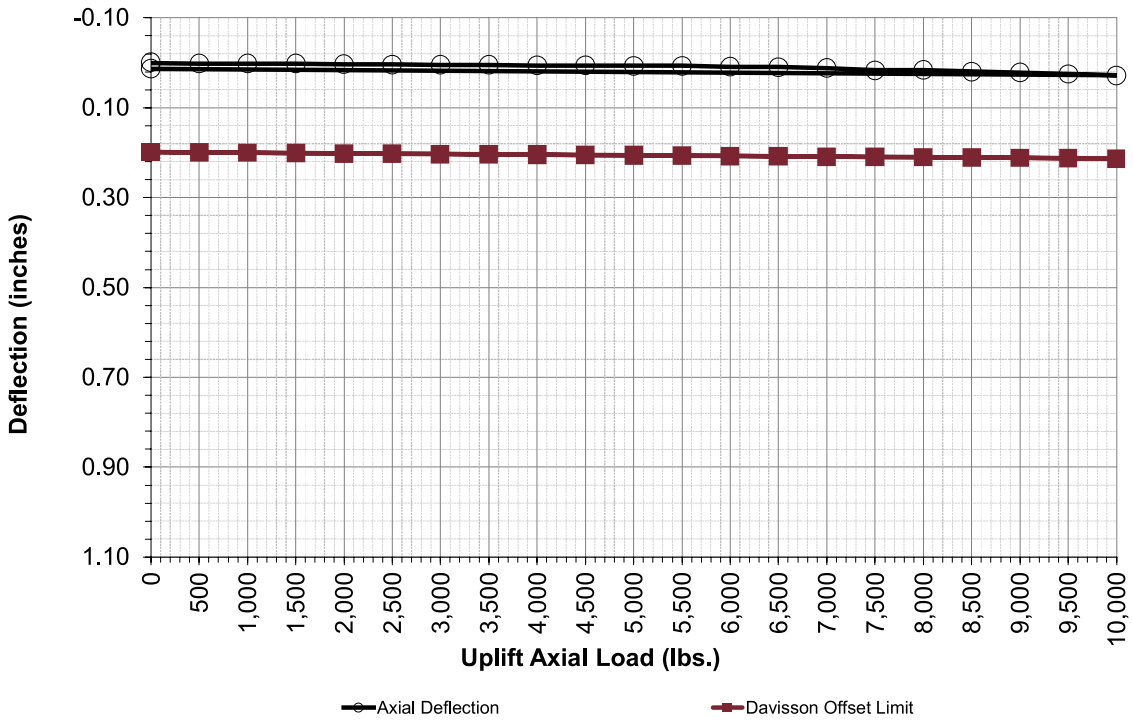
Test Date and Representative

Tested By Terracon Rep:	SL/JPS
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-106A
Latitude [deg.]:	35.54803
Longitude[deg.]:	106.00973
Pile Type:	W6x9
Pile Embedment Depth [in.]:	108
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	36
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	21.5

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.002	0.001	0.200	
10%	1000	0.002	0.001	0.201	
15%	1500	0.002	0.002	0.201	
20%	2000	0.003	0.003	0.202	
25%	2500	0.004	0.003	0.203	
30%	3000	0.005	0.004	0.203	
35%	3500	0.005	0.005	0.204	
40%	4000	0.006	0.006	0.205	
45%	4500	0.006	0.006	0.205	
50%	5000	0.007	0.007	0.206	
55%	5500	0.007	0.008	0.207	
60%	6000	0.009	0.008	0.208	
65%	6500	0.010	0.009	0.208	
70%	7000	0.012	0.010	0.209	
75%	7500	0.017	0.010	0.210	
80%	8000	0.016	0.011	0.210	
85%	8500	0.020	0.012	0.211	
90%	9000	0.022	0.013	0.212	
95%	9500	0.025	0.013	0.212	
100%	10000	0.028	0.014	0.213	
0%	0	0.013	0.000	0.199	



Tension Load Test Result for PLT-106B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

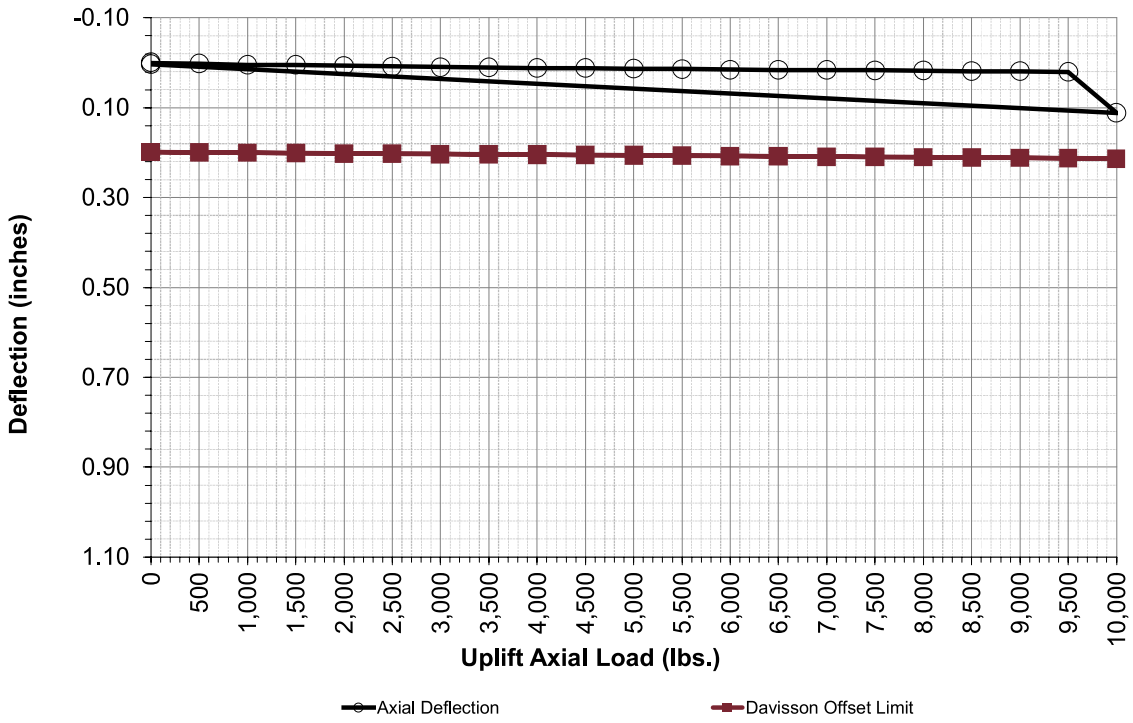
Test Date and Representative

Tested By Terracon Rep:	SL/JPS
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-106B
Latitude [deg.]:	35.54803
Longitude[deg.]:	106.00973
Pile Type:	W6x9
Pile Embedment Depth [in.]:	108
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	36
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	50.3

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.002	0.001	0.200	
10%	1000	0.005	0.001	0.201	
15%	1500	0.005	0.002	0.201	
20%	2000	0.007	0.003	0.202	
25%	2500	0.008	0.003	0.203	
30%	3000	0.010	0.004	0.203	
35%	3500	0.011	0.005	0.204	
40%	4000	0.012	0.006	0.205	
45%	4500	0.012	0.006	0.205	
50%	5000	0.013	0.007	0.206	
55%	5500	0.014	0.008	0.207	
60%	6000	0.015	0.008	0.208	
65%	6500	0.016	0.009	0.208	
70%	7000	0.016	0.010	0.209	
75%	7500	0.017	0.010	0.210	
80%	8000	0.018	0.011	0.210	
85%	8500	0.019	0.012	0.211	
90%	9000	0.019	0.013	0.212	
95%	9500	0.020	0.013	0.212	
100%	10000	0.112	0.014	0.213	
0%	0	0.003	0.000	0.199	



Tension Load Test Result for PLT-107A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

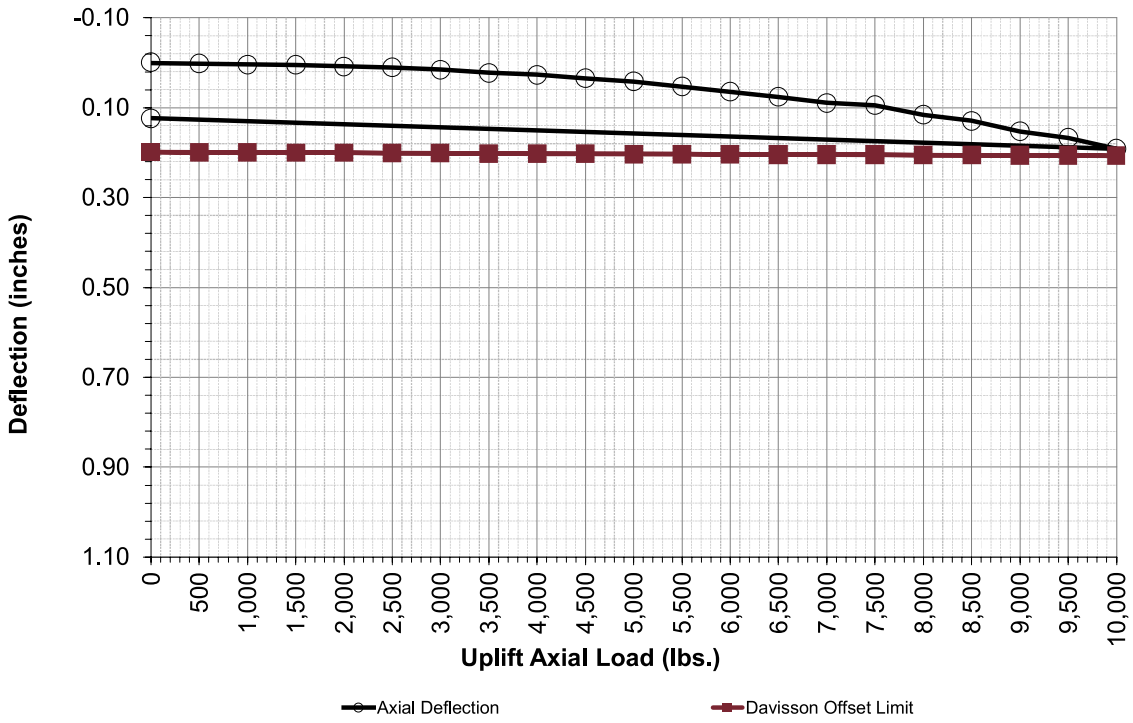
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/4/2023

Pile Information

Pile ID:	PLT-107A
Latitude [deg.]:	35.54924
Longitude[deg.]:	106.01518
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	12.9

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.002	0.000	0.200	
10%	1000	0.004	0.001	0.200	
15%	1500	0.005	0.001	0.200	
20%	2000	0.008	0.002	0.201	
25%	2500	0.011	0.002	0.201	
30%	3000	0.015	0.002	0.201	
35%	3500	0.022	0.003	0.202	
40%	4000	0.027	0.003	0.202	
45%	4500	0.035	0.003	0.203	
50%	5000	0.042	0.004	0.203	
55%	5500	0.053	0.004	0.203	
60%	6000	0.065	0.005	0.204	
65%	6500	0.076	0.005	0.204	
70%	7000	0.089	0.005	0.205	
75%	7500	0.095	0.006	0.205	
80%	8000	0.116	0.006	0.205	
85%	8500	0.129	0.007	0.206	
90%	9000	0.153	0.007	0.206	
95%	9500	0.167	0.007	0.207	
100%	10000	0.191	0.008	0.207	
0%	0	0.124	0.000	0.199	



Tension Load Test Result for PLT-107B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

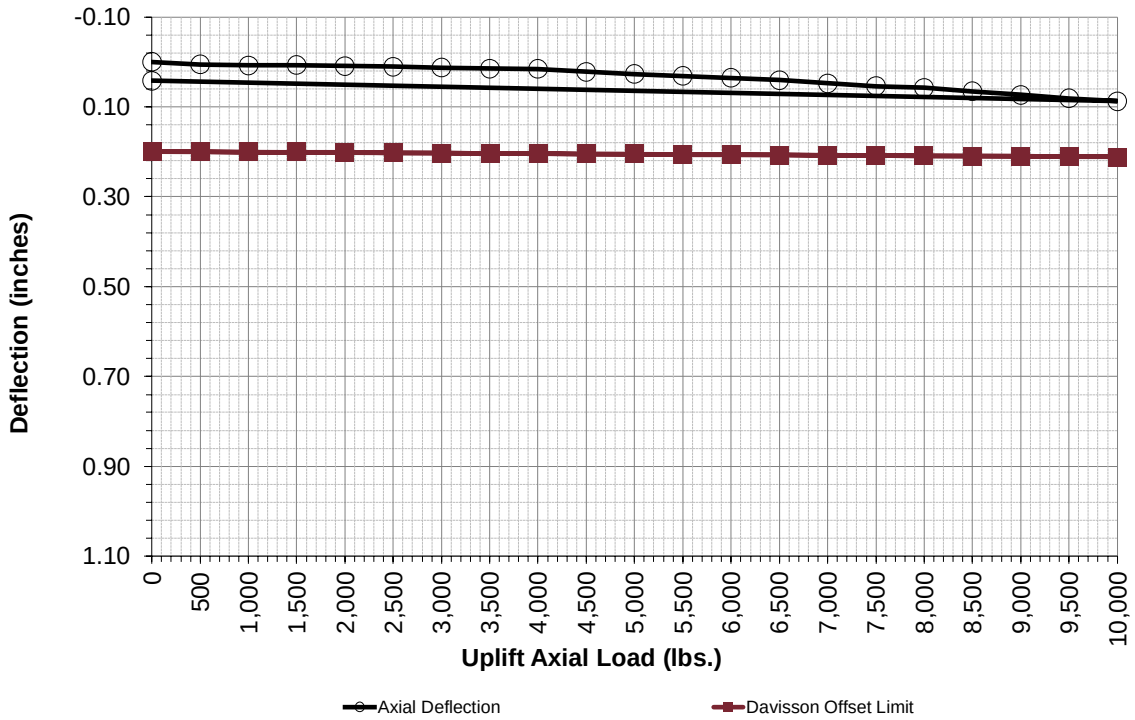
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/4/2023

Pile Information

Pile ID:	PLT-107B
Latitude [deg.]:	35.54924
Longitude[deg.]:	106.01518
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	23.9

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.006	0.001	0.200	
10%	1000	0.008	0.001	0.200	
15%	1500	0.008	0.002	0.201	
20%	2000	0.009	0.002	0.202	
25%	2500	0.011	0.003	0.202	
30%	3000	0.013	0.004	0.203	
35%	3500	0.015	0.004	0.203	
40%	4000	0.016	0.005	0.204	
45%	4500	0.022	0.006	0.205	
50%	5000	0.027	0.006	0.205	
55%	5500	0.031	0.007	0.206	
60%	6000	0.036	0.007	0.207	
65%	6500	0.041	0.008	0.207	
70%	7000	0.048	0.009	0.208	
75%	7500	0.054	0.009	0.208	
80%	8000	0.058	0.010	0.209	
85%	8500	0.066	0.010	0.210	
90%	9000	0.073	0.011	0.210	
95%	9500	0.082	0.012	0.211	
100%	10000	0.088	0.012	0.212	
0%	0	0.042	0.000	0.199	



Tension Load Test Result for PLT-108A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

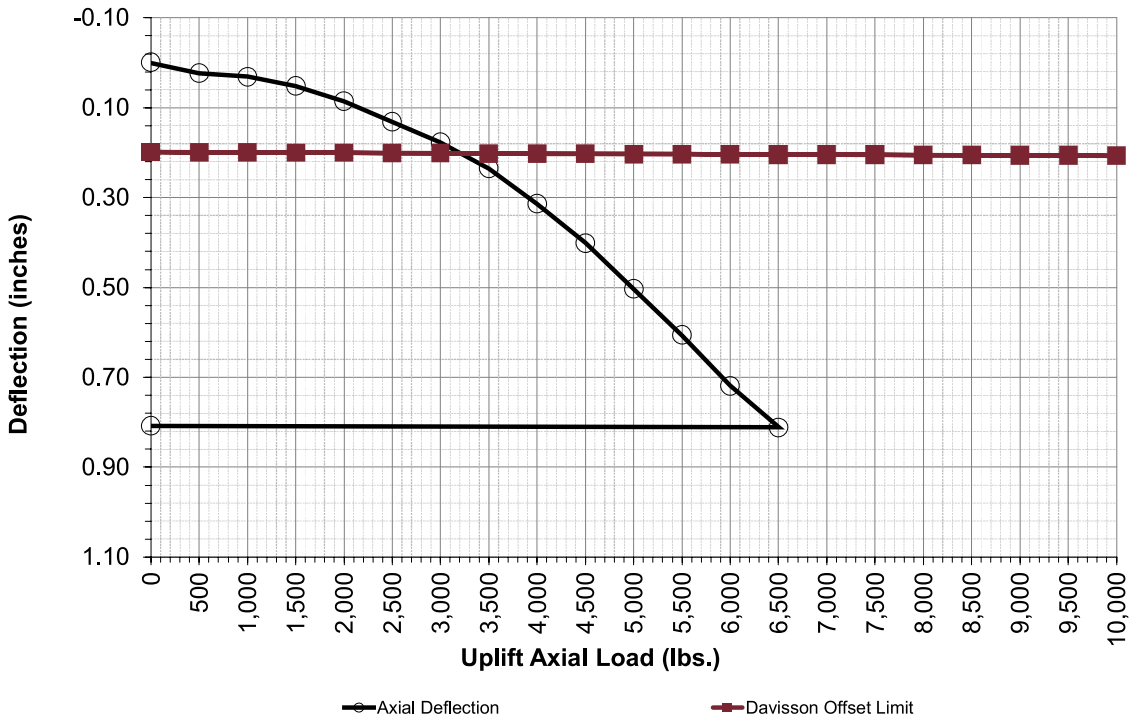
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-108A
Latitude [deg.]:	35.55227
Longitude[deg.]:	106.01033
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	8.1

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.024	0.000	0.200	
10%	1000	0.031	0.001	0.200	
15%	1500	0.052	0.001	0.200	
20%	2000	0.086	0.002	0.201	
25%	2500	0.132	0.002	0.201	
30%	3000	0.178	0.002	0.201	
35%	3500	0.235	0.003	0.202	
40%	4000	0.314	0.003	0.202	
45%	4500	0.401	0.003	0.203	
50%	5000	0.503	0.004	0.203	
55%	5500	0.607	0.004	0.203	
60%	6000	0.719	0.005	0.204	
65%	6500	0.812	0.005	0.204	
70%	7000		0.005	0.205	
75%	7500		0.006	0.205	
80%	8000		0.006	0.205	
85%	8500		0.007	0.206	
90%	9000		0.007	0.206	
95%	9500		0.007	0.207	
100%	10000		0.008	0.207	
0%	0	0.808	0.000	0.199	



Tension Load Test Result for PLT-108B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

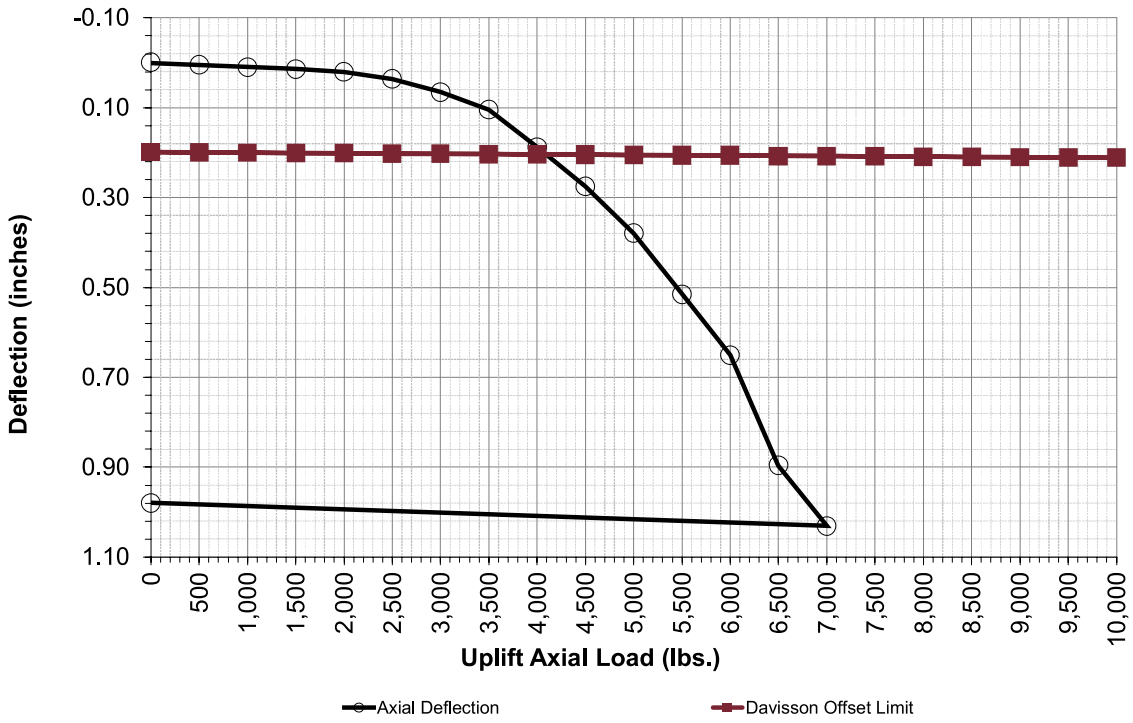
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-108B
Latitude [deg.]:	35.55227
Longitude[deg.]:	106.01033
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	9.2

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.005	0.001	0.200	
10%	1000	0.010	0.001	0.200	
15%	1500	0.014	0.002	0.201	
20%	2000	0.021	0.002	0.202	
25%	2500	0.037	0.003	0.202	
30%	3000	0.065	0.004	0.203	
35%	3500	0.104	0.004	0.203	
40%	4000	0.188	0.005	0.204	
45%	4500	0.275	0.006	0.205	
50%	5000	0.380	0.006	0.205	
55%	5500	0.515	0.007	0.206	
60%	6000	0.651	0.007	0.207	
65%	6500	0.896	0.008	0.207	
70%	7000	1.031	0.009	0.208	
75%	7500		0.009	0.208	
80%	8000		0.010	0.209	
85%	8500		0.010	0.210	
90%	9000		0.011	0.210	
95%	9500		0.012	0.211	
100%	10000		0.012	0.212	
0%	0	0.980	0.000	0.199	



Tension Load Test Result for PLT-109A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

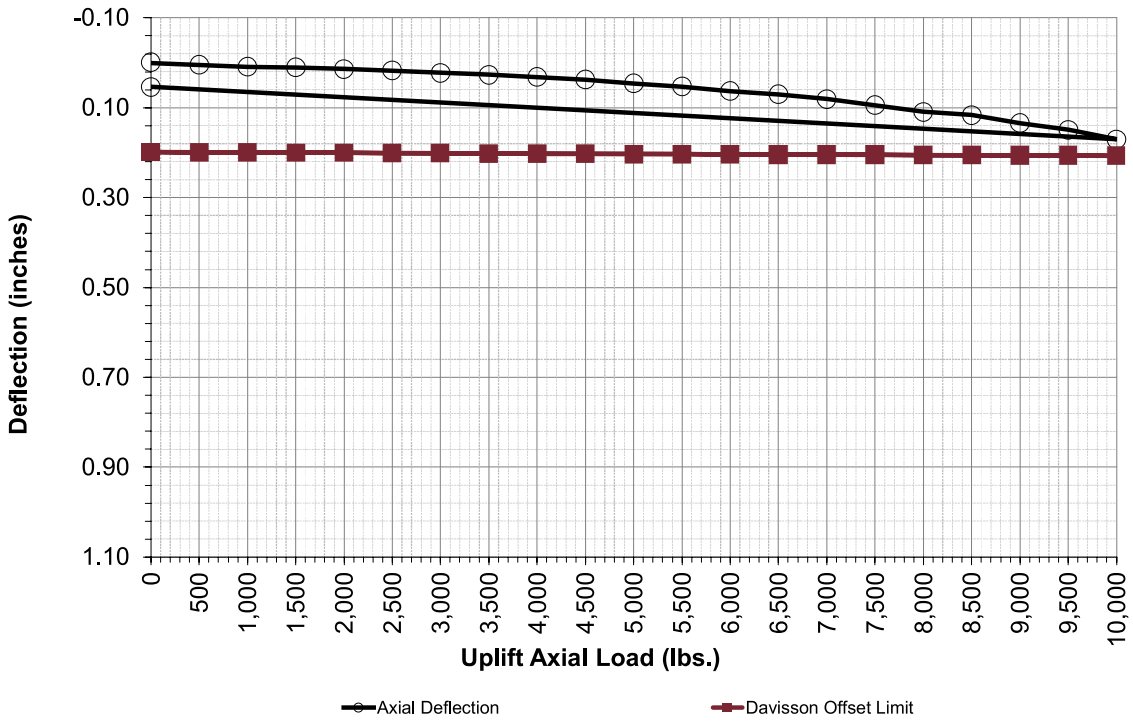
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/4/2023

Pile Information

Pile ID:	PLT-109A
Latitude [deg.]:	35.55374
Longitude[deg.]:	106.01736
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	16.7

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.005	0.000	0.200	
10%	1000	0.009	0.001	0.200	
15%	1500	0.011	0.001	0.200	
20%	2000	0.014	0.002	0.201	
25%	2500	0.018	0.002	0.201	
30%	3000	0.022	0.002	0.201	
35%	3500	0.027	0.003	0.202	
40%	4000	0.032	0.003	0.202	
45%	4500	0.037	0.003	0.203	
50%	5000	0.046	0.004	0.203	
55%	5500	0.053	0.004	0.203	
60%	6000	0.063	0.005	0.204	
65%	6500	0.070	0.005	0.204	
70%	7000	0.081	0.005	0.205	
75%	7500	0.094	0.006	0.205	
80%	8000	0.109	0.006	0.205	
85%	8500	0.117	0.007	0.206	
90%	9000	0.134	0.007	0.206	
95%	9500	0.150	0.007	0.207	
100%	10000	0.171	0.008	0.207	
0%	0	0.054	0.000	0.199	



Tension Load Test Result for PLT-109B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

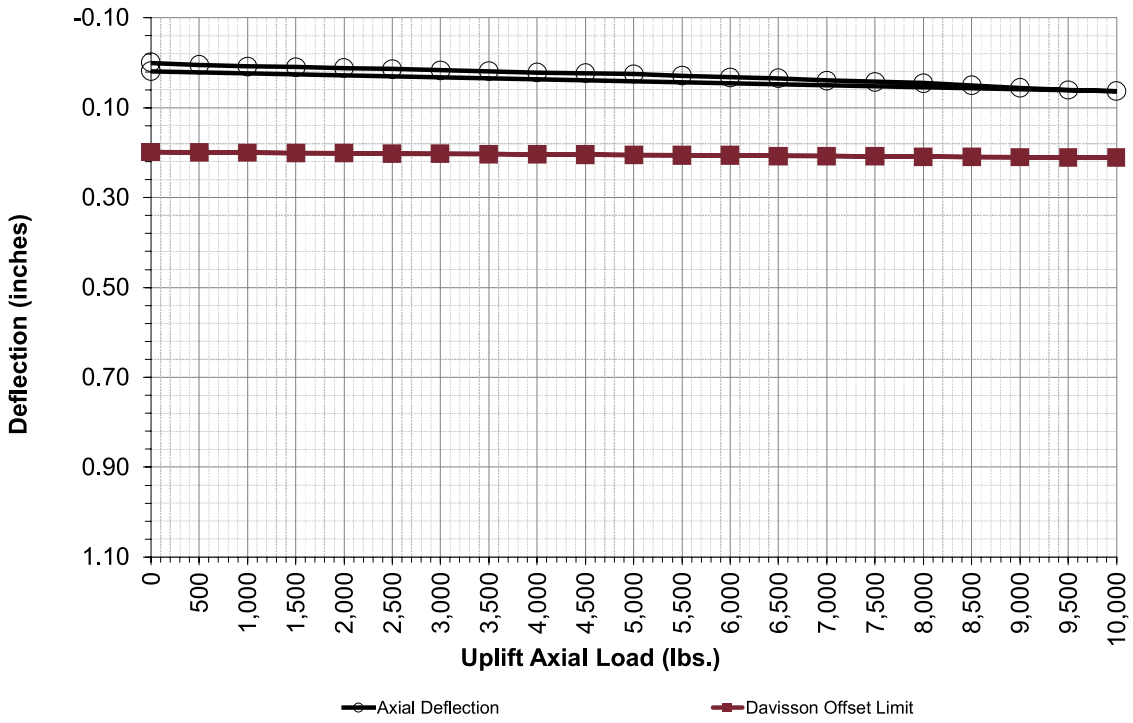
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/4/2023

Pile Information

Pile ID:	PLT-109B
Latitude [deg.]:	35.55374
Longitude[deg.]:	106.01736
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	37.6

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.005	0.001	0.200	
10%	1000	0.008	0.001	0.200	
15%	1500	0.010	0.002	0.201	
20%	2000	0.012	0.002	0.202	
25%	2500	0.014	0.003	0.202	
30%	3000	0.017	0.004	0.203	
35%	3500	0.019	0.004	0.203	
40%	4000	0.022	0.005	0.204	
45%	4500	0.024	0.006	0.205	
50%	5000	0.025	0.006	0.205	
55%	5500	0.029	0.007	0.206	
60%	6000	0.032	0.007	0.207	
65%	6500	0.036	0.008	0.207	
70%	7000	0.039	0.009	0.208	
75%	7500	0.042	0.009	0.208	
80%	8000	0.046	0.010	0.209	
85%	8500	0.050	0.010	0.210	
90%	9000	0.056	0.011	0.210	
95%	9500	0.061	0.012	0.211	
100%	10000	0.063	0.012	0.212	
0%	0	0.019	0.000	0.199	



Tension Load Test Result for PLT-110A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

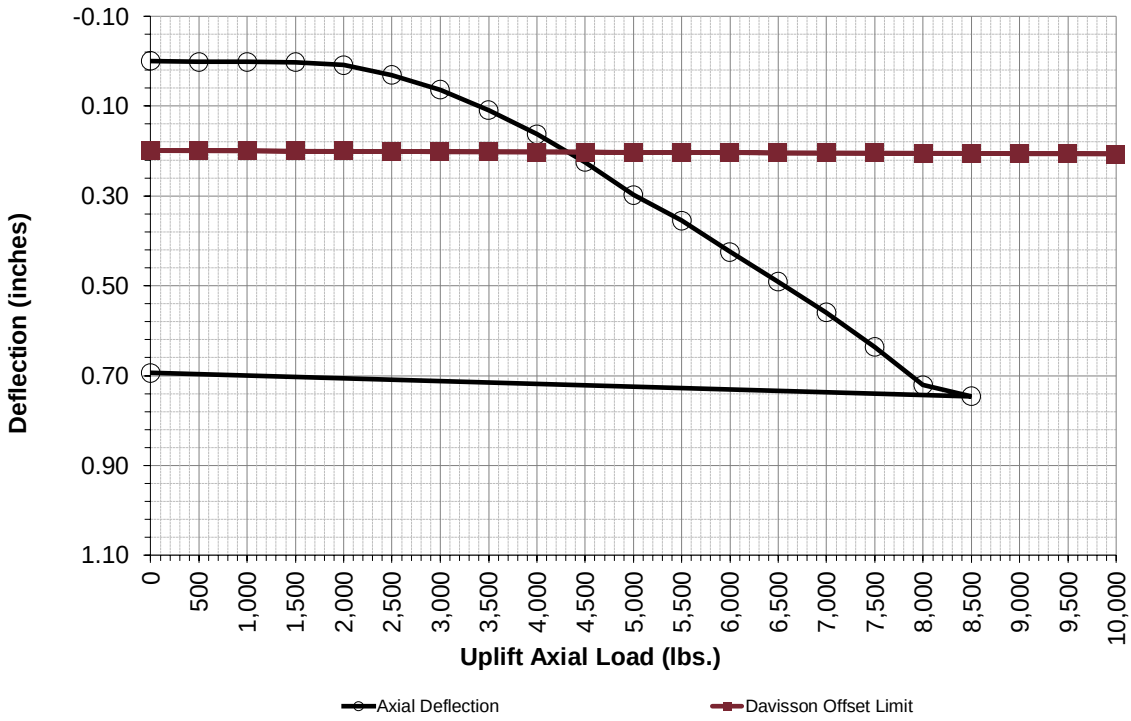
Test Date and Representative

Tested By Terracon Rep:	ED/AR
Date Tested:	3/11/2024

Pile Information

Pile ID:	PLT-110A
Latitude [deg.]:	35.54438
Longitude[deg.]:	-106.01141
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	0

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.002	0.000	0.200	
10%	1000	0.002	0.001	0.200	
15%	1500	0.003	0.001	0.200	
20%	2000	0.009	0.002	0.201	
25%	2500	0.031	0.002	0.201	
30%	3000	0.064	0.002	0.201	
35%	3500	0.109	0.003	0.202	
40%	4000	0.163	0.003	0.202	
45%	4500	0.225	0.003	0.203	
50%	5000	0.298	0.004	0.203	
55%	5500	0.355	0.004	0.203	
60%	6000	0.425	0.005	0.204	
65%	6500	0.491	0.005	0.204	
70%	7000	0.560	0.005	0.205	
75%	7500	0.636	0.006	0.205	
80%	8000	0.721	0.006	0.205	
85%	8500	0.746	0.007	0.206	
90%	9000		0.007	0.206	
95%	9500		0.007	0.207	
100%	10000		0.008	0.207	
0%	0	0.694	0.000	0.199	



Tension Load Test Result for PLT-110B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in.]:	6
Load Cell:	Dillion

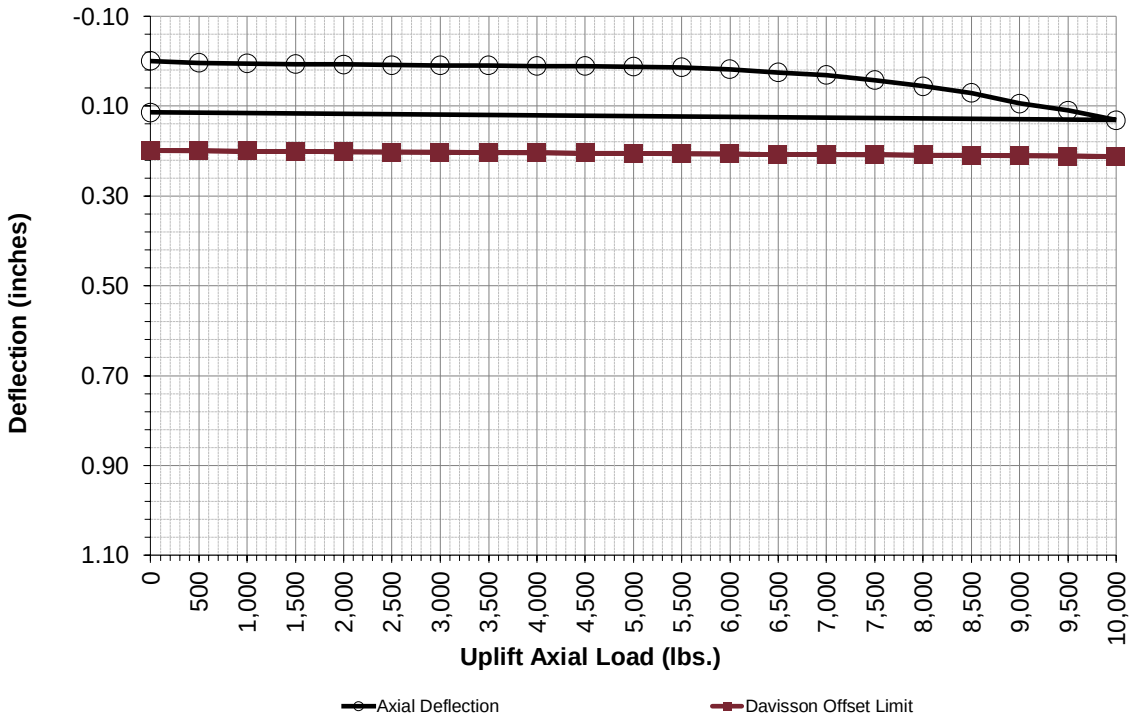
Test Date and Representative

Tested By Terracon Rep:	ED/AR
Date Tested:	3/11/2024

Pile Information

Pile ID:	PLT-110B
Latitude [deg.]:	35.54438
Longitude[deg.]:	-106.01141
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Diameter [in.]:	5.9
Pile Stick-Up [in.]:	48
Axial Design Load [lbs.]:	10,000
Pile Area [sq. in.]:	2.68
Elastic Modulus [ksi.]:	29,000
Drive Time [sec.]:	0

Tension Test Results				Davisson Offset Limit Lines	
% of Design Load	Axial Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in.) (PL/AE)	Davisson Offest Limit (in.) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.004	0.001	0.200	
10%	1000	0.005	0.001	0.200	
15%	1500	0.007	0.002	0.201	
20%	2000	0.008	0.002	0.202	
25%	2500	0.009	0.003	0.202	
30%	3000	0.010	0.004	0.203	
35%	3500	0.010	0.004	0.203	
40%	4000	0.011	0.005	0.204	
45%	4500	0.011	0.006	0.205	
50%	5000	0.013	0.006	0.205	
55%	5500	0.014	0.007	0.206	
60%	6000	0.018	0.007	0.207	
65%	6500	0.025	0.008	0.207	
70%	7000	0.031	0.009	0.208	
75%	7500	0.043	0.009	0.208	
80%	8000	0.056	0.010	0.209	
85%	8500	0.071	0.010	0.210	
90%	9000	0.094	0.011	0.210	
95%	9500	0.110	0.012	0.211	
100%	10000	0.132	0.012	0.212	
0%	0	0.115	0.000	0.199	



Tension Load Test Result for PLT-001A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

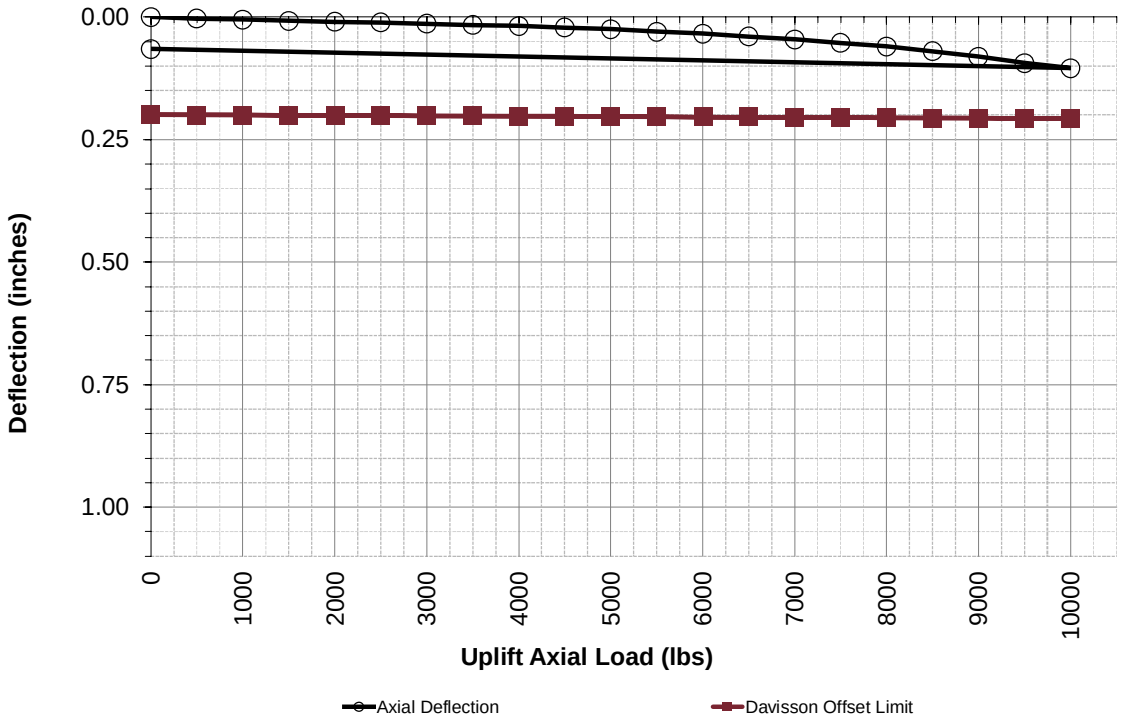
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-001A
Latitude:	35.55334
Longitude:	-106.01315
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	39.7

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.003	0.000	0.200	
10%	1000	0.005	0.001	0.200	
15%	1500	0.008	0.001	0.200	
20%	2000	0.010	0.002	0.201	
25%	2500	0.011	0.002	0.201	
30%	3000	0.014	0.002	0.201	
35%	3500	0.016	0.003	0.202	
40%	4000	0.018	0.003	0.202	
45%	4500	0.022	0.003	0.203	
50%	5000	0.025	0.004	0.203	
55%	5500	0.030	0.004	0.203	
60%	6000	0.034	0.005	0.204	
65%	6500	0.040	0.005	0.204	
70%	7000	0.046	0.005	0.205	
75%	7500	0.053	0.006	0.205	
80%	8000	0.060	0.006	0.205	
85%	8500	0.070	0.007	0.206	
90%	9000	0.081	0.007	0.206	
95%	9500	0.094	0.007	0.207	
100%	10000	0.104	0.008	0.207	
0%	0	0.065	0.000	0.199	



Tension Load Test Result for PLT-001B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

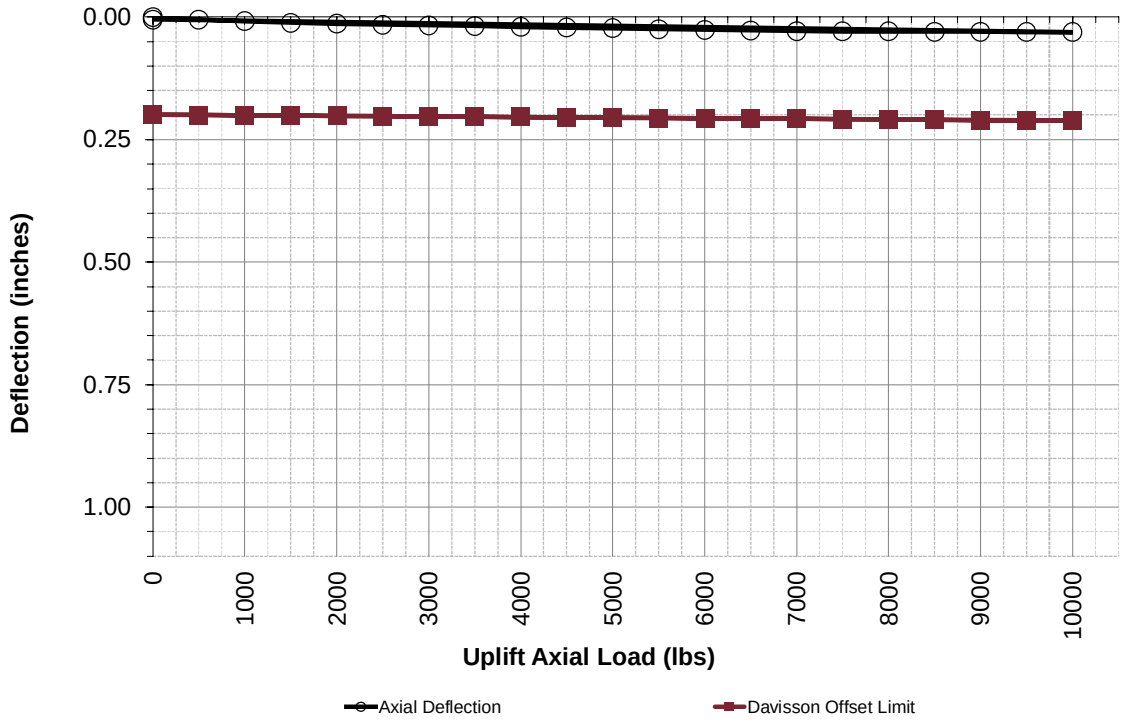
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-001B
Latitude:	35.55334
Longitude:	-106.01315
Pile Type:	W6X9
Pile Embedment Depth [in]:	96
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	50.8

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.005	0.001	0.200	
10%	1000	0.009	0.001	0.200	
15%	1500	0.012	0.002	0.201	
20%	2000	0.014	0.002	0.202	
25%	2500	0.016	0.003	0.202	
30%	3000	0.017	0.004	0.203	
35%	3500	0.019	0.004	0.203	
40%	4000	0.020	0.005	0.204	
45%	4500	0.021	0.006	0.205	
50%	5000	0.023	0.006	0.205	
55%	5500	0.025	0.007	0.206	
60%	6000	0.026	0.007	0.207	
65%	6500	0.027	0.008	0.207	
70%	7000	0.029	0.009	0.208	
75%	7500	0.030	0.009	0.208	
80%	8000	0.030	0.010	0.209	
85%	8500	0.030	0.010	0.210	
90%	9000	0.030	0.011	0.210	
95%	9500	0.031	0.012	0.211	
100%	10000	0.031	0.012	0.212	
0%	0	0.005	0.000	0.199	



Tension Load Test Result for PLT-002A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

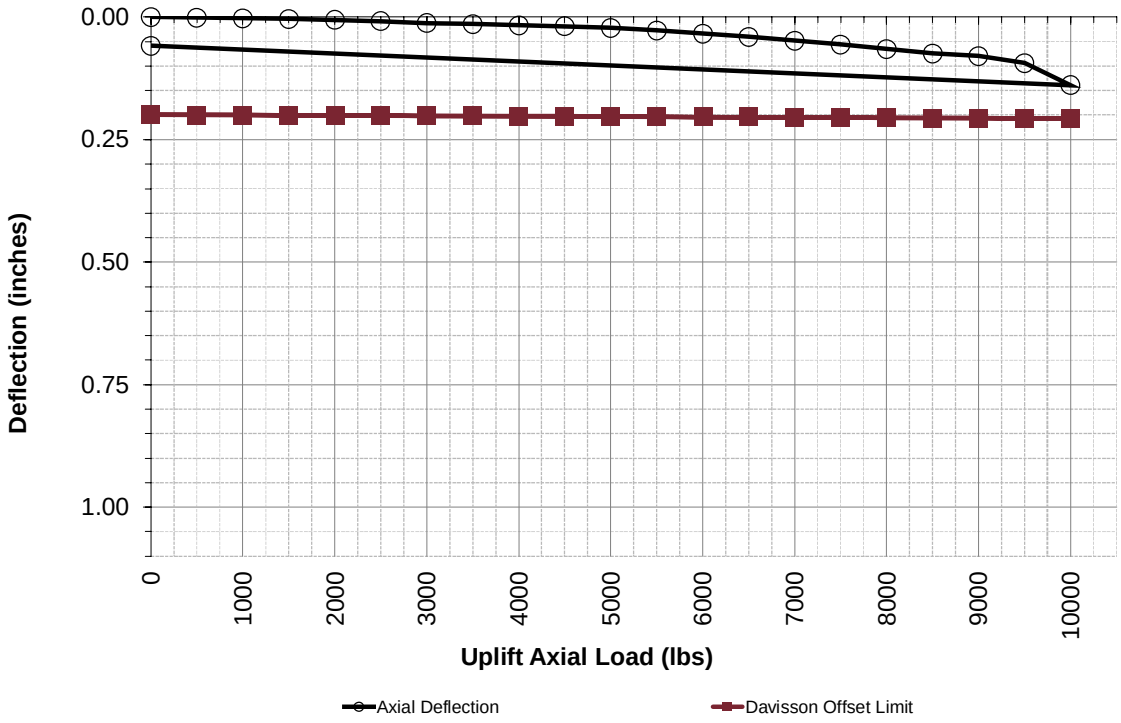
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-002A
Latitude:	35.55151
Longitude:	-106.00214
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	35.4

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.001	0.000	0.200	
10%	1000	0.002	0.001	0.200	
15%	1500	0.004	0.001	0.200	
20%	2000	0.006	0.002	0.201	
25%	2500	0.009	0.002	0.201	
30%	3000	0.012	0.002	0.201	
35%	3500	0.014	0.003	0.202	
40%	4000	0.017	0.003	0.202	
45%	4500	0.019	0.003	0.203	
50%	5000	0.022	0.004	0.203	
55%	5500	0.027	0.004	0.203	
60%	6000	0.034	0.005	0.204	
65%	6500	0.041	0.005	0.204	
70%	7000	0.048	0.005	0.205	
75%	7500	0.056	0.006	0.205	
80%	8000	0.065	0.006	0.205	
85%	8500	0.074	0.007	0.206	
90%	9000	0.080	0.007	0.206	
95%	9500	0.094	0.007	0.207	
100%	10000	0.139	0.008	0.207	
0%	0	0.059	0.000	0.199	



Tension Load Test Result for PLT-002B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

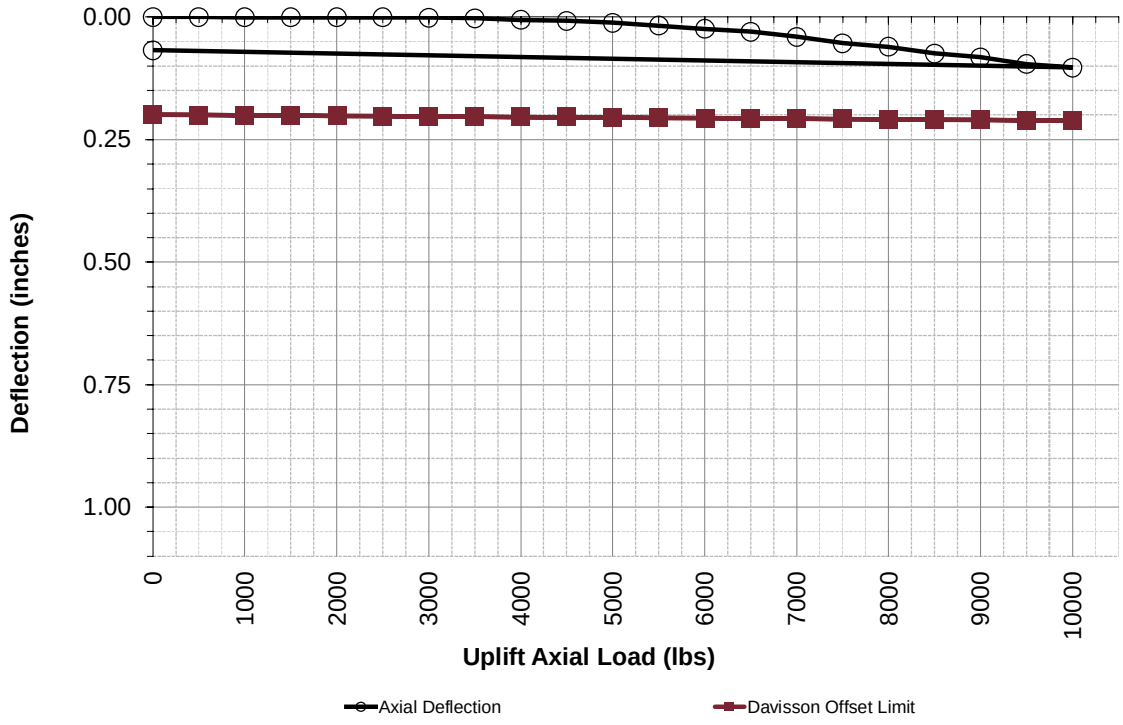
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-002B
Latitude:	35.55151
Longitude:	-106.00214
Pile Type:	W6X9
Pile Embedment Depth [in]:	92
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	37.1

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.000	0.001	0.200	
10%	1000	0.001	0.001	0.200	
15%	1500	0.001	0.002	0.201	
20%	2000	0.001	0.002	0.202	
25%	2500	0.001	0.003	0.202	
30%	3000	0.002	0.004	0.203	
35%	3500	0.003	0.004	0.203	
40%	4000	0.006	0.005	0.204	
45%	4500	0.008	0.005	0.204	
50%	5000	0.012	0.006	0.205	
55%	5500	0.018	0.007	0.206	
60%	6000	0.024	0.007	0.206	
65%	6500	0.030	0.008	0.207	
70%	7000	0.040	0.008	0.207	
75%	7500	0.054	0.009	0.208	
80%	8000	0.061	0.009	0.209	
85%	8500	0.074	0.010	0.209	
90%	9000	0.082	0.011	0.210	
95%	9500	0.096	0.011	0.210	
100%	10000	0.103	0.012	0.211	
0%	0	0.068	0.000	0.199	



Tension Load Test Result for PLT-003A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

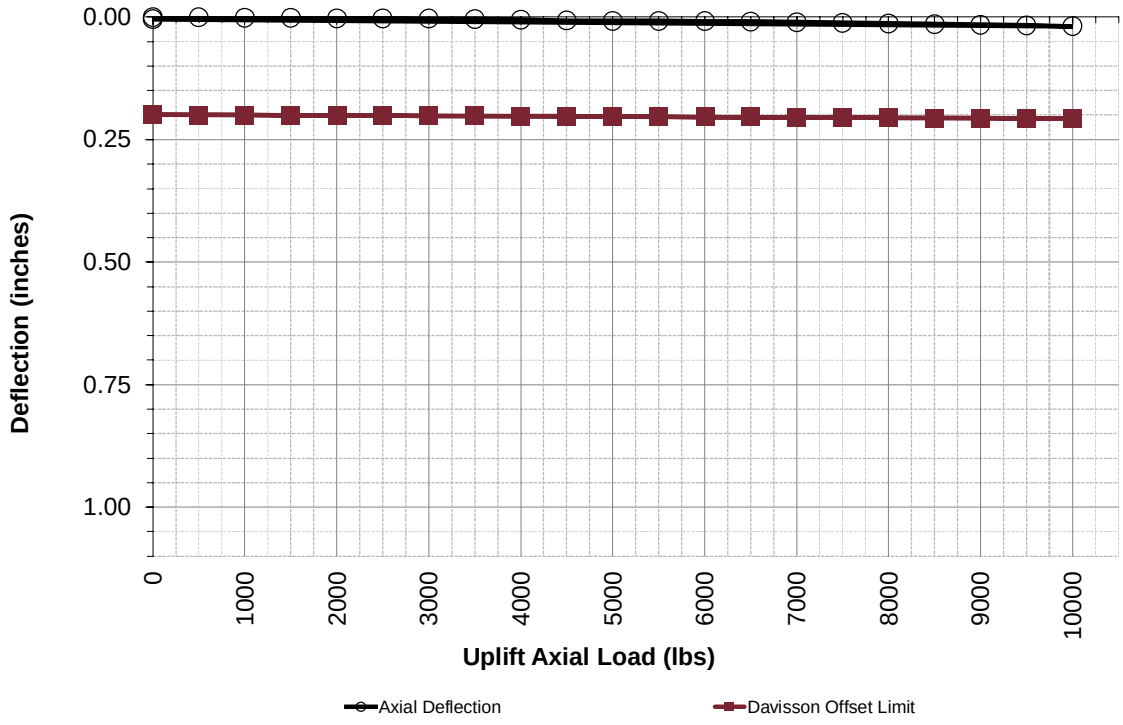
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-003A
Latitude:	35.54711
Longitude:	-106.01618
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	97.2

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.001	0.000	0.200	
10%	1000	0.001	0.001	0.200	
15%	1500	0.002	0.001	0.200	
20%	2000	0.002	0.002	0.201	
25%	2500	0.003	0.002	0.201	
30%	3000	0.003	0.002	0.201	
35%	3500	0.004	0.003	0.202	
40%	4000	0.005	0.003	0.202	
45%	4500	0.007	0.003	0.203	
50%	5000	0.008	0.004	0.203	
55%	5500	0.008	0.004	0.203	
60%	6000	0.009	0.005	0.204	
65%	6500	0.009	0.005	0.204	
70%	7000	0.011	0.005	0.205	
75%	7500	0.012	0.006	0.205	
80%	8000	0.013	0.006	0.205	
85%	8500	0.014	0.007	0.206	
90%	9000	0.016	0.007	0.206	
95%	9500	0.017	0.007	0.207	
100%	10000	0.019	0.008	0.207	
0%	0	0.005	0.000	0.199	



Tension Load Test Result for PLT-003B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

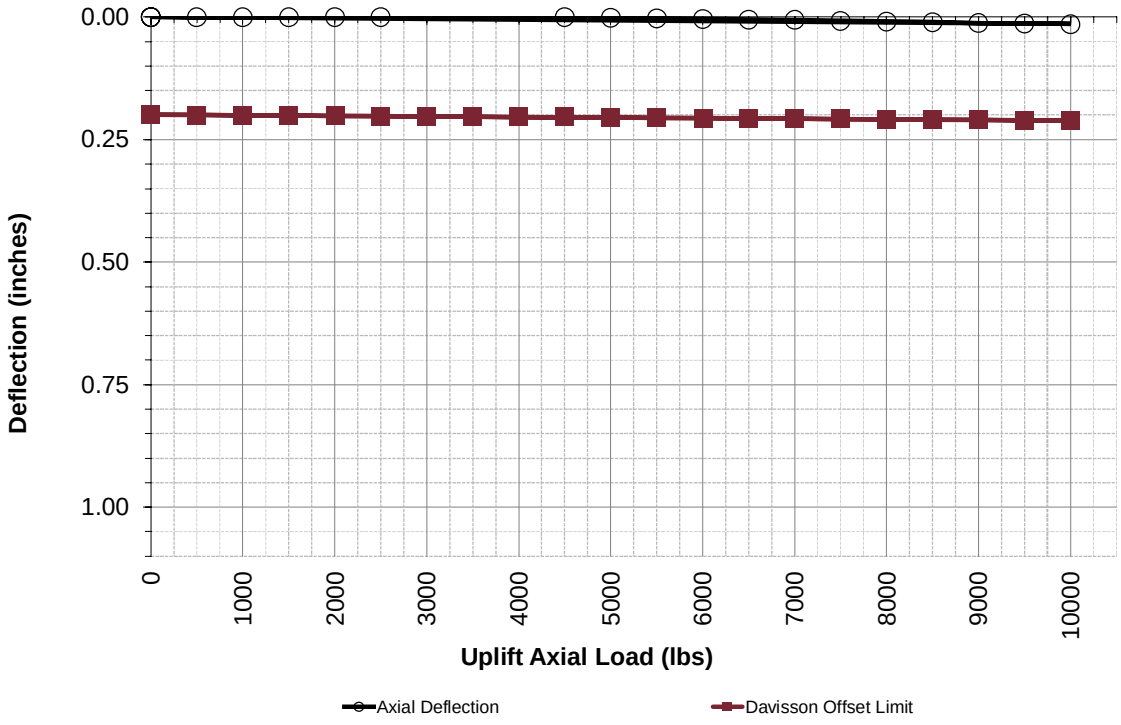
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-003B
Latitude:	35.54711
Longitude:	-106.01618
Pile Type:	W6X9
Pile Embedment Depth [in]:	92
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	239.4

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.001	0.001	0.200	
10%	1000	0.001	0.001	0.200	
15%	1500	0.001	0.002	0.201	
20%	2000	0.000	0.002	0.202	
25%	2500	0.000	0.003	0.202	
30%	3000	-0.002	0.004	0.203	
35%	3500	-0.002	0.004	0.203	
40%	4000	-0.001	0.005	0.204	
45%	4500	0.000	0.005	0.204	
50%	5000	0.001	0.006	0.205	
55%	5500	0.002	0.007	0.206	
60%	6000	0.004	0.007	0.206	
65%	6500	0.005	0.008	0.207	
70%	7000	0.006	0.008	0.207	
75%	7500	0.008	0.009	0.208	
80%	8000	0.009	0.009	0.209	
85%	8500	0.011	0.010	0.209	
90%	9000	0.012	0.011	0.210	
95%	9500	0.013	0.011	0.210	
100%	10000	0.015	0.012	0.211	
0%	0	0.000	0.000	0.199	



Tension Load Test Result for PLT-004A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

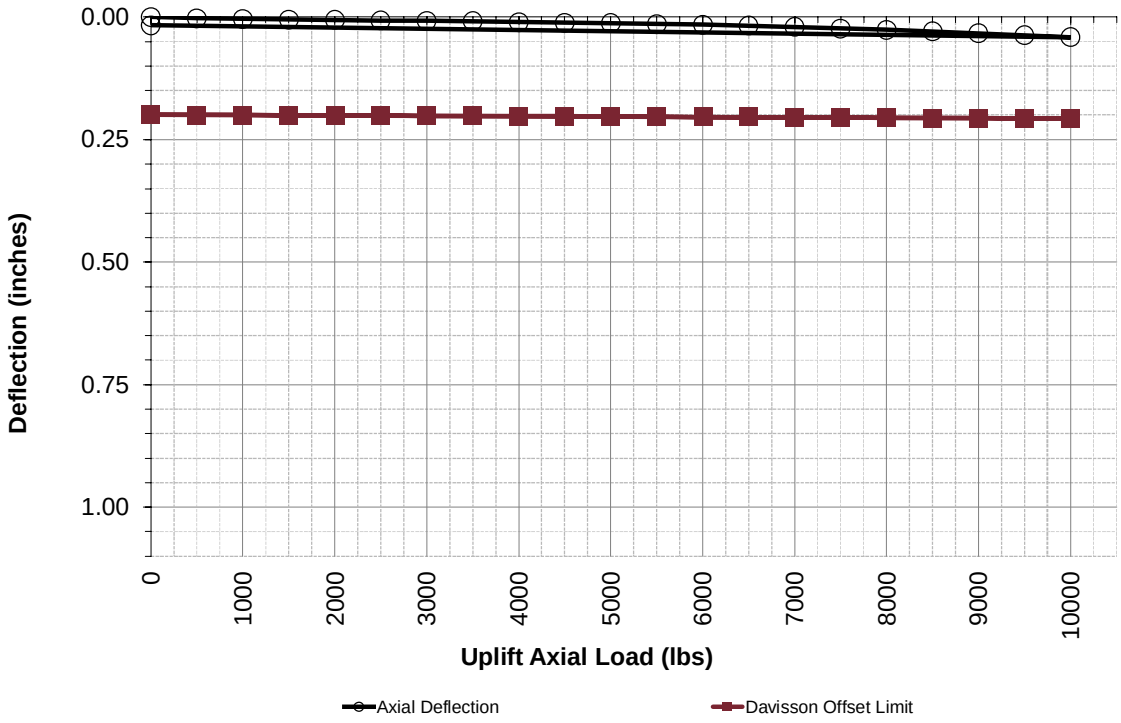
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-004A
Latitude:	35.54296
Longitude:	-106.03023
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	22.6

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.002	0.000	0.200	
10%	1000	0.004	0.001	0.200	
15%	1500	0.005	0.001	0.200	
20%	2000	0.006	0.002	0.201	
25%	2500	0.007	0.002	0.201	
30%	3000	0.008	0.002	0.201	
35%	3500	0.009	0.003	0.202	
40%	4000	0.011	0.003	0.202	
45%	4500	0.012	0.003	0.203	
50%	5000	0.013	0.004	0.203	
55%	5500	0.014	0.004	0.203	
60%	6000	0.016	0.005	0.204	
65%	6500	0.018	0.005	0.204	
70%	7000	0.020	0.005	0.205	
75%	7500	0.024	0.006	0.205	
80%	8000	0.026	0.006	0.205	
85%	8500	0.029	0.007	0.206	
90%	9000	0.033	0.007	0.206	
95%	9500	0.038	0.007	0.207	
100%	10000	0.041	0.008	0.207	
0%	0	0.017	0.000	0.199	



Tension Load Test Result for PLT-004B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

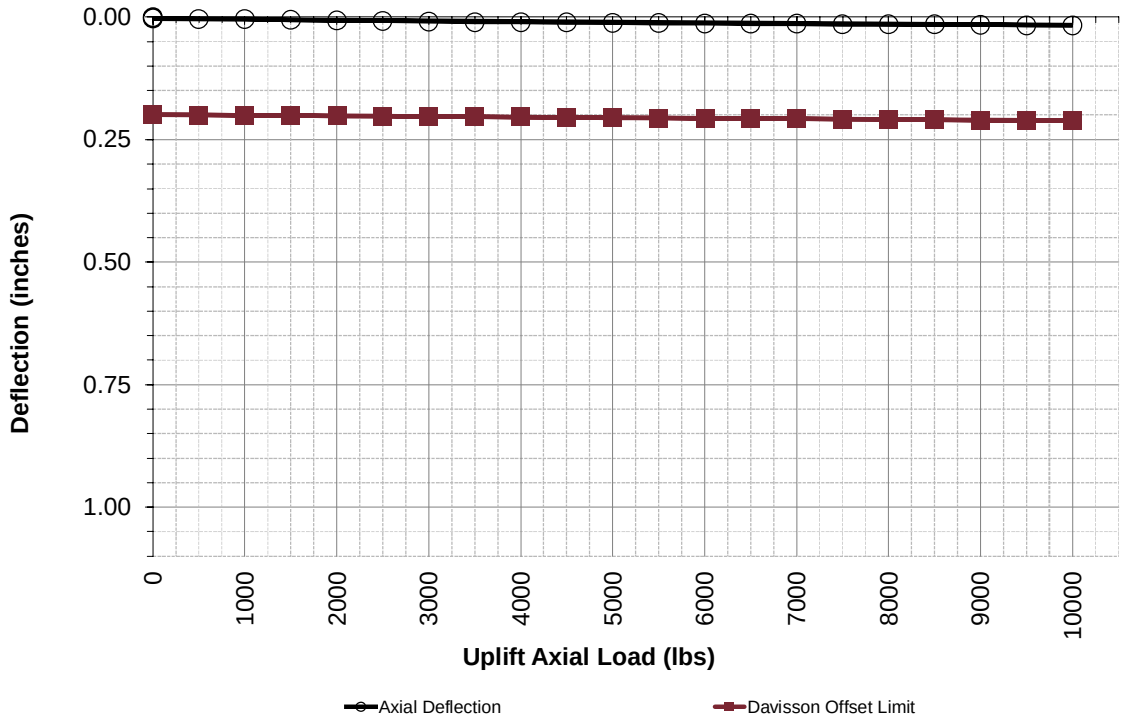
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-004B
Latitude:	35.54296
Longitude:	-106.03023
Pile Type:	W6X9
Pile Embedment Depth [in]:	96
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	108.7

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.004	0.001	0.200	
10%	1000	0.004	0.001	0.200	
15%	1500	0.006	0.002	0.201	
20%	2000	0.007	0.002	0.202	
25%	2500	0.008	0.003	0.202	
30%	3000	0.009	0.004	0.203	
35%	3500	0.010	0.004	0.203	
40%	4000	0.011	0.005	0.204	
45%	4500	0.011	0.006	0.205	
50%	5000	0.012	0.006	0.205	
55%	5500	0.013	0.007	0.206	
60%	6000	0.013	0.007	0.207	
65%	6500	0.014	0.008	0.207	
70%	7000	0.014	0.009	0.208	
75%	7500	0.015	0.009	0.208	
80%	8000	0.015	0.010	0.209	
85%	8500	0.015	0.010	0.210	
90%	9000	0.016	0.011	0.210	
95%	9500	0.017	0.012	0.211	
100%	10000	0.017	0.012	0.212	
0%	0	0.003	0.000	0.199	



Tension Load Test Result for PLT-005A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

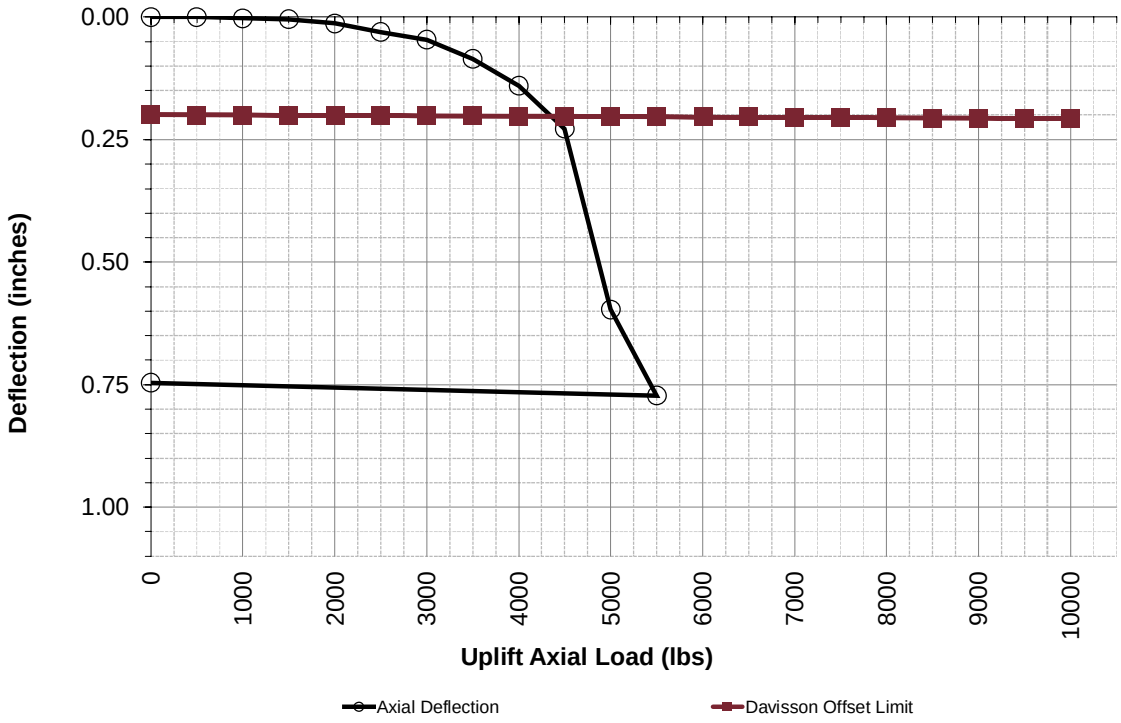
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-005A
Latitude:	35.53853
Longitude:	-106.01312
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	15

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.000	0.000	0.200	
10%	1000	0.002	0.001	0.200	
15%	1500	0.005	0.001	0.200	
20%	2000	0.013	0.002	0.201	
25%	2500	0.031	0.002	0.201	
30%	3000	0.047	0.002	0.201	
35%	3500	0.086	0.003	0.202	
40%	4000	0.141	0.003	0.202	
45%	4500	0.228	0.003	0.203	
50%	5000	0.597	0.004	0.203	
55%	5500	0.772	0.004	0.203	
60%	6000		0.005	0.204	
65%	6500		0.005	0.204	
70%	7000		0.005	0.205	
75%	7500		0.006	0.205	
80%	8000		0.006	0.205	
85%	8500		0.007	0.206	
90%	9000		0.007	0.206	
95%	9500		0.007	0.207	
100%	10000		0.008	0.207	
0%	0	0.746	0.000	0.199	



Tension Load Test Result for PLT-005B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

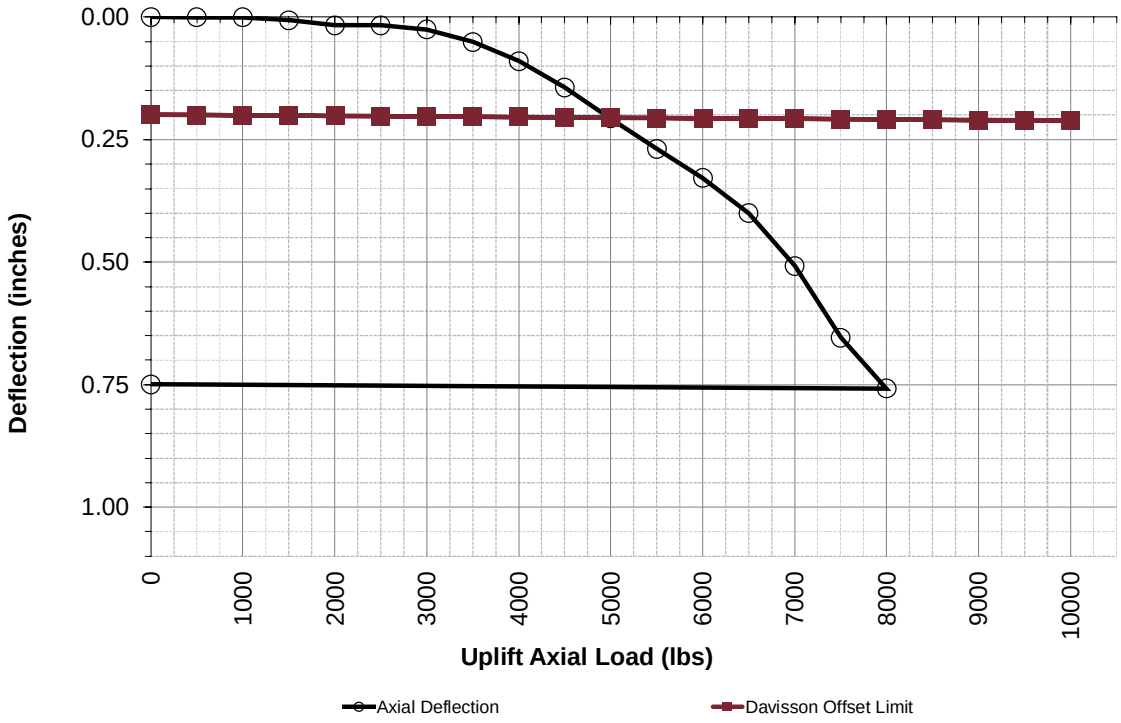
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-005B
Latitude:	35.53853
Longitude:	-106.01312
Pile Type:	W6X9
Pile Embedment Depth [in]:	96
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	27.3

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.001	0.001	0.200	
10%	1000	0.001	0.001	0.200	
15%	1500	0.007	0.002	0.201	
20%	2000	0.017	0.002	0.202	
25%	2500	0.017	0.003	0.202	
30%	3000	0.026	0.004	0.203	
35%	3500	0.051	0.004	0.203	
40%	4000	0.090	0.005	0.204	
45%	4500	0.144	0.006	0.205	
50%	5000	0.207	0.006	0.205	
55%	5500	0.269	0.007	0.206	
60%	6000	0.329	0.007	0.207	
65%	6500	0.400	0.008	0.207	
70%	7000	0.508	0.009	0.208	
75%	7500	0.654	0.009	0.208	
80%	8000	0.758	0.010	0.209	
85%	8500		0.010	0.210	
90%	9000		0.011	0.210	
95%	9500		0.012	0.211	
100%	10000		0.012	0.212	
0%	0	0.750	0.000	0.199	



Tension Load Test Result for PLT-006A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

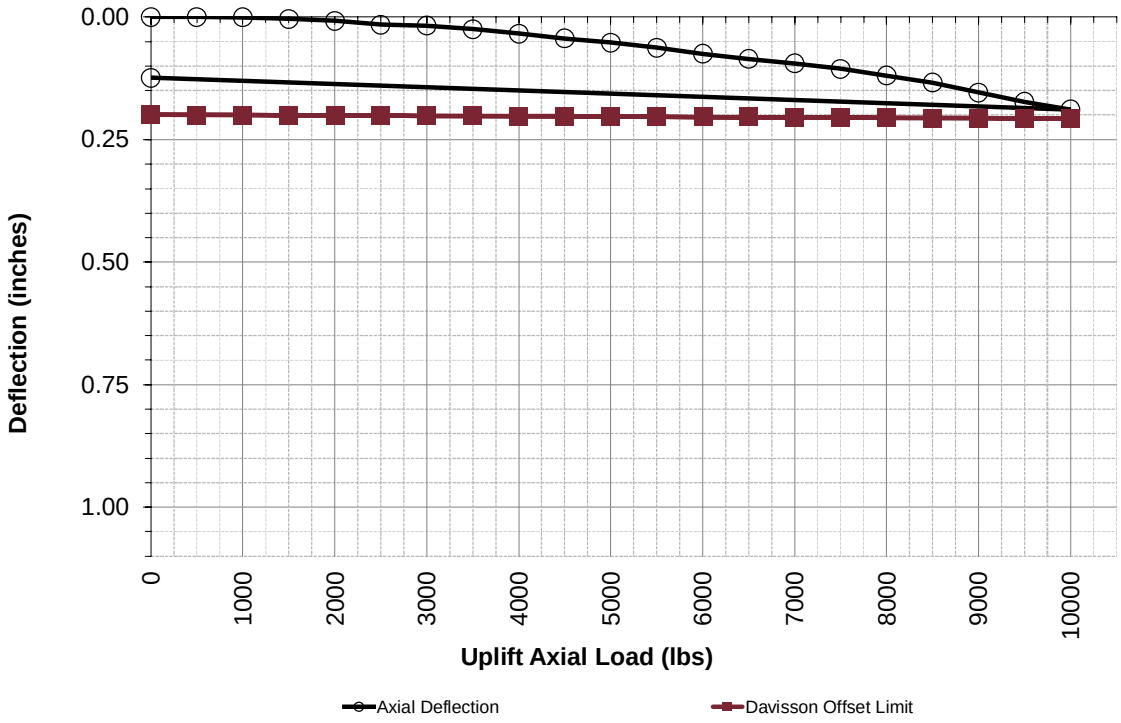
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/22/2022

Pile Information

Pile ID:	PLT-006A
Latitude:	35.54313
Longitude:	-106.00830
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	29.8

Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.000	0.000	0.200	
10%	1000	0.001	0.001	0.200	
15%	1500	0.004	0.001	0.200	
20%	2000	0.008	0.002	0.201	
25%	2500	0.016	0.002	0.201	
30%	3000	0.018	0.002	0.201	
35%	3500	0.025	0.003	0.202	
40%	4000	0.034	0.003	0.202	
45%	4500	0.044	0.003	0.203	
50%	5000	0.052	0.004	0.203	
55%	5500	0.063	0.004	0.203	
60%	6000	0.075	0.005	0.204	
65%	6500	0.085	0.005	0.204	
70%	7000	0.095	0.005	0.205	
75%	7500	0.106	0.006	0.205	
80%	8000	0.120	0.006	0.205	
85%	8500	0.134	0.007	0.206	
90%	9000	0.154	0.007	0.206	
95%	9500	0.173	0.007	0.207	
100%	10000	0.189	0.008	0.207	
0%	0	0.124	0.000	0.199	



Tension Load Test Result for PLT-006B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Axial Load Test Set Up

Number of Gauges:	2
Height of Gauges [in]:	6
Load Cell:	Dillon ED jr 10,000lb

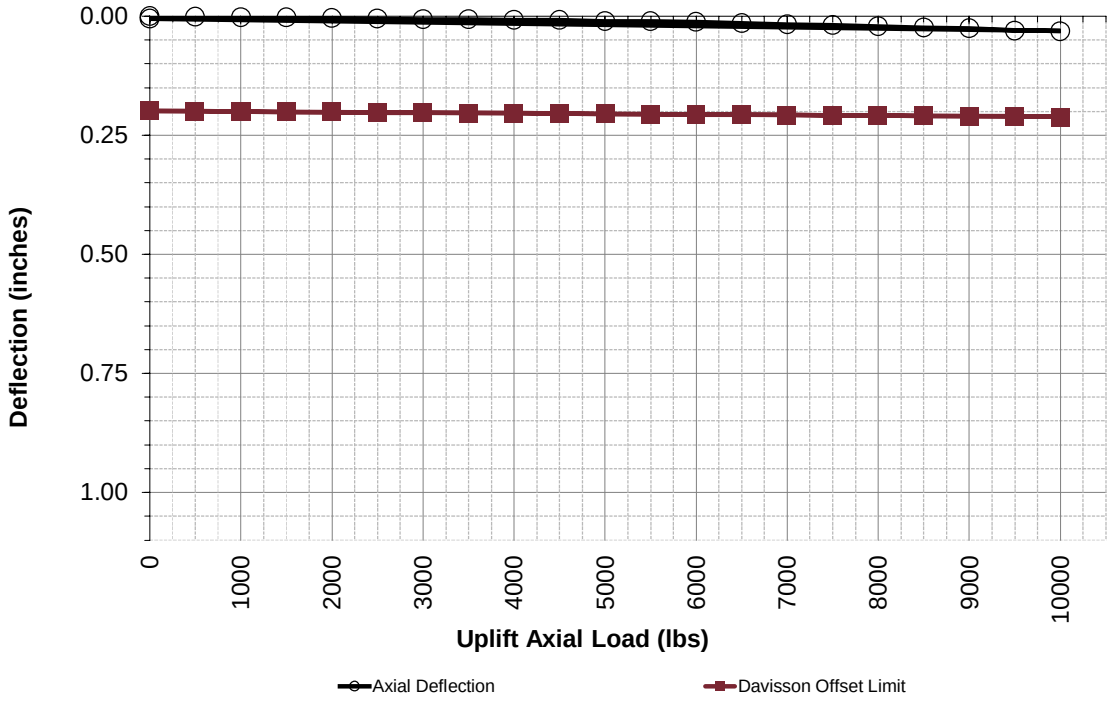
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/22/2022

Pile Information

Pile ID:	PLT-006B
Latitude:	35.54313
Longitude:	-106.00830
Pile Type:	W6X9
Pile Embedment Depth [in]:	96
Pile Diameter [in]:	5.9
Pile Stick-Up [in]:	48
Axial Design Load [lbs]:	10000
Pile Area [sq. in]:	2.68
Elastic Modulus [ksi]:	29,000
Drive Time [sec]:	75.7

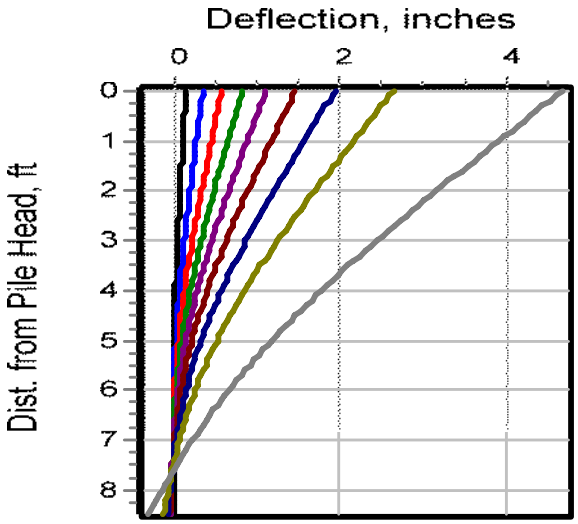
Tension Test Results			Davisson Offset Limit Lines		
% of Design Load	Axial Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Elastic Data (in) (PL/AE)	Davisson Offest Limit (in) (0.15+D/120+(PL/AE))	Comments
0%	0	0.000	0.000	0.199	
5%	500	0.002	0.001	0.200	
10%	1000	0.002	0.001	0.200	
15%	1500	0.003	0.002	0.201	
20%	2000	0.004	0.002	0.202	
25%	2500	0.005	0.003	0.202	
30%	3000	0.006	0.004	0.203	
35%	3500	0.006	0.004	0.203	
40%	4000	0.008	0.005	0.204	
45%	4500	0.008	0.006	0.205	
50%	5000	0.010	0.006	0.205	
55%	5500	0.011	0.007	0.206	
60%	6000	0.012	0.007	0.207	
65%	6500	0.015	0.008	0.207	
70%	7000	0.017	0.009	0.208	
75%	7500	0.019	0.009	0.208	
80%	8000	0.021	0.010	0.209	
85%	8500	0.024	0.010	0.210	
90%	9000	0.026	0.011	0.210	
95%	9500	0.030	0.012	0.211	
100%	10000	0.032	0.012	0.212	
0%	0	0.006	0.000	0.199	

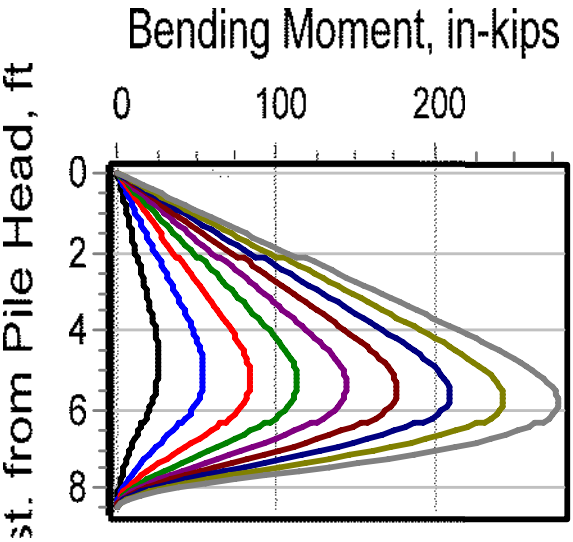


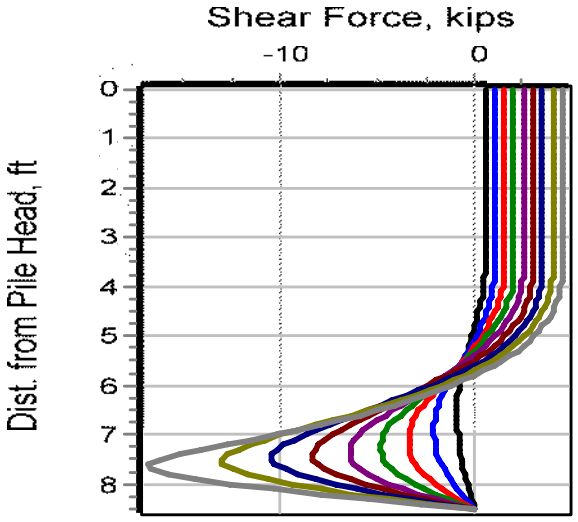
APPENDIX H

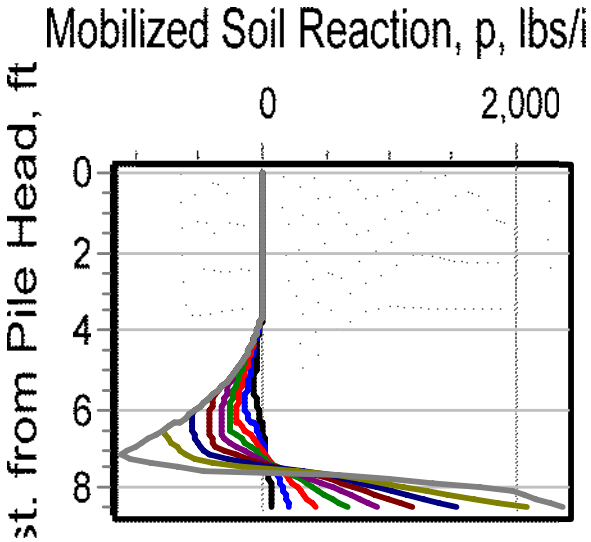
PILE LOAD TESTING RESULTS – LATERAL LOAD

L-Pile Calibration Curve, Zone A, 5' Embedment

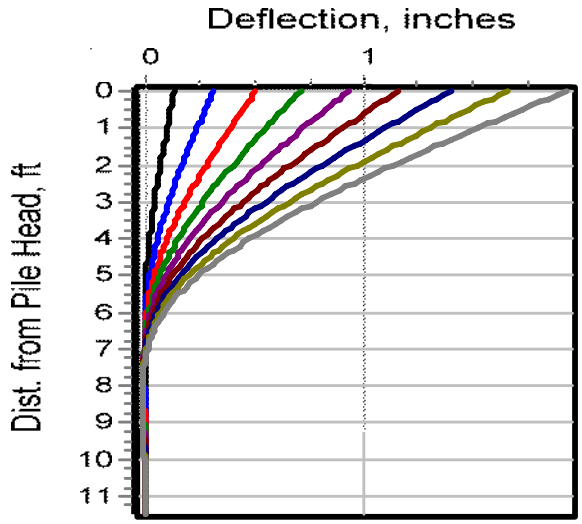


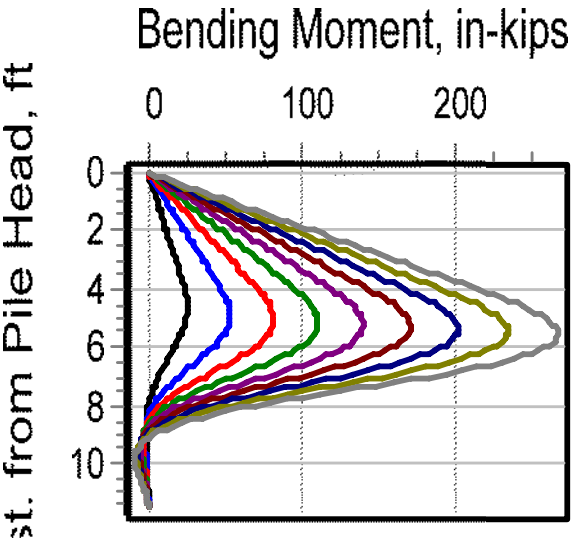


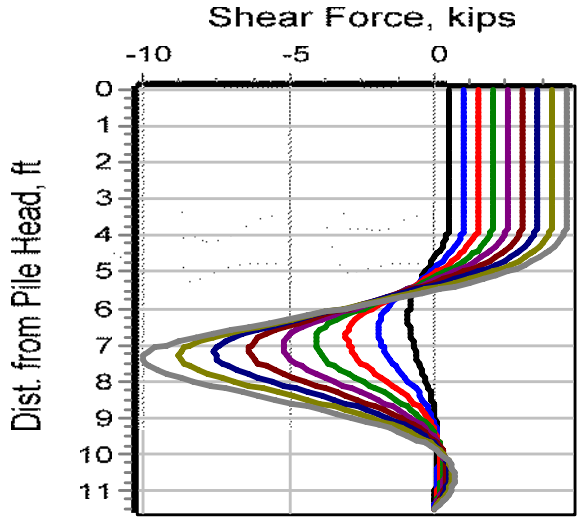


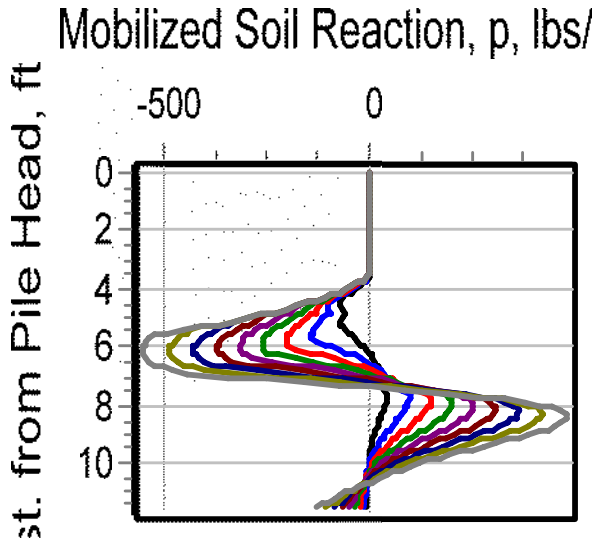


L-Pile Calibration Curve, Zone A, 8' Embedment

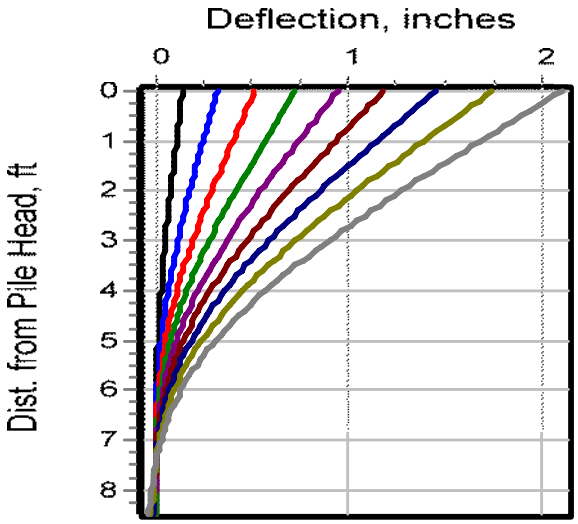


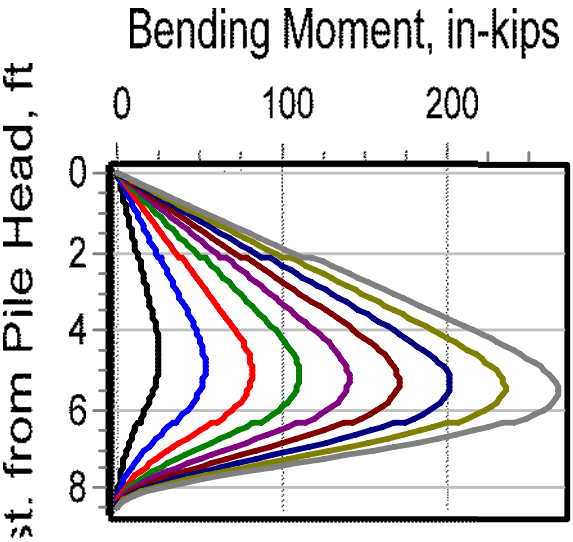


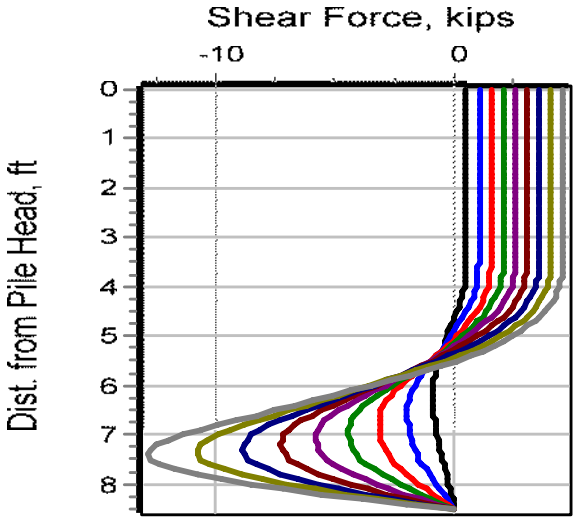


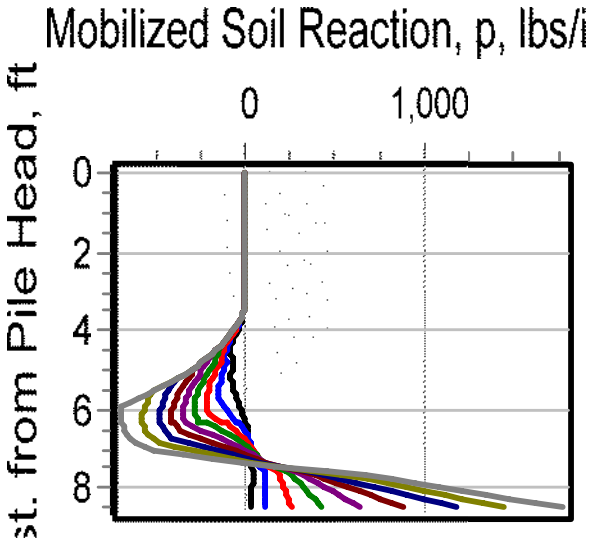


L-Pile Calibration Curve, Zone B, 5' Embedment

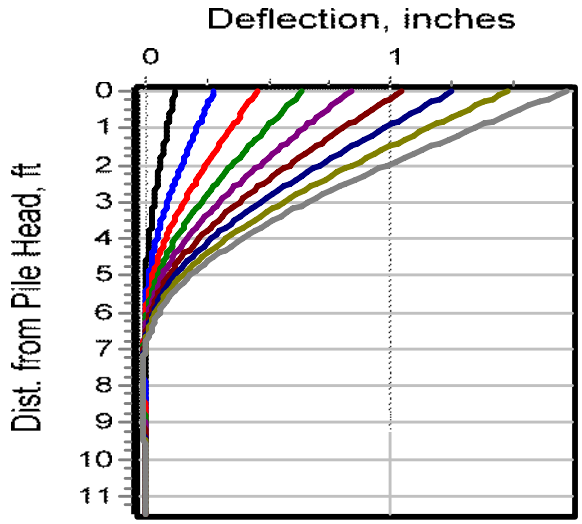


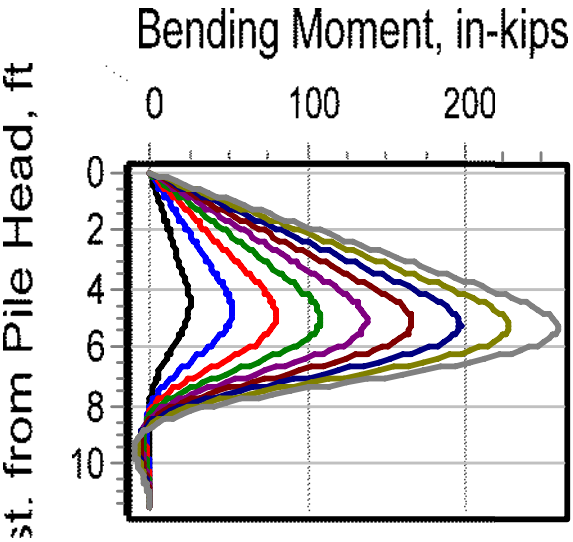


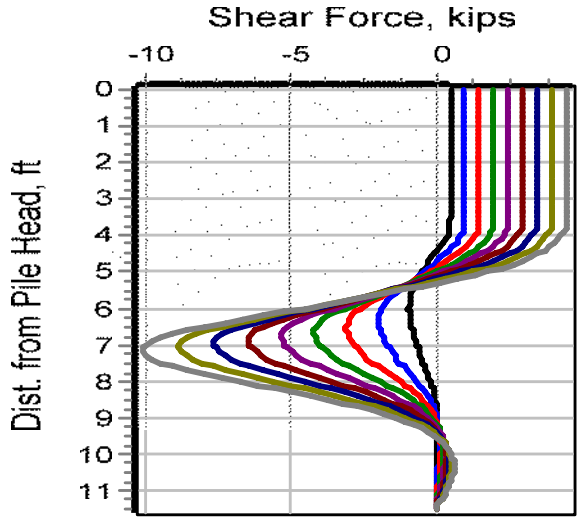


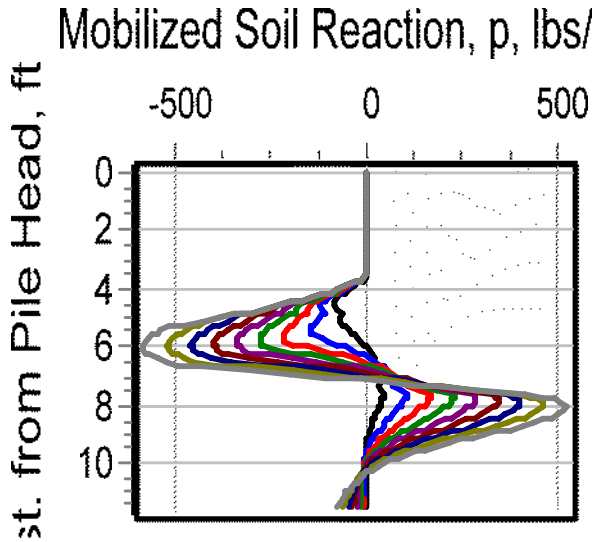


L-Pile Calibration Curve, Zone B, 8' Embedment









Lateral Load Test Results for PLT-101A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

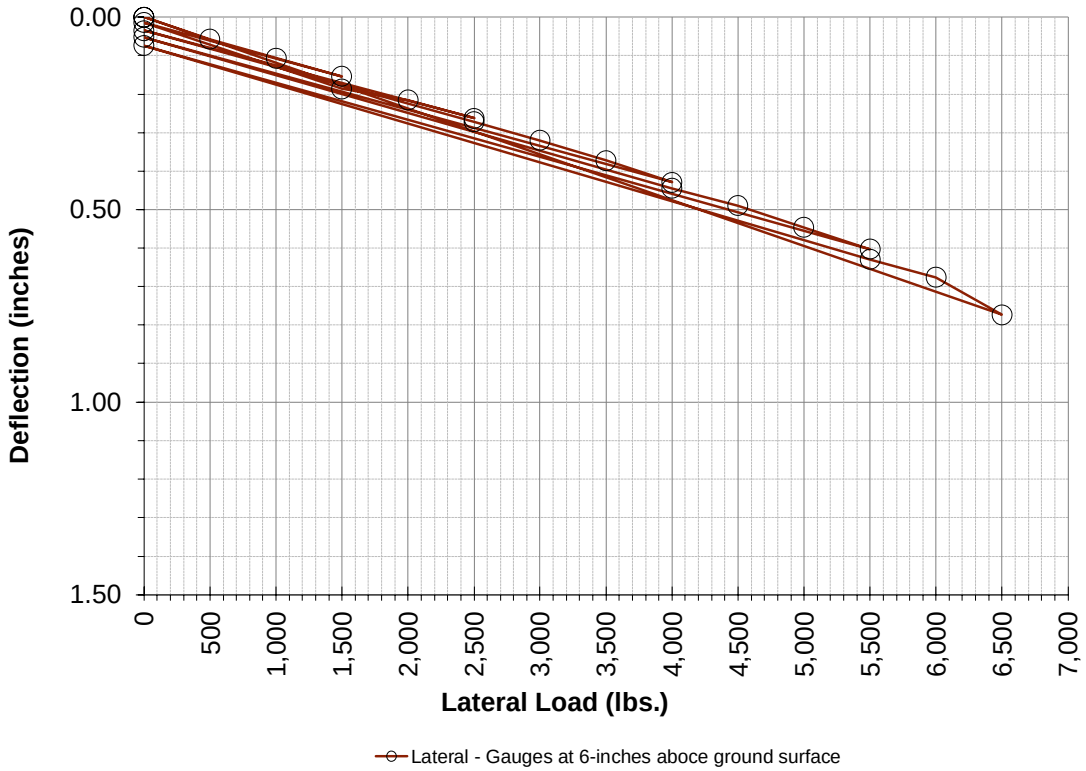
Test Date and Representative

Tested By Terracon Rep:	SL/MGB/ED
Date Tested:	9/23/2023

Pile Information

Pile ID:	PLT-101A
Latitude [deg.]:	35.54106
Longitude [deg.]:	-106.01558
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	90.3

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.058	
14%	1,000	0.107	
21%	1,500	0.155	
0%	0	0.014	
21%	1,500	0.187	
29%	2,000	0.216	
36%	2,500	0.263	
0%	0	0.035	
36%	2,500	0.273	
43%	3,000	0.320	
50%	3,500	0.373	
57%	4,000	0.429	
0%	0	0.052	
57%	4,000	0.445	
64%	4,500	0.490	
71%	5,000	0.547	
79%	5,500	0.603	
0%	0	0.074	
79%	5,500	0.629	
86%	6,000	0.676	
93%	6,500	0.773	
100%	7,000		
0%	0	0.000	



Lateral Load Test Results for PLT-101B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

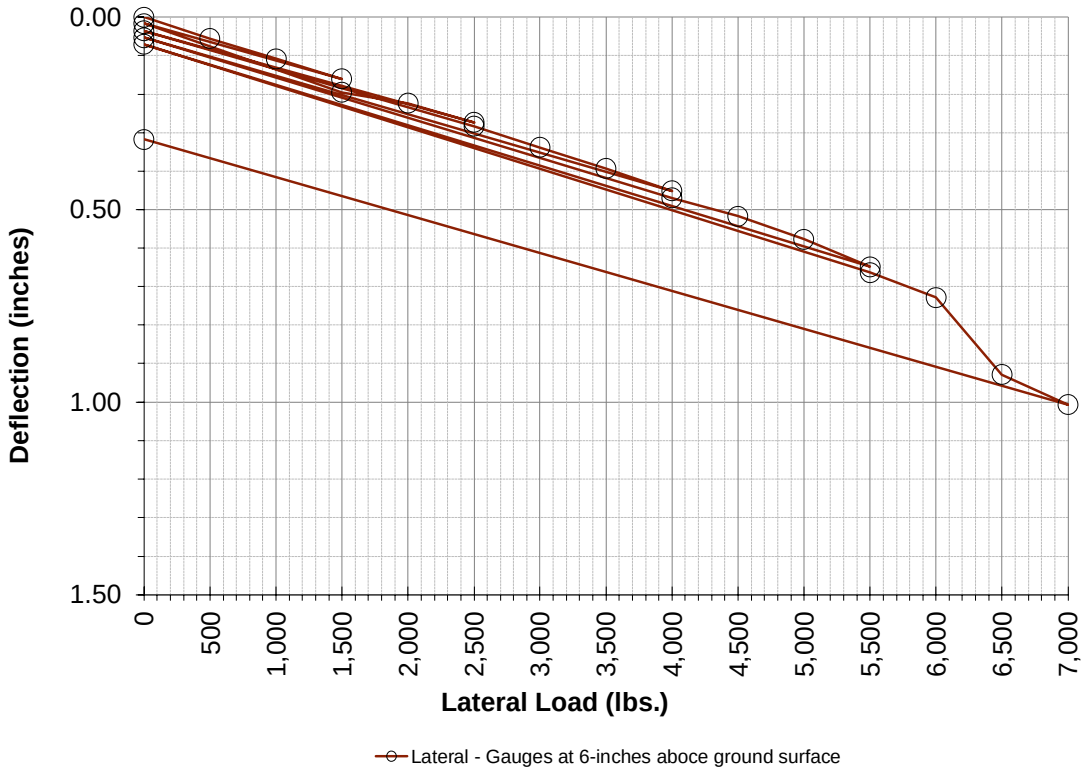
Test Date and Representative

Tested By Terracon Rep:	SL/MGB/ED
Date Tested:	9/23/2023

Pile Information

Pile ID:	PLT-101B
Latitude [deg.]:	35.54106
Longitude [deg.]:	-106.01558
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	26.1

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.056	
14%	1,000	0.109	
21%	1,500	0.161	
0%	0	0.017	
21%	1,500	0.196	
29%	2,000	0.224	
36%	2,500	0.274	
0%	0	0.036	
36%	2,500	0.284	
43%	3,000	0.339	
50%	3,500	0.394	
57%	4,000	0.452	
0%	0	0.054	
57%	4,000	0.470	
64%	4,500	0.517	
71%	5,000	0.578	
79%	5,500	0.649	
0%	0	0.072	
79%	5,500	0.664	
86%	6,000	0.728	
93%	6,500	0.929	
100%	7,000	1.007	
0%	0	0.318	



Lateral Load Test Results for PLT-102A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

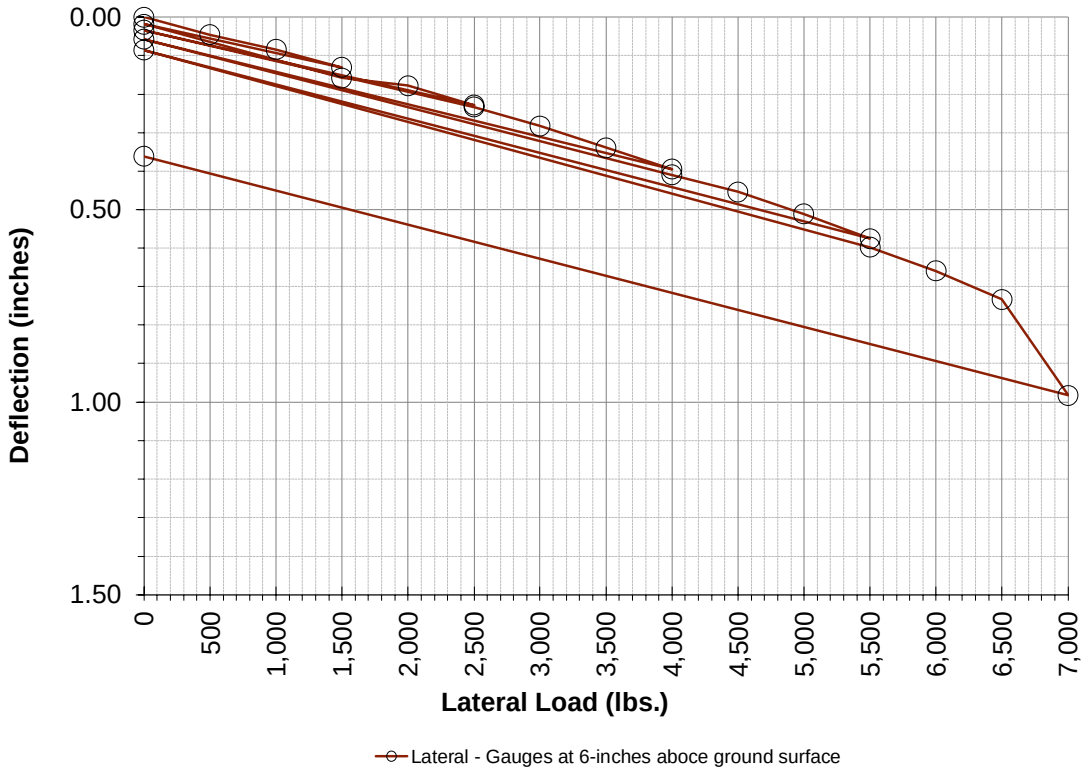
Test Date and Representative

Tested By Terracon Rep:	ED/TS
Date Tested:	3/7/2024

Pile Information

Pile ID:	PLT-102A
Latitude [deg.]:	35.53980
Longitude [deg.]:	-106.00941
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	0

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.046	
14%	1,000	0.085	
21%	1,500	0.131	
0%	0	0.019	
21%	1,500	0.158	
29%	2,000	0.178	
36%	2,500	0.229	
0%	0	0.035	
36%	2,500	0.234	
43%	3,000	0.283	
50%	3,500	0.339	
57%	4,000	0.395	
0%	0	0.058	
57%	4,000	0.411	
64%	4,500	0.454	
71%	5,000	0.512	
79%	5,500	0.575	
0%	0	0.087	
79%	5,500	0.598	
86%	6,000	0.659	
93%	6,500	0.734	
100%	7,000	0.982	
0%	0	0.362	



Lateral Load Test Results for PLT-102B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

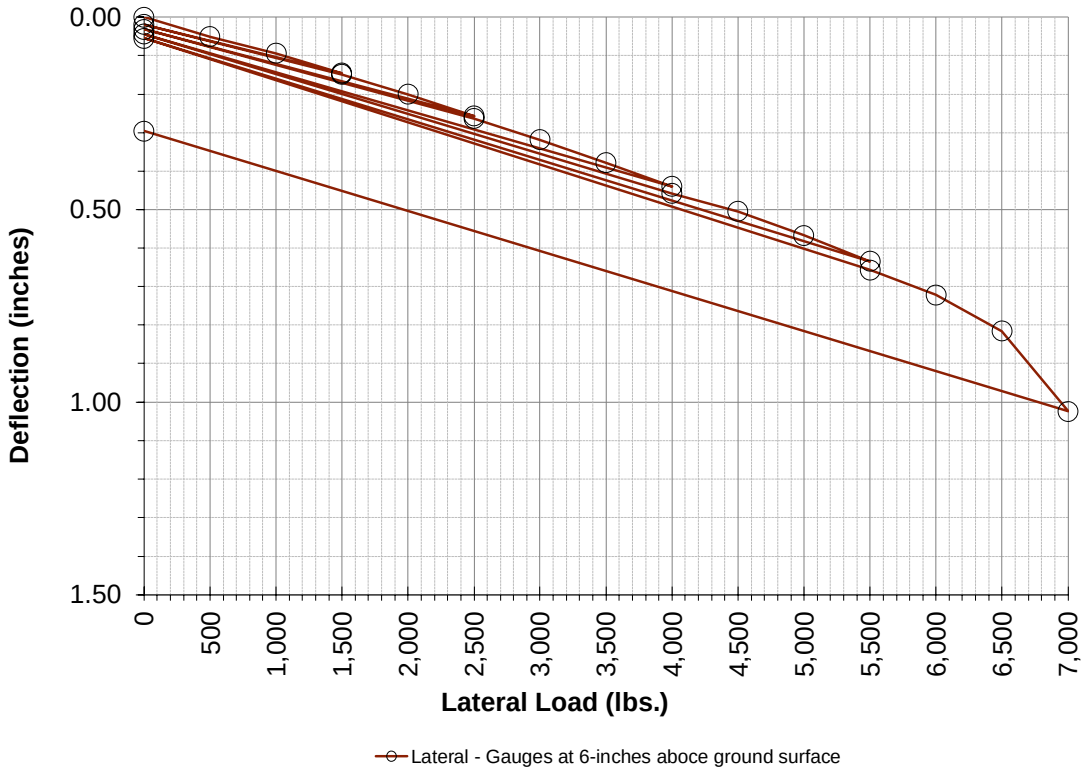
Test Date and Representative

Tested By Terracon Rep:	ED/TS
Date Tested:	3/7/2024

Pile Information

Pile ID:	PLT-102B
Latitude [deg.]:	35.53980
Longitude [deg.]:	-106.00941
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	0

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.051	
14%	1,000	0.095	
21%	1,500	0.146	
0%	0	0.020	
21%	1,500	0.149	
29%	2,000	0.200	
36%	2,500	0.257	
0%	0	0.032	
36%	2,500	0.264	
43%	3,000	0.318	
50%	3,500	0.379	
57%	4,000	0.440	
0%	0	0.045	
57%	4,000	0.458	
64%	4,500	0.505	
71%	5,000	0.567	
79%	5,500	0.635	
0%	0	0.056	
79%	5,500	0.657	
86%	6,000	0.722	
93%	6,500	0.816	
100%	7,000	1.024	
0%	0	0.296	



Lateral Load Test Results for PLT-103A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

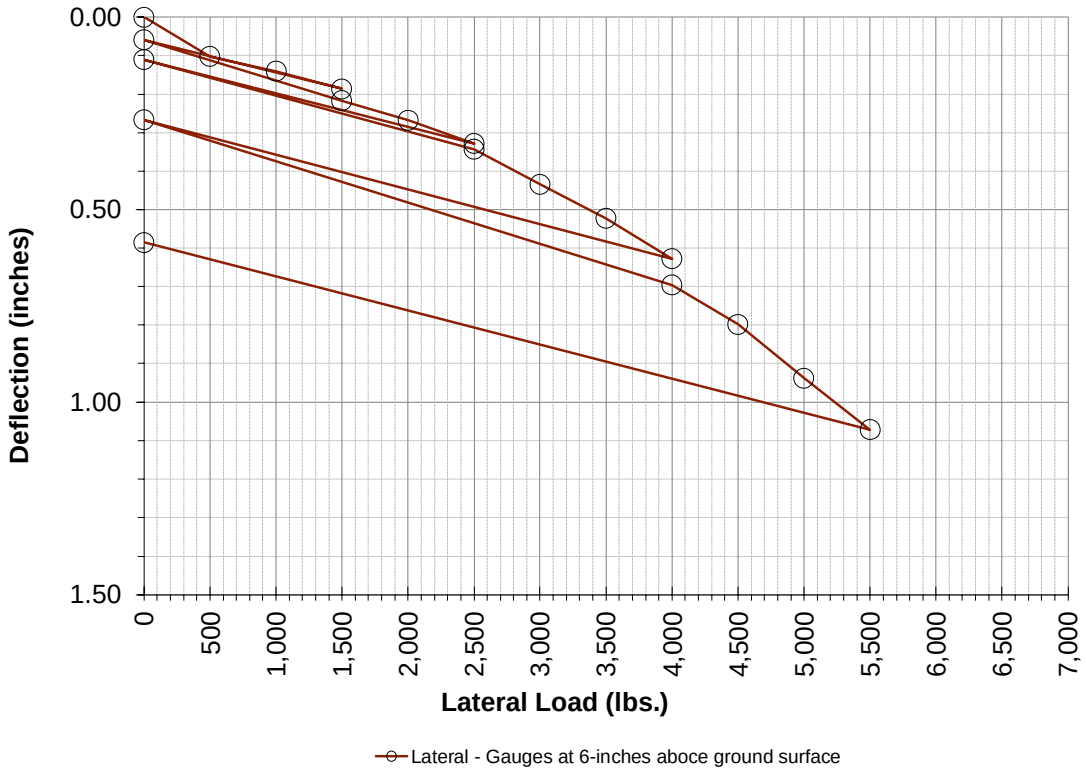
Test Date and Representative

Tested By Terracon Rep:	SL/SS
Date Tested:	9/27/2023

Pile Information

Pile ID:	PLT-103A
Latitude [deg.]:	35.54149
Longitude [deg.]:	-106.00401
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	5.8

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.103	
14%	1,000	0.141	
21%	1,500	0.187	
0%	0	0.060	
21%	1,500	0.218	
29%	2,000	0.268	
36%	2,500	0.329	
0%	0	0.111	
36%	2,500	0.344	
43%	3,000	0.434	
50%	3,500	0.523	
57%	4,000	0.628	
0%	0	0.267	
57%	4,000	0.697	
64%	4,500	0.798	
71%	5,000	0.938	
79%	5,500	1.072	
0%	0		
79%	5,500		
86%	6,000		
93%	6,500		
100%	7,000		
0%	0	0.586	



Lateral Load Test Results for PLT-103B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

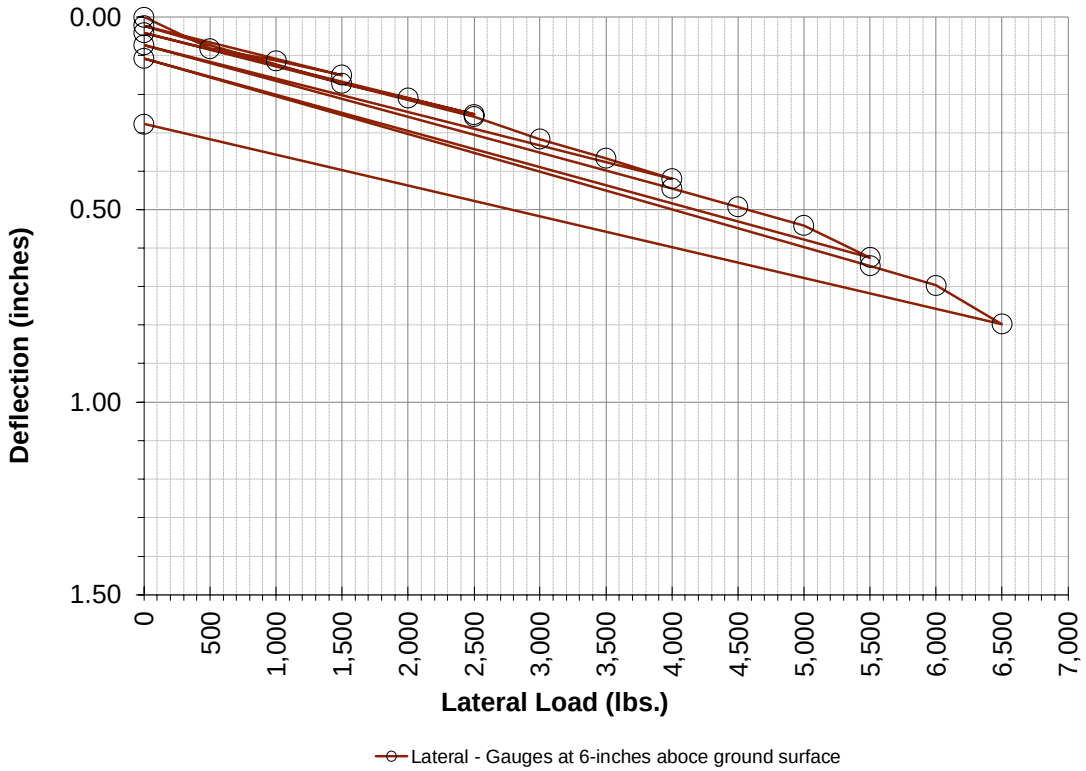
Test Date and Representative

Tested By Terracon Rep:	SL/SS
Date Tested:	9/27/2023

Pile Information

Pile ID:	PLT-103B
Latitude [deg.]:	35.54149
Longitude [deg.]:	-106.00400
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	11.3

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.082	
14%	1,000	0.114	
21%	1,500	0.151	
0%	0	0.023	
21%	1,500	0.173	
29%	2,000	0.211	
36%	2,500	0.253	
0%	0	0.041	
36%	2,500	0.259	
43%	3,000	0.317	
50%	3,500	0.367	
57%	4,000	0.420	
0%	0	0.073	
57%	4,000	0.446	
64%	4,500	0.494	
71%	5,000	0.542	
79%	5,500	0.624	
0%	0	0.108	
79%	5,500	0.647	
86%	6,000	0.697	
93%	6,500	0.798	
100%	7,000		
0%	0	0.278	



Lateral Load Test Results for PLT-104A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

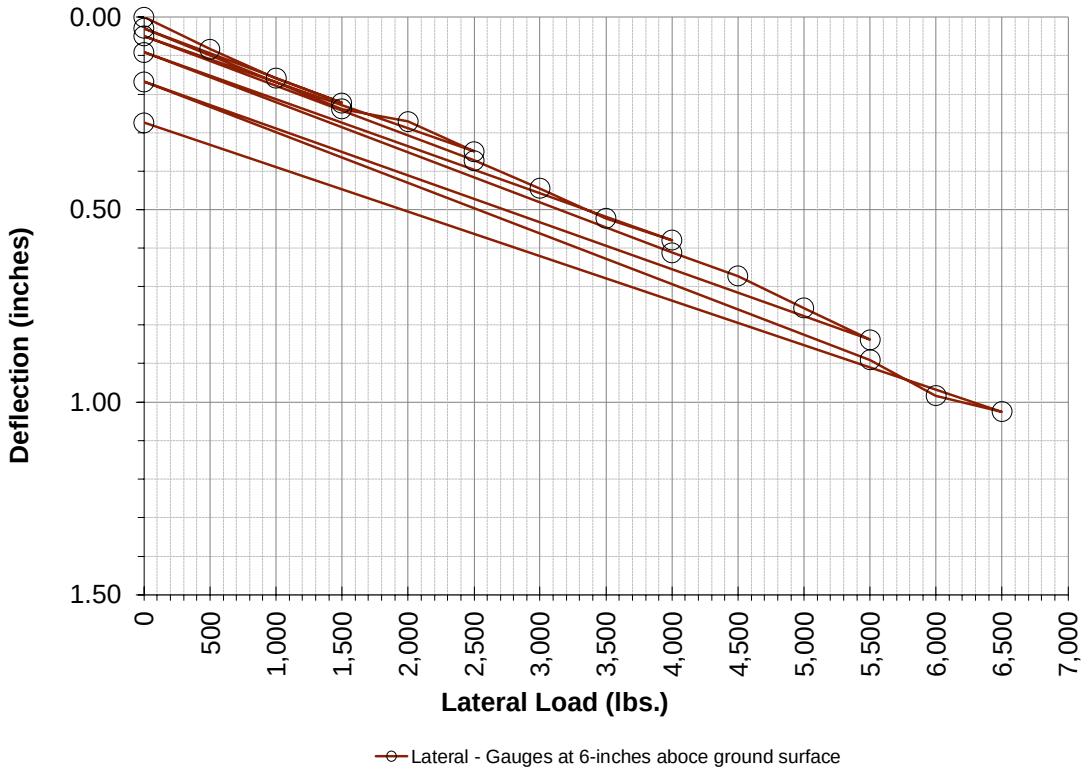
Test Date and Representative

Tested By Terracon Rep:	SL/SS
Date Tested:	9/27/2023

Pile Information

Pile ID:	PLT-104A
Latitude [deg.]:	35.54444
Longitude [deg.]:	-106.00580
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	5.3

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.084	
14%	1,000	0.160	
21%	1,500	0.224	
0%	0	0.030	
21%	1,500	0.239	
29%	2,000	0.271	
36%	2,500	0.350	
0%	0	0.049	
36%	2,500	0.373	
43%	3,000	0.446	
50%	3,500	0.523	
57%	4,000	0.580	
0%	0	0.092	
57%	4,000	0.612	
64%	4,500	0.673	
71%	5,000	0.756	
79%	5,500	0.838	
0%	0	0.168	
79%	5,500	0.891	
86%	6,000	0.984	
93%	6,500	1.025	
100%	7,000		
0%	0	0.275	



Lateral Load Test Results for PLT-104B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

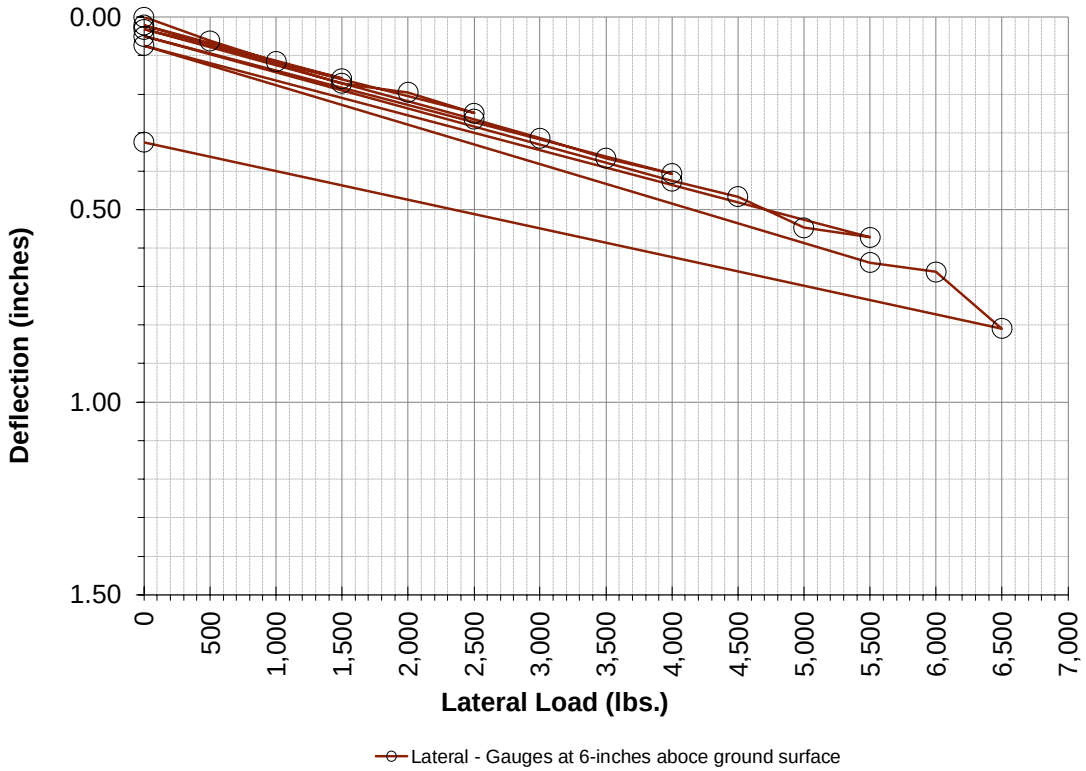
Test Date and Representative

Tested By Terracon Rep:	SL/SS
Date Tested:	9/27/2023

Pile Information

Pile ID:	PLT-104B
Latitude [deg.]:	35.54444
Longitude [deg.]:	-106.00580
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	16

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.062	
14%	1,000	0.116	
21%	1,500	0.160	
0%	0	0.021	
21%	1,500	0.173	
29%	2,000	0.196	
36%	2,500	0.250	
0%	0	0.032	
36%	2,500	0.265	
43%	3,000	0.315	
50%	3,500	0.367	
57%	4,000	0.407	
0%	0	0.050	
57%	4,000	0.426	
64%	4,500	0.467	
71%	5,000	0.548	
79%	5,500	0.572	
0%	0	0.074	
79%	5,500	0.638	
86%	6,000	0.662	
93%	6,500	0.809	
100%	7,000		
0%	0	0.325	



Lateral Load Test Results for PLT-105A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

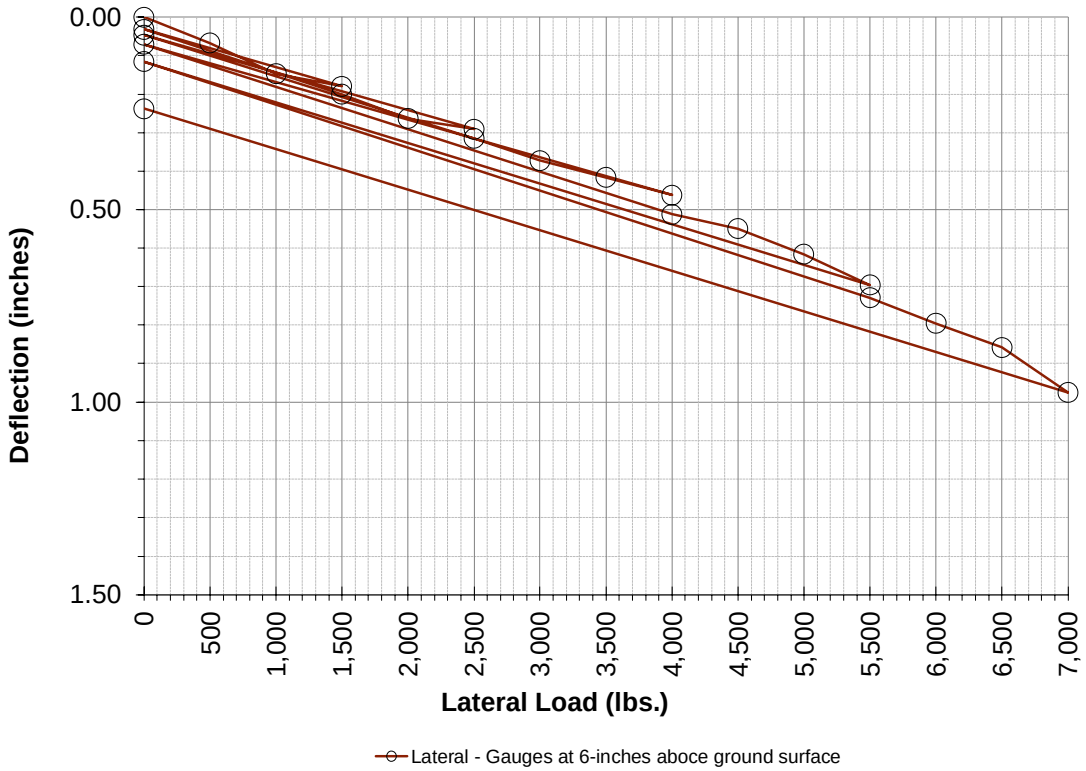
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-105A
Latitude [deg.]:	35.54761
Longitude [deg.]:	-106.00260
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	20.8

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.067	
14%	1,000	0.147	
21%	1,500	0.180	
0%	0	0.032	
21%	1,500	0.201	
29%	2,000	0.264	
36%	2,500	0.292	
0%	0	0.047	
36%	2,500	0.316	
43%	3,000	0.373	
50%	3,500	0.417	
57%	4,000	0.463	
0%	0	0.071	
57%	4,000	0.513	
64%	4,500	0.550	
71%	5,000	0.616	
79%	5,500	0.697	
0%	0	0.116	
79%	5,500	0.729	
86%	6,000	0.795	
93%	6,500	0.858	
100%	7,000	0.976	
0%	0	0.239	



Lateral Load Test Results for PLT-105B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

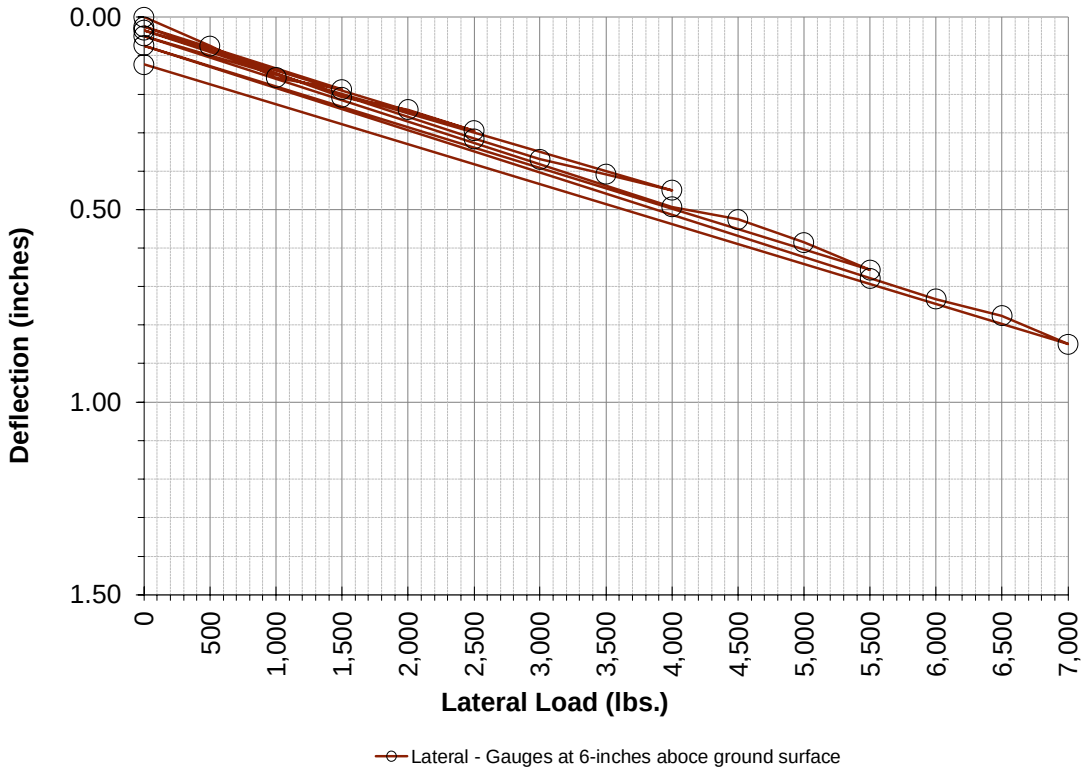
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-105B
Latitude [deg.]:	35.54761
Longitude [deg.]:	-106.00260
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	57

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.076	
14%	1,000	0.158	
21%	1,500	0.189	
0%	0	0.026	
21%	1,500	0.209	
29%	2,000	0.241	
36%	2,500	0.295	
0%	0	0.034	
36%	2,500	0.316	
43%	3,000	0.369	
50%	3,500	0.409	
57%	4,000	0.450	
0%	0	0.049	
57%	4,000	0.493	
64%	4,500	0.526	
71%	5,000	0.586	
79%	5,500	0.657	
0%	0	0.074	
79%	5,500	0.679	
86%	6,000	0.733	
93%	6,500	0.776	
100%	7,000	0.850	
0%	0	0.124	



Lateral Load Test Results for PLT-106A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

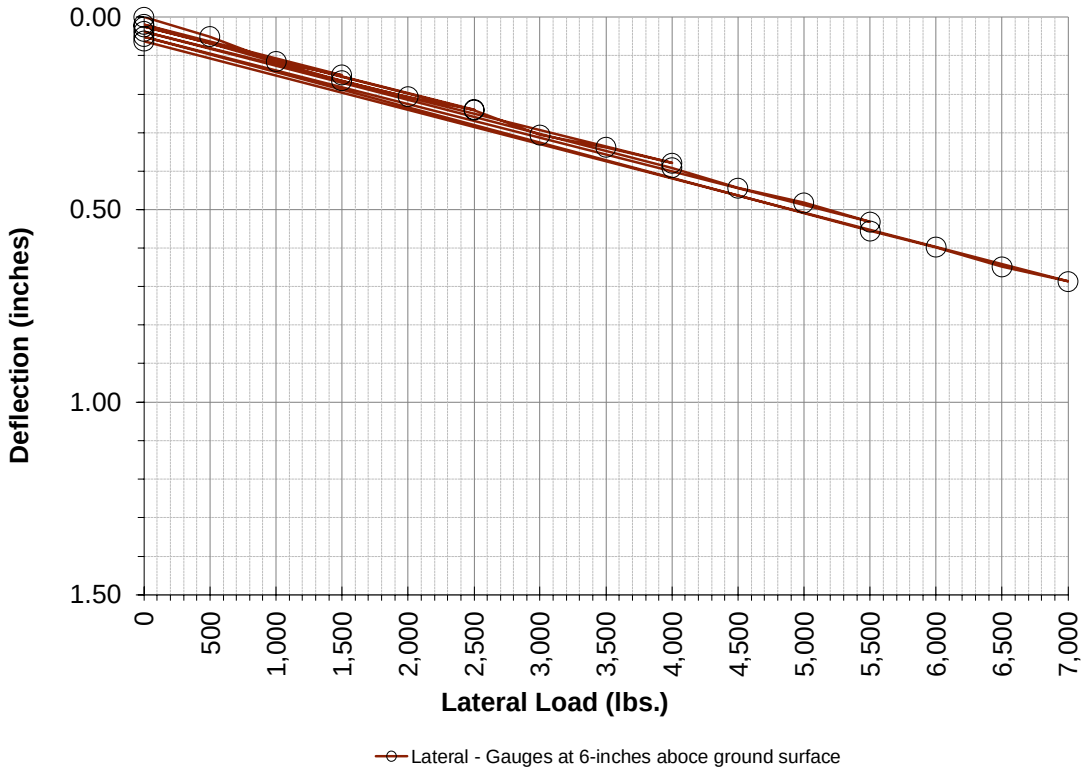
Test Date and Representative

Tested By Terracon Rep:	SL/JPS
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-106A
Latitude [deg.]:	35.54803
Longitude [deg.]:	-106.00970
Pile Type:	W6x9
Pile Embedment Depth [in.]:	108
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	21.5

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.051	
14%	1,000	0.116	
21%	1,500	0.151	
0%	0	0.020	
21%	1,500	0.166	
29%	2,000	0.207	
36%	2,500	0.241	
0%	0	0.026	
36%	2,500	0.243	
43%	3,000	0.306	
50%	3,500	0.339	
57%	4,000	0.380	
0%	0	0.038	
57%	4,000	0.392	
64%	4,500	0.445	
71%	5,000	0.483	
79%	5,500	0.533	
0%	0	0.051	
79%	5,500	0.555	
86%	6,000	0.598	
93%	6,500	0.649	
100%	7,000	0.687	
0%	0	0.063	



Lateral Load Test Results for PLT-106B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

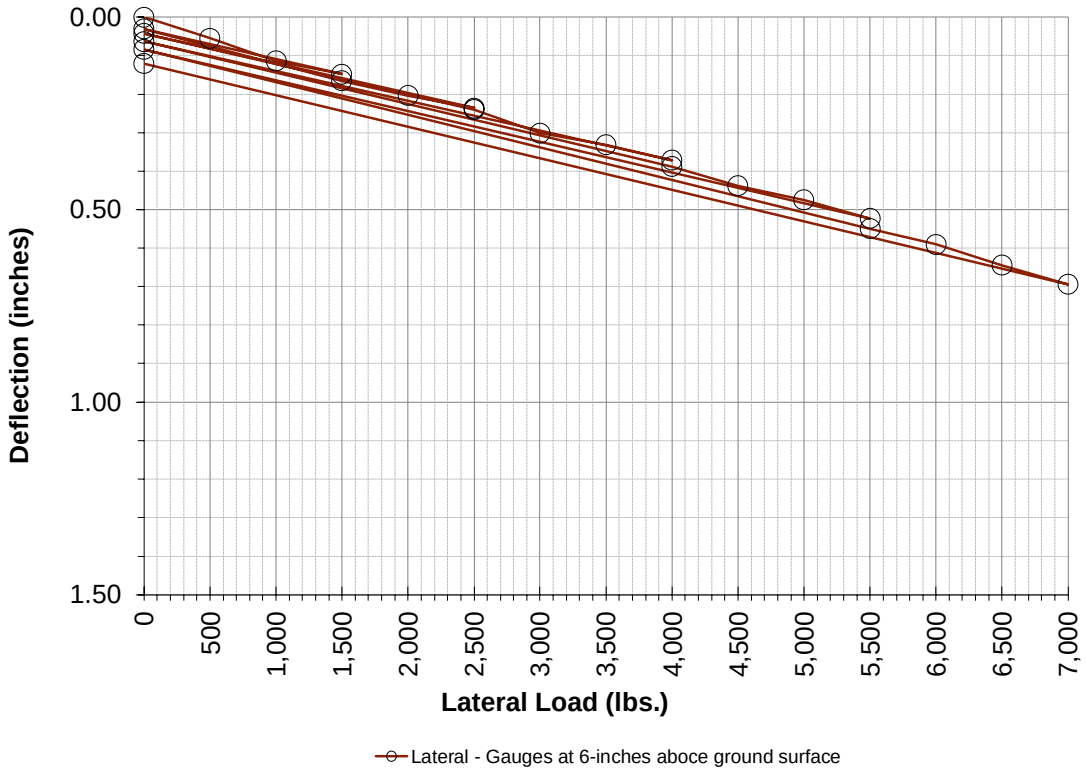
Test Date and Representative

Tested By Terracon Rep:	SL/JPS
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-106B
Latitude [deg.]:	35.54803
Longitude [deg.]:	-106.00970
Pile Type:	W6x9
Pile Embedment Depth [in.]:	108
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	50.3

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.055	
14%	1,000	0.114	
21%	1,500	0.148	
0%	0	0.031	
21%	1,500	0.166	
29%	2,000	0.204	
36%	2,500	0.236	
0%	0	0.043	
36%	2,500	0.241	
43%	3,000	0.301	
50%	3,500	0.332	
57%	4,000	0.372	
0%	0	0.064	
57%	4,000	0.388	
64%	4,500	0.439	
71%	5,000	0.476	
79%	5,500	0.523	
0%	0	0.084	
79%	5,500	0.550	
86%	6,000	0.591	
93%	6,500	0.645	
100%	7,000	0.694	
0%	0	0.122	



Lateral Load Test Results for PTL-107A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

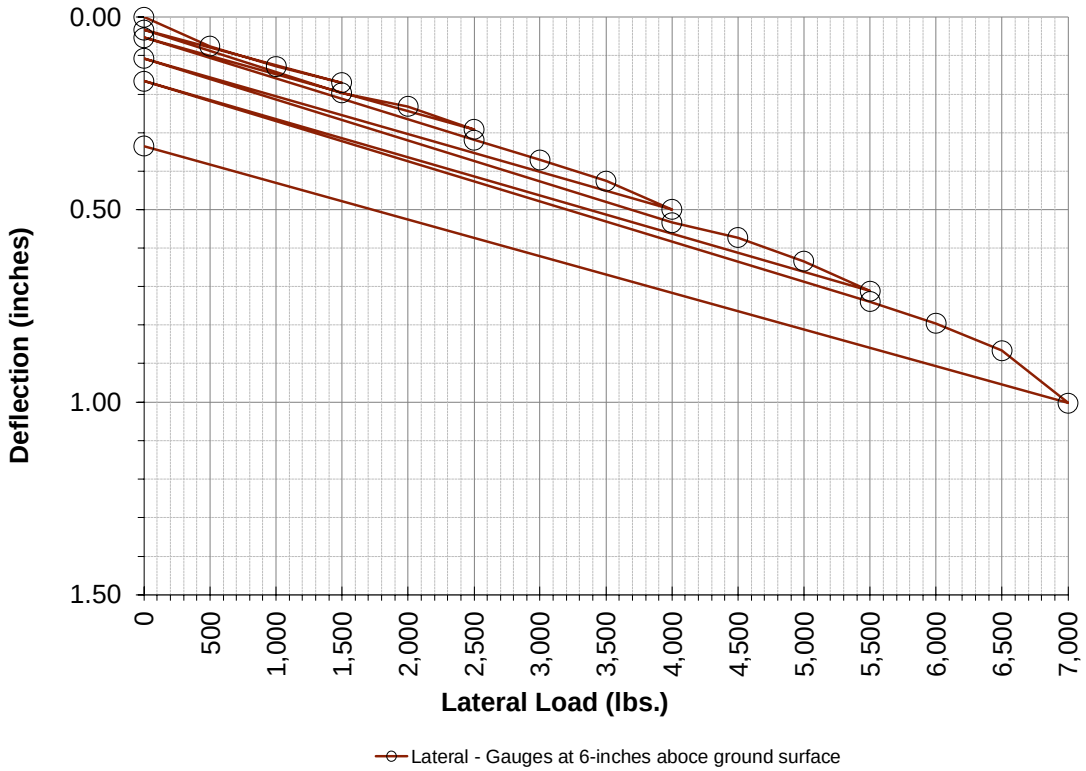
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/4/2023

Pile Information

Pile ID:	PTL-107A
Latitude [deg.]:	35.54924
Longitude [deg.]:	-106.01520
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	12.9

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.076	
14%	1,000	0.128	
21%	1,500	0.170	
0%	0	0.034	
21%	1,500	0.198	
29%	2,000	0.233	
36%	2,500	0.293	
0%	0	0.054	
36%	2,500	0.320	
43%	3,000	0.371	
50%	3,500	0.426	
57%	4,000	0.500	
0%	0	0.108	
57%	4,000	0.534	
64%	4,500	0.573	
71%	5,000	0.634	
79%	5,500	0.712	
0%	0	0.167	
79%	5,500	0.739	
86%	6,000	0.796	
93%	6,500	0.867	
100%	7,000	1.003	
0%	0	0.336	



Lateral Load Test Results for PLT-107B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

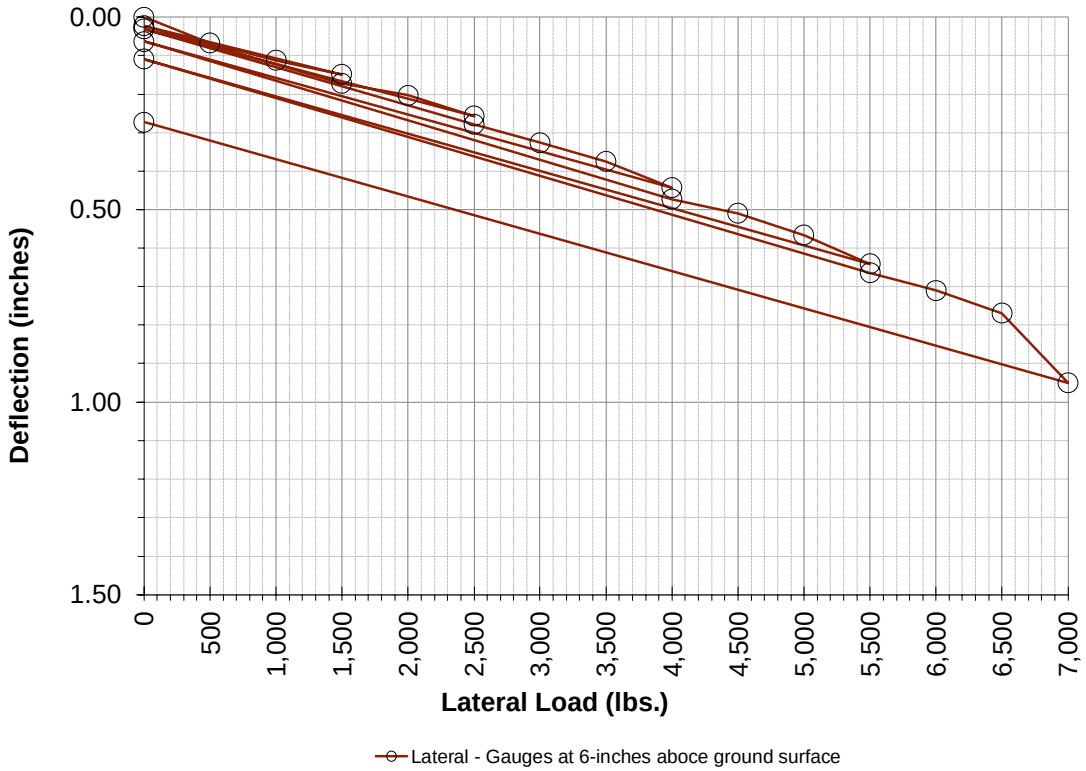
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/4/2023

Pile Information

Pile ID:	PLT-107B
Latitude [deg.]:	35.54924
Longitude [deg.]:	-106.01518
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	23.9

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.068	
14%	1,000	0.113	
21%	1,500	0.149	
0%	0	0.023	
21%	1,500	0.173	
29%	2,000	0.203	
36%	2,500	0.257	
0%	0	0.031	
36%	2,500	0.279	
43%	3,000	0.326	
50%	3,500	0.376	
57%	4,000	0.443	
0%	0	0.064	
57%	4,000	0.473	
64%	4,500	0.510	
71%	5,000	0.567	
79%	5,500	0.641	
0%	0	0.109	
79%	5,500	0.664	
86%	6,000	0.710	
93%	6,500	0.770	
100%	7,000	0.951	
0%	0	0.273	



Lateral Load Test Results for PLT-108A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

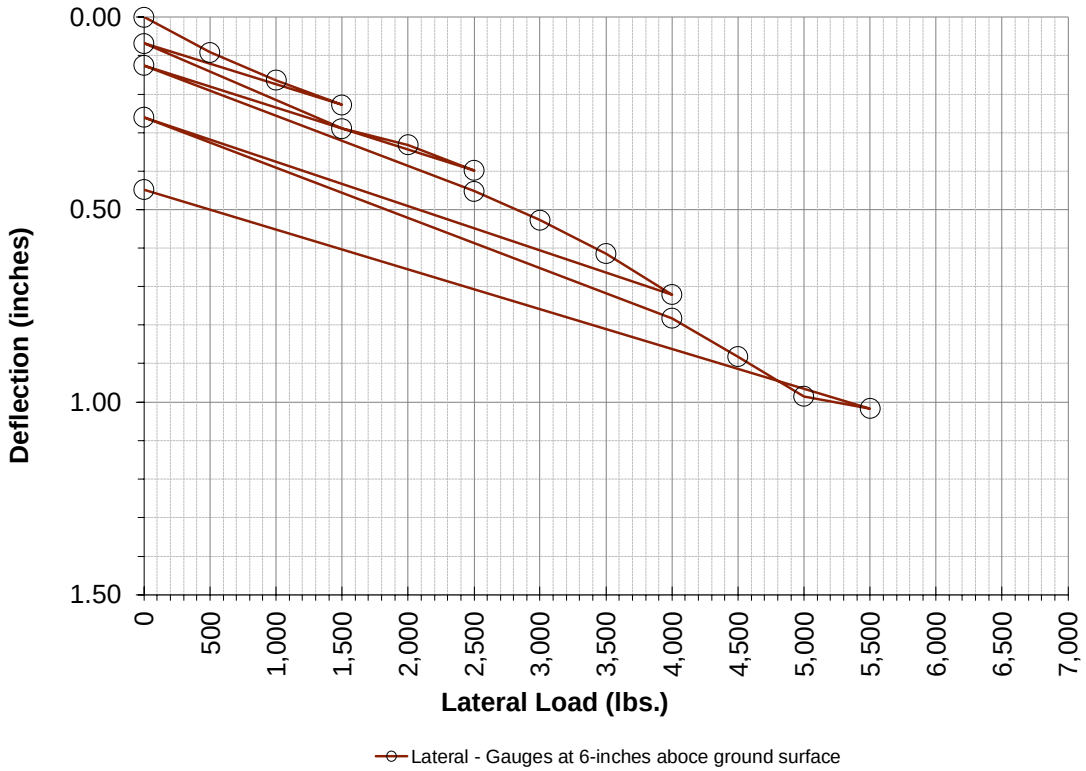
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-108A
Latitude [deg.]:	35.55227
Longitude [deg.]:	-106.01030
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	8.1

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.092	
14%	1,000	0.164	
21%	1,500	0.228	
0%	0	0.069	
21%	1,500	0.290	
29%	2,000	0.332	
36%	2,500	0.399	
0%	0	0.126	
36%	2,500	0.453	
43%	3,000	0.528	
50%	3,500	0.615	
57%	4,000	0.721	
0%	0	0.261	
57%	4,000	0.783	
64%	4,500	0.883	
71%	5,000	0.986	
79%	5,500	1.017	
0%	0		
79%	5,500		
86%	6,000		
93%	6,500		
100%	7,000		
0%	0	0.449	



Lateral Load Test Results for PLT-108B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

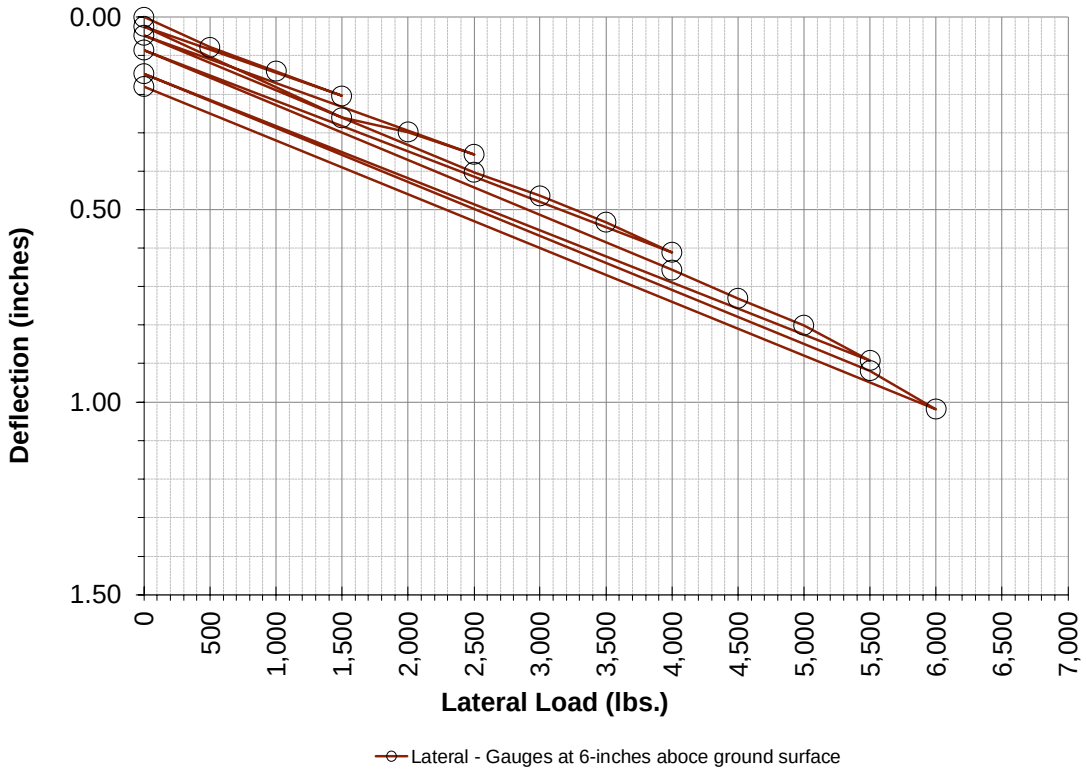
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/3/2023

Pile Information

Pile ID:	PLT-108B
Latitude [deg.]:	35.55227
Longitude [deg.]:	-106.01030
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	9.2

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.079	
14%	1,000	0.141	
21%	1,500	0.205	
0%	0	0.025	
21%	1,500	0.262	
29%	2,000	0.299	
36%	2,500	0.357	
0%	0	0.048	
36%	2,500	0.404	
43%	3,000	0.464	
50%	3,500	0.533	
57%	4,000	0.612	
0%	0	0.086	
57%	4,000	0.657	
64%	4,500	0.731	
71%	5,000	0.801	
79%	5,500	0.892	
0%	0	0.147	
79%	5,500	0.919	
86%	6,000	1.018	
93%	6,500		
100%	7,000		
0%	0	0.181	



Lateral Load Test Results for PLT-109A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

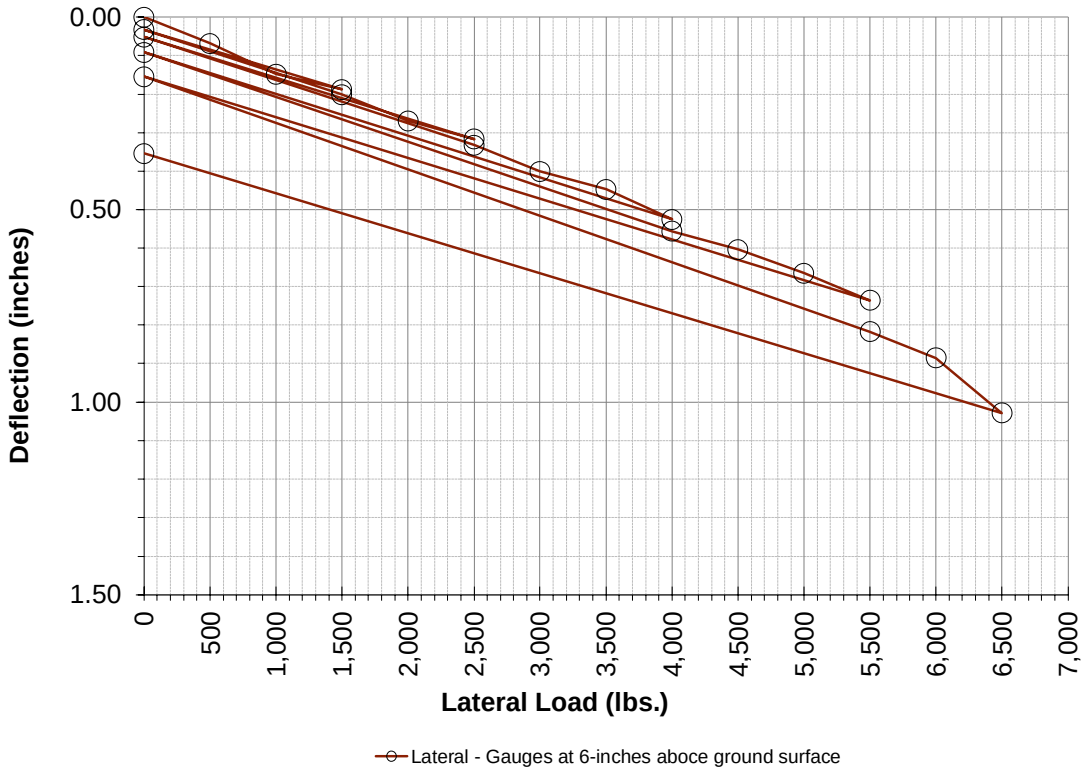
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/4/2023

Pile Information

Pile ID:	PLT-109A
Latitude [deg.]:	35.55374
Longitude [deg.]:	-106.01736
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	16.7

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.068	
14%	1,000	0.148	
21%	1,500	0.189	
0%	0	0.033	
21%	1,500	0.201	
29%	2,000	0.270	
36%	2,500	0.317	
0%	0	0.052	
36%	2,500	0.333	
43%	3,000	0.401	
50%	3,500	0.448	
57%	4,000	0.526	
0%	0	0.092	
57%	4,000	0.557	
64%	4,500	0.604	
71%	5,000	0.666	
79%	5,500	0.736	
0%	0	0.155	
79%	5,500	0.818	
86%	6,000	0.885	
93%	6,500	1.028	
100%	7,000		
0%	0	0.354	



Lateral Load Test Results for PLT-109B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

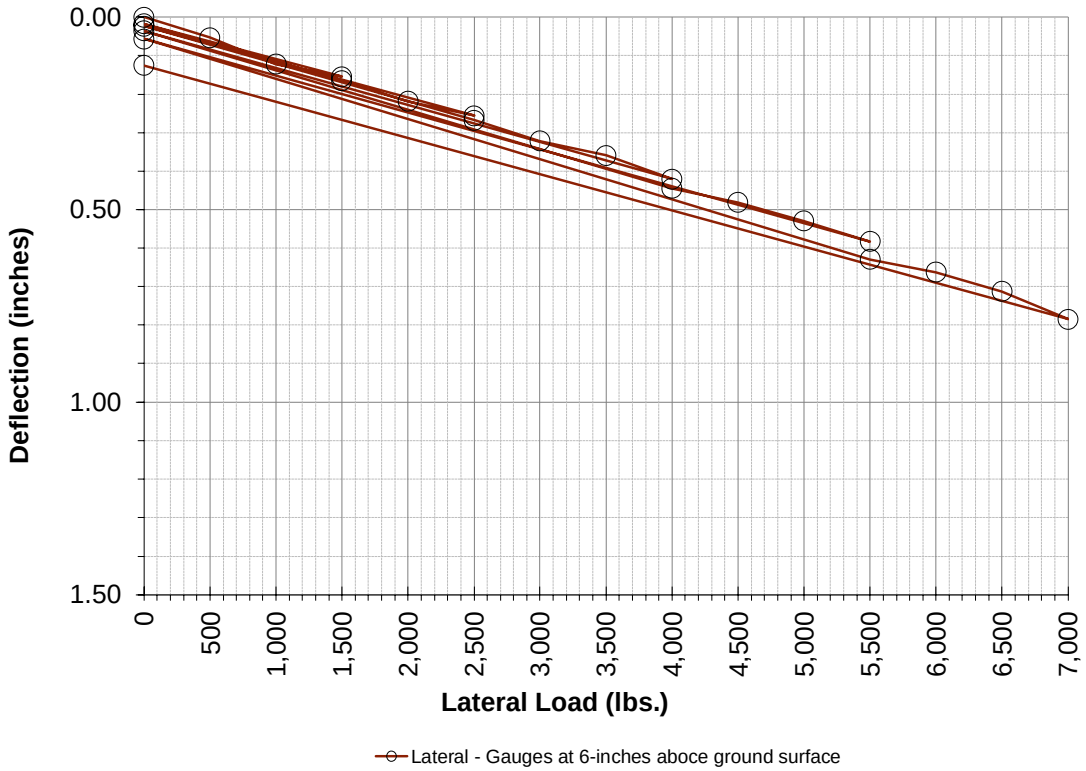
Test Date and Representative

Tested By Terracon Rep:	SL/ED
Date Tested:	10/4/2023

Pile Information

Pile ID:	PLT-109B
Latitude [deg.]:	35.55374
Longitude [deg.]:	-106.01736
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	37.6

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.054	
14%	1,000	0.123	
21%	1,500	0.155	
0%	0	0.018	
21%	1,500	0.165	
29%	2,000	0.219	
36%	2,500	0.257	
0%	0	0.024	
36%	2,500	0.268	
43%	3,000	0.322	
50%	3,500	0.360	
57%	4,000	0.421	
0%	0	0.036	
57%	4,000	0.446	
64%	4,500	0.482	
71%	5,000	0.530	
79%	5,500	0.583	
0%	0	0.057	
79%	5,500	0.630	
86%	6,000	0.663	
93%	6,500	0.713	
100%	7,000	0.785	
0%	0	0.126	



Lateral Load Test Results for PLT-110A

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

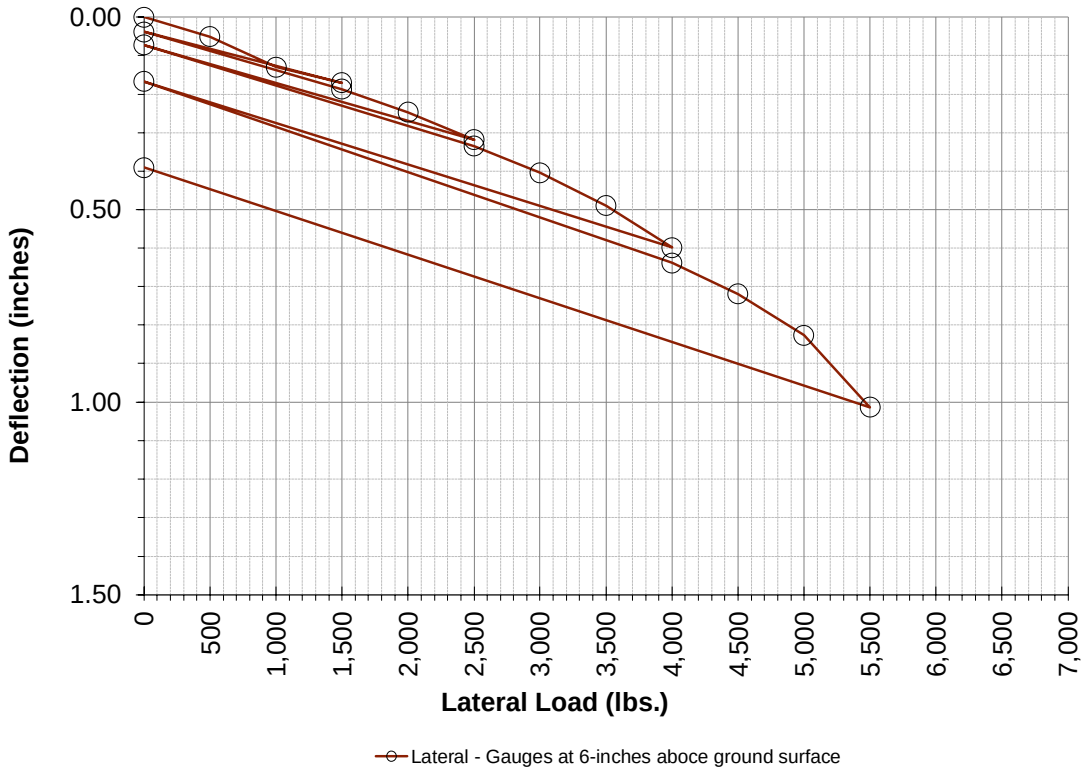
Test Date and Representative

Tested By Terracon Rep:	ED/TS
Date Tested:	3/11/2024

Pile Information

Pile ID:	PLT-110A
Latitude [deg.]:	35.54438
Longitude [deg.]:	-106.01141
Pile Type:	W6x9
Pile Embedment Depth [in.]:	60
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	0

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.051	
14%	1,000	0.130	
21%	1,500	0.171	
0%	0	0.039	
21%	1,500	0.188	
29%	2,000	0.248	
36%	2,500	0.319	
0%	0	0.073	
36%	2,500	0.335	
43%	3,000	0.404	
50%	3,500	0.490	
57%	4,000	0.599	
0%	0	0.167	
57%	4,000	0.639	
64%	4,500	0.719	
71%	5,000	0.827	
79%	5,500	1.014	
0%	0		
79%	5,500		
86%	6,000		
93%	6,500		
100%	7,000		
0%	0	0.391	



Lateral Load Test Results for PLT-110B

Project Information

Project Name:	Rancho Viejo
Project Location:	Santa Fe, New Mexico
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	N/A
Number of Bottom Gauges:	2
Height of Top Gauges [in.]:	NA
Height of Bottom Gauges [in.]:	6
Height of Applied Load [in.]:	42
Load Cell:	Dillion

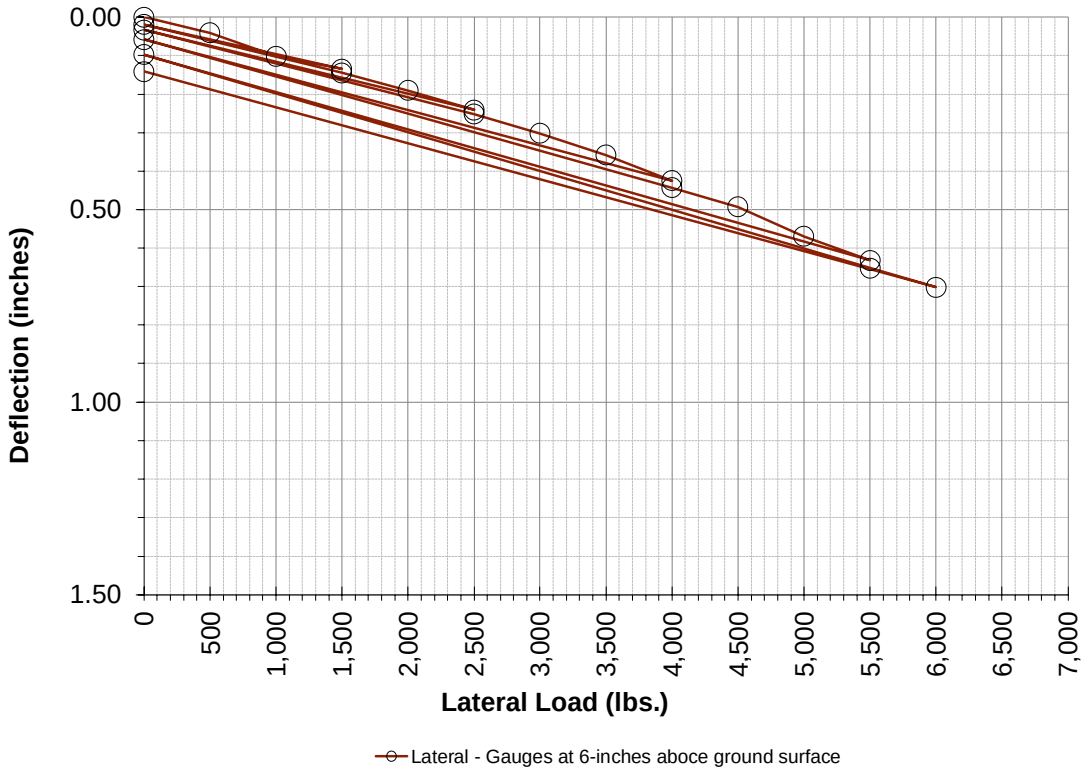
Test Date and Representative

Tested By Terracon Rep:	ED/TS
Date Tested:	3/11/2024

Pile Information

Pile ID:	PLT-110B
Latitude [deg.]:	35.54438
Longitude [deg.]:	-106.01141
Pile Type:	W6x9
Pile Embedment Depth [in.]:	96
Pile Stick-Up [in.]:	48
Lateral Design Load [lbs.]:	7,000
Drive Time [sec.]:	0

% of Design Load	Lateral Load [lbs.]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.042	
14%	1,000	0.102	
21%	1,500	0.135	
0%	0	0.020	
21%	1,500	0.145	
29%	2,000	0.191	
36%	2,500	0.242	
0%	0	0.034	
36%	2,500	0.252	
43%	3,000	0.302	
50%	3,500	0.359	
57%	4,000	0.425	
0%	0	0.059	
57%	4,000	0.444	
64%	4,500	0.494	
71%	5,000	0.570	
79%	5,500	0.632	
0%	0	0.098	
79%	5,500	0.652	
86%	6,000	0.702	
93%	6,500		
100%	7,000		
0%	0	0.142	



Lateral Load Test Result for PLT-001A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

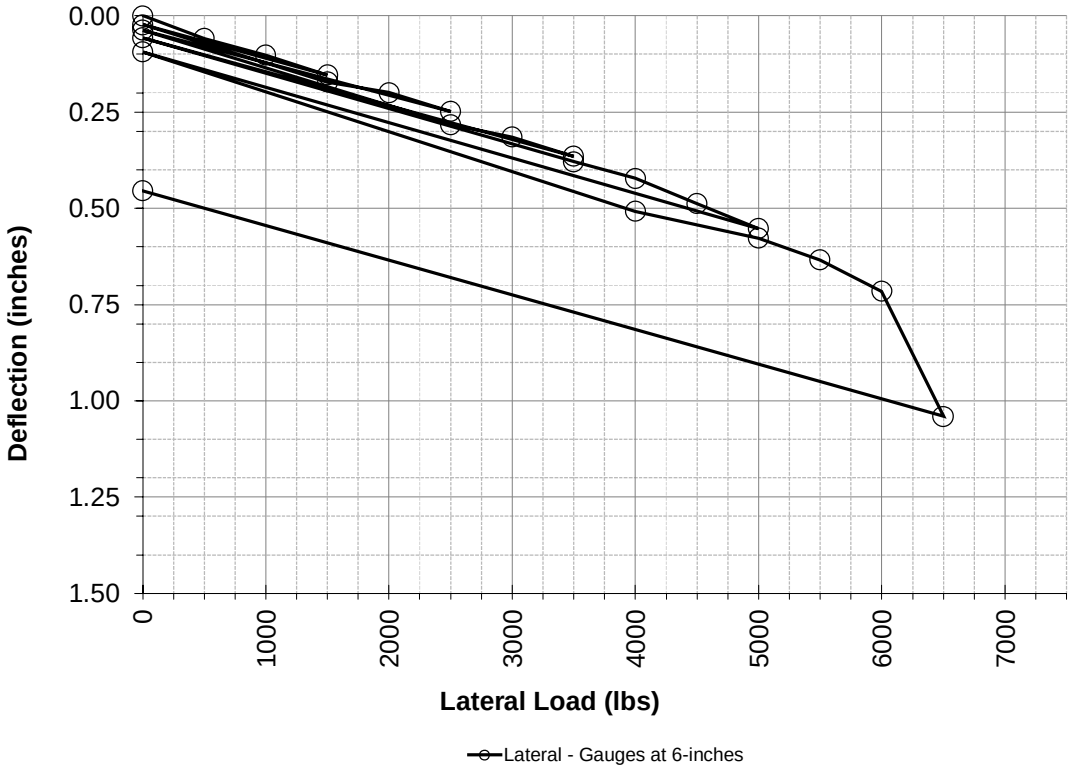
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-001A
Latitude:	35.55334
Longitude:	-106.01315
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	39.7

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.059	
14%	1000	0.102	
21%	1500	0.154	
0%	0	0.024	
21%	1500	0.172	
29%	2000	0.200	
36%	2500	0.249	
0%	0	0.037	
36%	2500	0.283	
43%	3000	0.316	
50%	3500	0.365	
0%	0	0.058	
50%	3500	0.380	
57%	4000	0.423	
64%	4500	0.488	
71%	5000	0.553	
0%	0	0.095	
57%	4000	0.508	
71%	5000	0.578	
79%	5500	0.634	
86%	6000	0.715	
93%	6500	1.040	
100%	7000		
0%	0	0.455	



Lateral Load Test Result for PLT-001B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

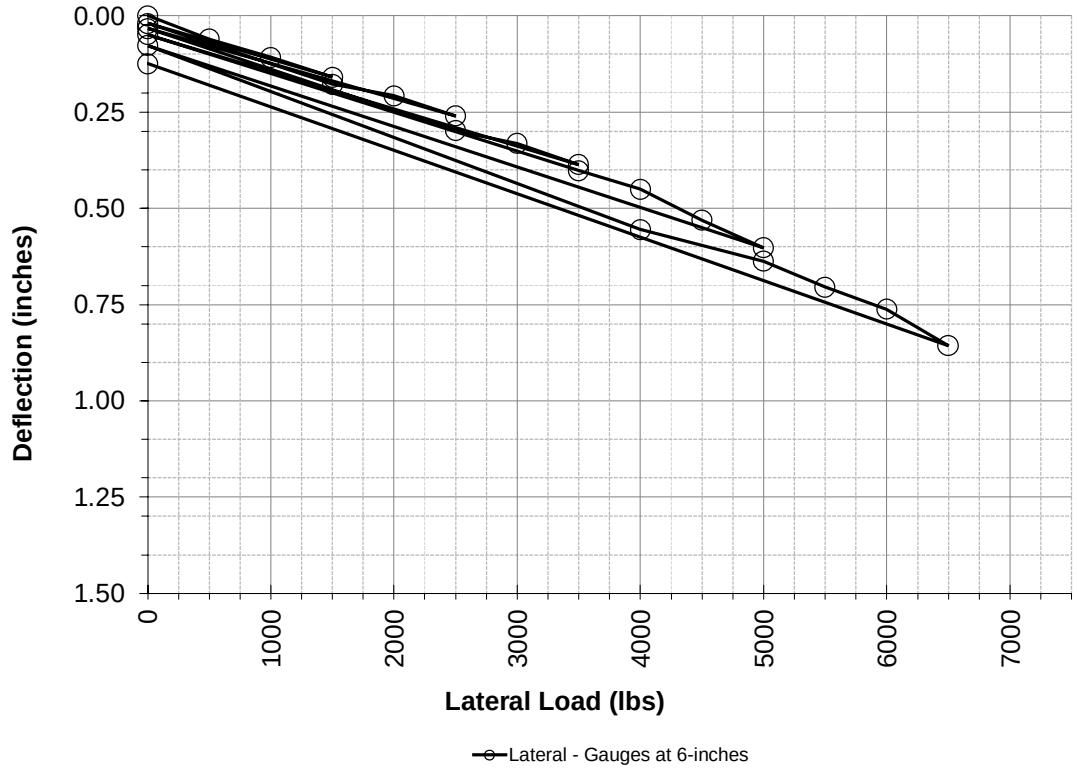
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-001B
Latitude:	35.55334
Longitude:	-106.01315
Pile Type:	W6X9
Pile Embedment Depth [in]:	96
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	50.8

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.061	
14%	1000	0.109	
21%	1500	0.160	
0%	0	0.021	
21%	1500	0.179	
29%	2000	0.209	
36%	2500	0.261	
0%	0	0.034	
36%	2500	0.299	
43%	3000	0.332	
50%	3500	0.387	
0%	0	0.049	
50%	3500	0.403	
57%	4000	0.451	
64%	4500	0.531	
71%	5000	0.603	
0%	0	0.078	
57%	4000	0.556	
71%	5000	0.638	
79%	5500	0.705	
86%	6000	0.762	
93%	6500	0.857	
100%	7000		
0%	0	0.125	



Lateral Load Test Result for PLT-002A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

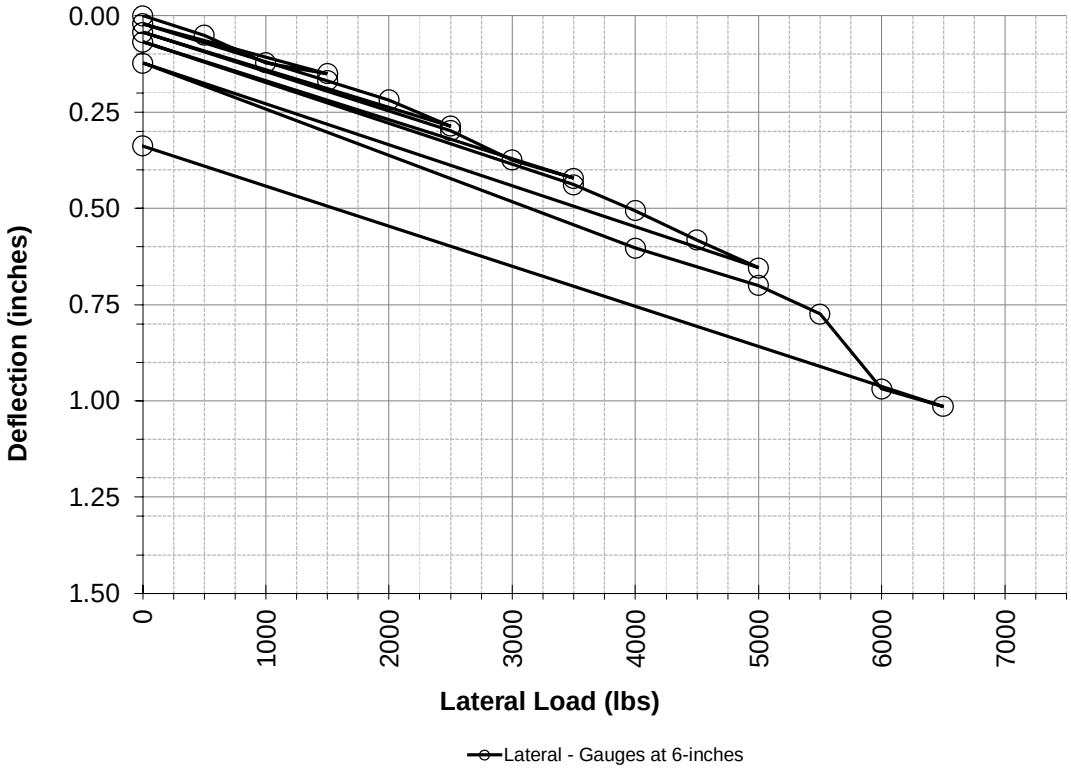
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-002A
Latitude:	35.55151
Longitude:	-106.00214
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	35.4

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.051	
14%	1000	0.123	
21%	1500	0.151	
0%	0	0.021	
21%	1500	0.169	
29%	2000	0.219	
36%	2500	0.287	
0%	0	0.044	
36%	2500	0.299	
43%	3000	0.375	
50%	3500	0.423	
0%	0	0.069	
50%	3500	0.439	
57%	4000	0.507	
64%	4500	0.582	
71%	5000	0.655	
0%	0	0.124	
57%	4000	0.604	
71%	5000	0.700	
79%	5500	0.775	
86%	6000	0.969	
93%	6500	1.015	
100%	7000		
0%	0	0.338	



Lateral Load Test Result for PLT-002B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

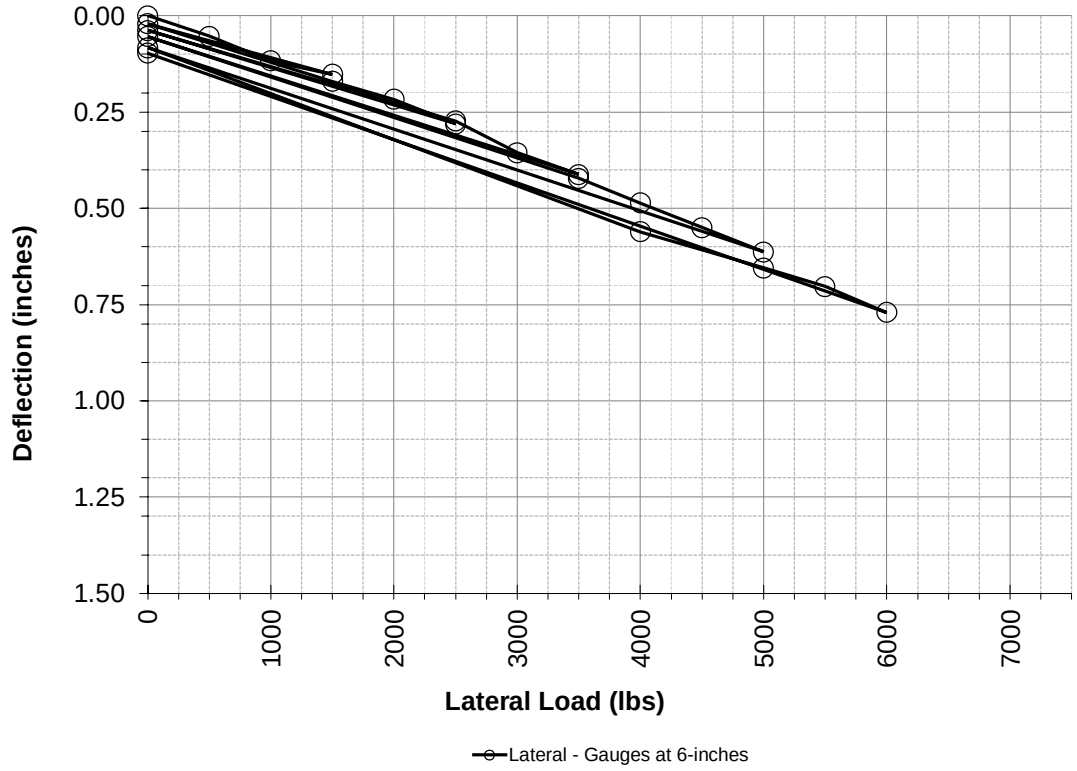
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/25/2022

Pile Information

Pile ID:	PLT-002B
Latitude:	35.55151
Longitude:	-106.00214
Pile Type:	W6X9
Pile Embedment Depth [in]:	92
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	37.1

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.054	
14%	1000	0.117	
21%	1500	0.153	
0%	0	0.022	
21%	1500	0.170	
29%	2000	0.218	
36%	2500	0.281	
0%	0	0.039	
36%	2500	0.274	
43%	3000	0.356	
50%	3500	0.412	
0%	0	0.055	
50%	3500	0.423	
57%	4000	0.486	
64%	4500	0.551	
71%	5000	0.614	
0%	0	0.083	
57%	4000	0.561	
71%	5000	0.655	
79%	5500	0.704	
86%	6000	0.770	
93%	6500		
100%	7000		
0%	0	0.097	



Lateral Load Test Result for PLT-003A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

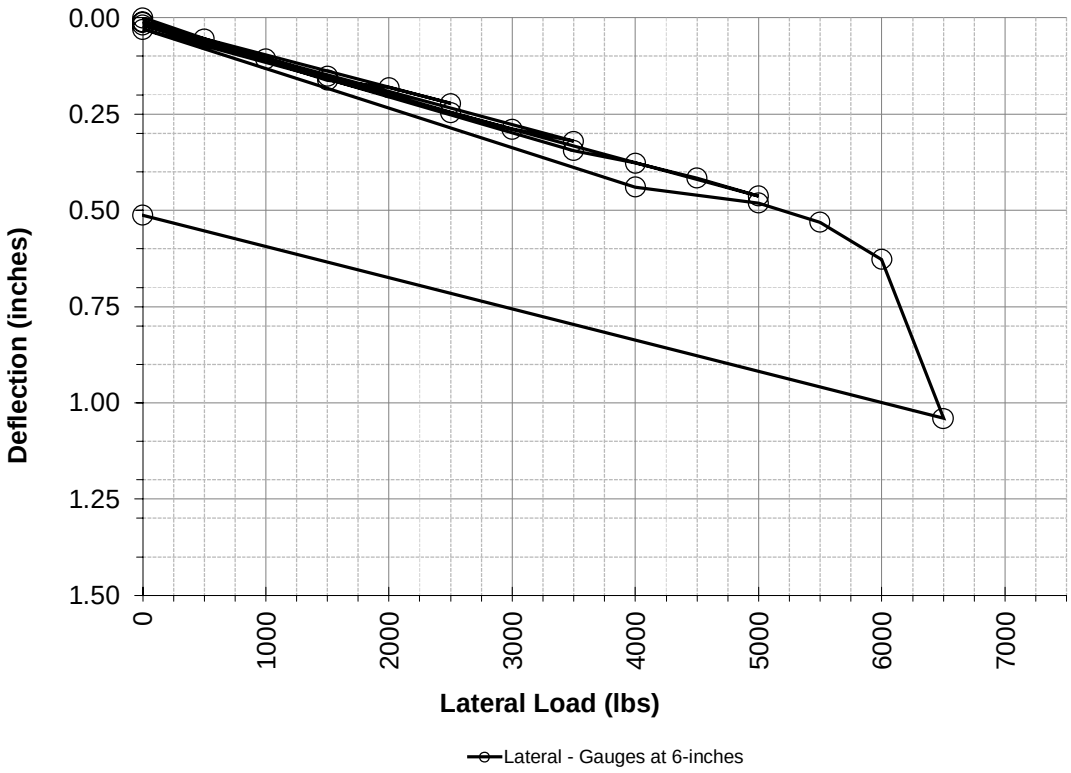
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-003A
Latitude:	35.54711
Longitude:	-106.01618
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	97.2

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.055	
14%	1000	0.107	
21%	1500	0.152	
0%	0	0.011	
21%	1500	0.163	
29%	2000	0.182	
36%	2500	0.223	
0%	0	0.013	
36%	2500	0.246	
43%	3000	0.289	
50%	3500	0.321	
0%	0	0.020	
50%	3500	0.345	
57%	4000	0.377	
64%	4500	0.417	
71%	5000	0.463	
0%	0	0.030	
57%	4000	0.440	
71%	5000	0.482	
79%	5500	0.531	
86%	6000	0.628	
93%	6500	1.040	
100%	7000		
0%	0	0.513	



Lateral Load Test Result for PLT-003B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

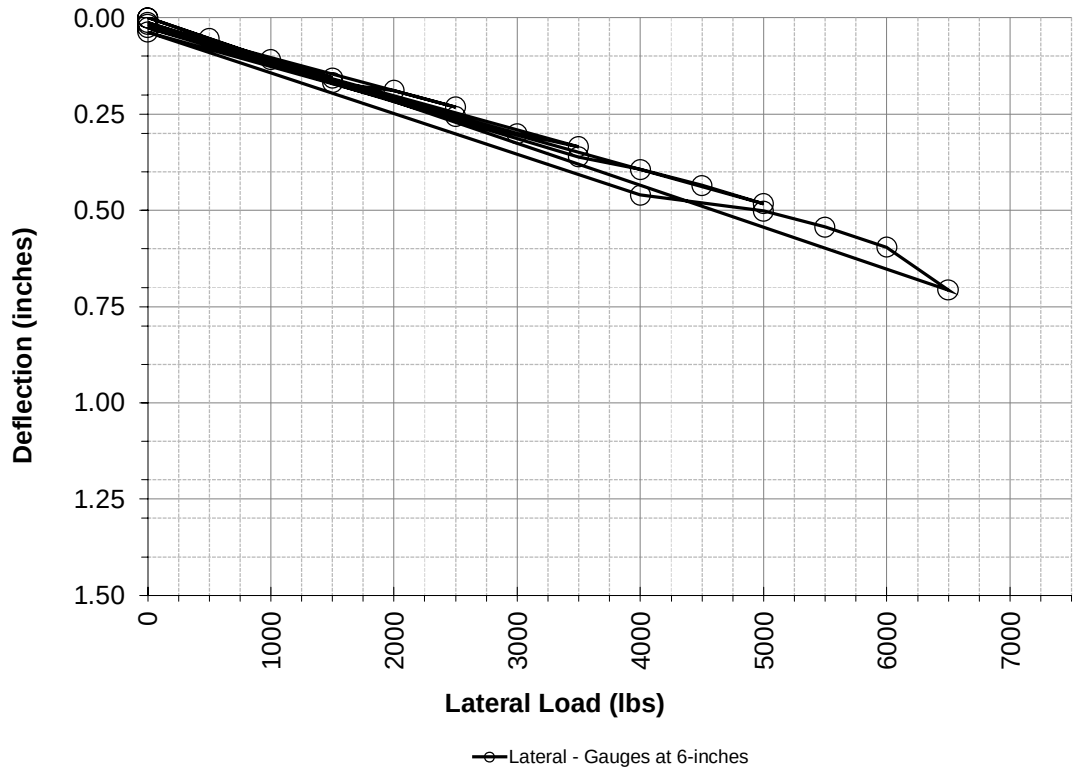
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-003B
Latitude:	35.54711
Longitude:	-106.01618
Pile Type:	W6X9
Pile Embedment Depth [in]:	92
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	239.4

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.055	
14%	1000	0.109	
21%	1500	0.157	
0%	0	0.013	
21%	1500	0.169	
29%	2000	0.189	
36%	2500	0.232	
0%	0	0.018	
36%	2500	0.256	
43%	3000	0.301	
50%	3500	0.335	
0%	0	0.026	
50%	3500	0.362	
57%	4000	0.394	
64%	4500	0.436	
71%	5000	0.484	
0%	0	0.038	
57%	4000	0.461	
71%	5000	0.503	
79%	5500	0.544	
86%	6000	0.596	
93%	6500	0.707	
100%	7000		
0%	0	0.000	



Lateral Load Test Result for PLT-004A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

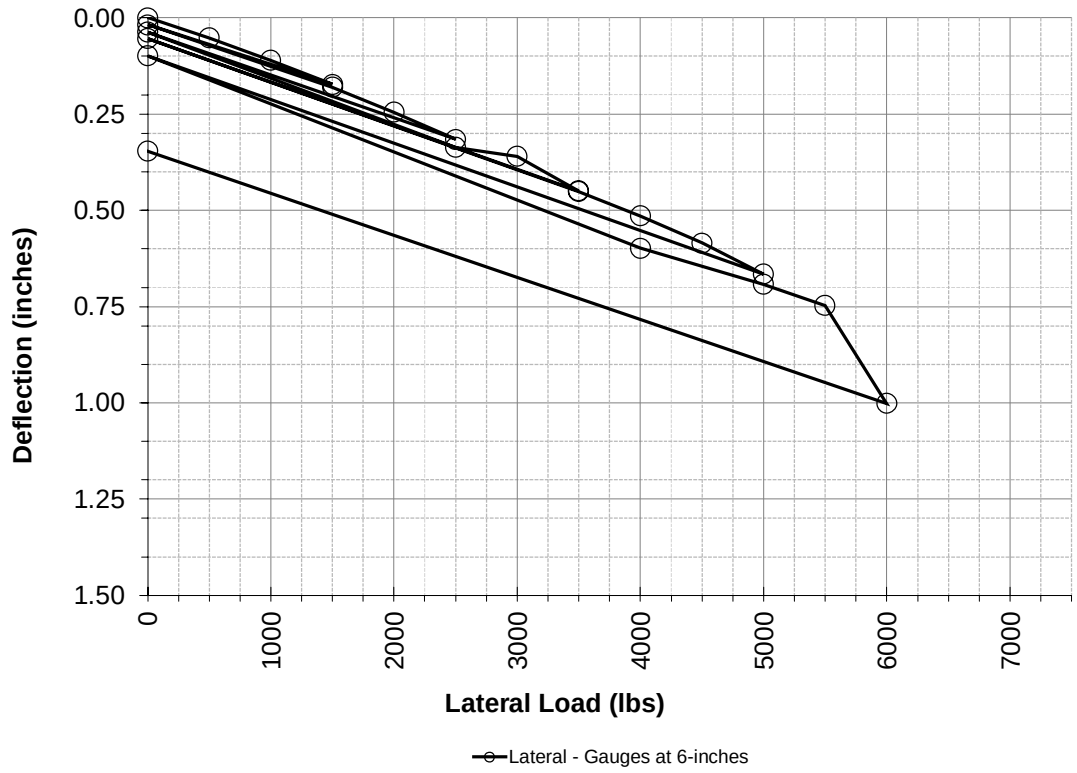
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-004A
Latitude:	35.54296
Longitude:	-106.03023
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	22.6

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.052	
14%	1000	0.111	
21%	1500	0.173	
0%	0	0.019	
21%	1500	0.181	
29%	2000	0.246	
36%	2500	0.316	
0%	0	0.038	
36%	2500	0.337	
43%	3000	0.360	
50%	3500	0.450	
0%	0	0.055	
50%	3500	0.452	
57%	4000	0.514	
64%	4500	0.586	
71%	5000	0.666	
0%	0	0.099	
57%	4000	0.599	
71%	5000	0.692	
79%	5500	0.748	
86%	6000	1.002	
93%	6500		
100%	7000		
0%	0	0.347	



Lateral Load Test Result for PLT-004B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

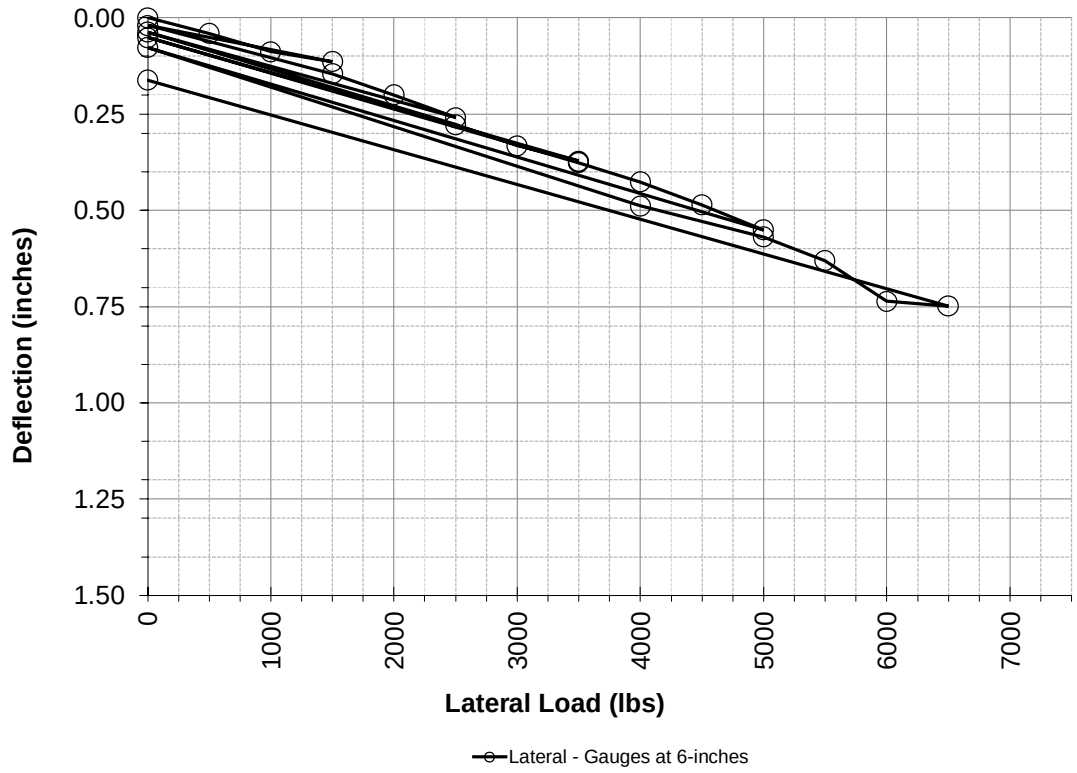
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-004B
Latitude:	35.54296
Longitude:	-106.03023
Pile Type:	W6X9
Pile Embedment Depth [in]:	96
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	108.7

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.042	
14%	1000	0.088	
21%	1500	0.114	
0%	0	0.021	
21%	1500	0.146	
29%	2000	0.201	
36%	2500	0.260	
0%	0	0.038	
36%	2500	0.278	
43%	3000	0.333	
50%	3500	0.373	
0%	0	0.052	
50%	3500	0.377	
57%	4000	0.427	
64%	4500	0.486	
71%	5000	0.551	
0%	0	0.078	
57%	4000	0.489	
71%	5000	0.570	
79%	5500	0.631	
86%	6000	0.737	
93%	6500	0.749	
100%	7000		
0%	0	0.163	



Lateral Load Test Result for PLT-005A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

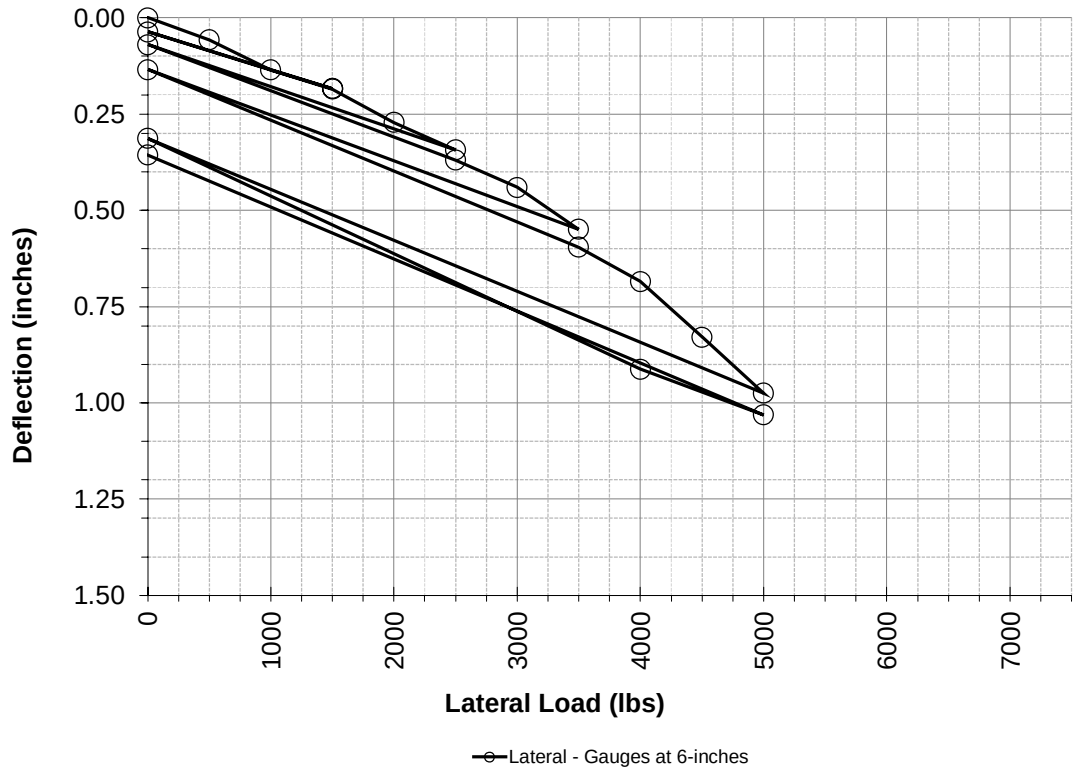
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-005A
Latitude:	35.53853
Longitude:	-106.01312
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	15

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.058	
14%	1000	0.136	
21%	1500	0.184	
0%	0	0.037	
21%	1500	0.185	
29%	2000	0.272	
36%	2500	0.343	
0%	0	0.070	
36%	2500	0.370	
43%	3000	0.441	
50%	3500	0.550	
0%	0	0.135	
50%	3500	0.596	
57%	4000	0.685	
64%	4500	0.830	
71%	5000	0.976	
0%	0	0.314	
57%	4000	0.913	
71%	5000	1.031	
79%	5500		
86%	6000		
93%	6500		
100%	7000		
0%	0	0.357	



Lateral Load Test Result for PLT-005B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

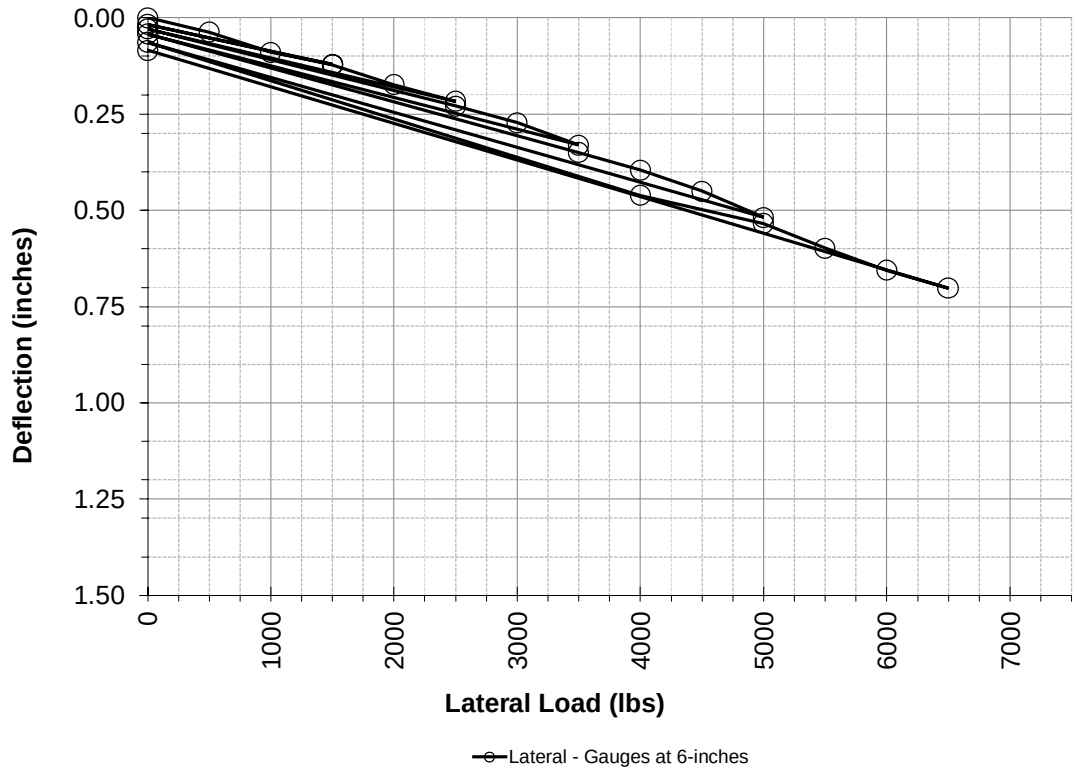
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/18/2022

Pile Information

Pile ID:	PLT-005B
Latitude:	35.53853
Longitude:	-106.01312
Pile Type:	W6X9
Pile Embedment Depth [in]:	96
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	27.3

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.038	
14%	1000	0.090	
21%	1500	0.121	
0%	0	0.018	
21%	1500	0.123	
29%	2000	0.175	
36%	2500	0.218	
0%	0	0.029	
36%	2500	0.230	
43%	3000	0.273	
50%	3500	0.331	
0%	0	0.043	
50%	3500	0.351	
57%	4000	0.396	
64%	4500	0.451	
71%	5000	0.519	
0%	0	0.064	
57%	4000	0.462	
71%	5000	0.535	
79%	5500	0.599	
86%	6000	0.656	
93%	6500	0.703	
100%	7000		
0%	0	0.085	



Lateral Load Test Result for PLT-006A

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

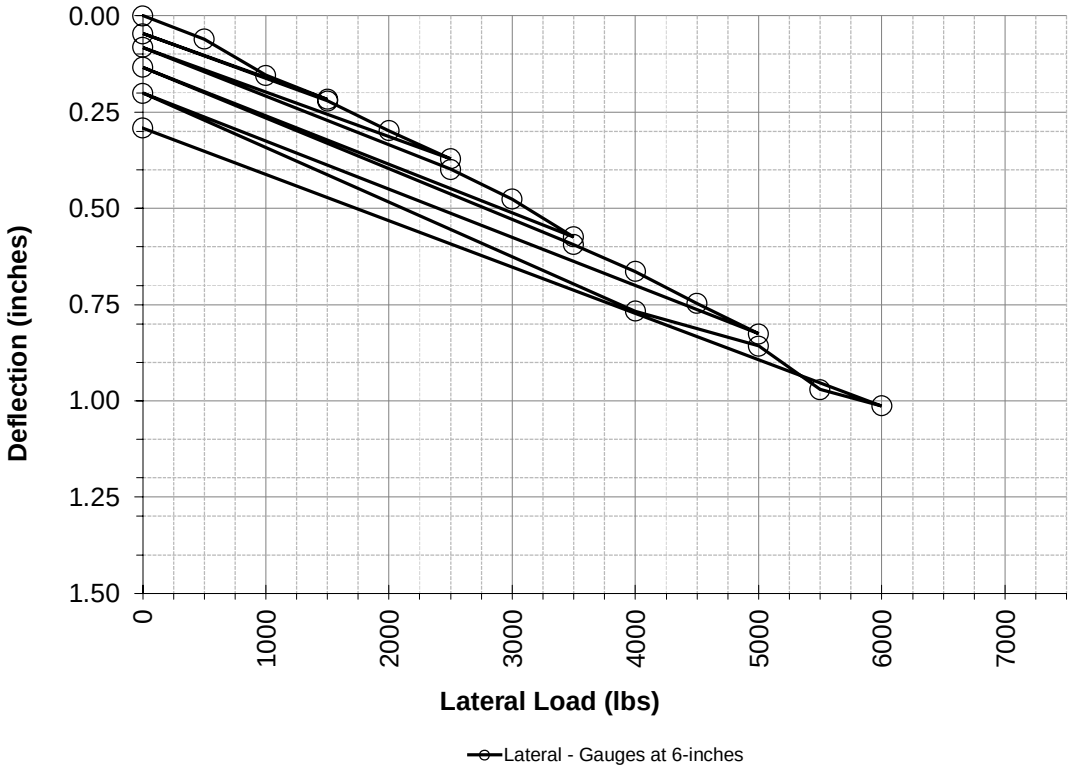
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/22/2022

Pile Information

Pile ID:	PLT-006A
Latitude:	35.54313
Longitude:	-106.00830
Pile Type:	W6X9
Pile Embedment Depth [in]:	60
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	29.8

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.061	
14%	1000	0.155	
21%	1500	0.218	
0%	0	0.047	
21%	1500	0.221	
29%	2000	0.299	
36%	2500	0.372	
0%	0	0.082	
36%	2500	0.400	
43%	3000	0.476	
50%	3500	0.575	
0%	0	0.134	
50%	3500	0.594	
57%	4000	0.664	
64%	4500	0.747	
71%	5000	0.826	
0%	0	0.202	
57%	4000	0.767	
71%	5000	0.858	
79%	5500	0.971	
86%	6000	1.014	
93%	6500		
100%	7000		
0%	0	0.292	



Lateral Load Test Result for PLT-006B

Project Information

Project Name:	Rancho Viejo Solar Facility
Project Location:	Santa Fe County, NM
Project Number:	66225093

Lateral Load Test Set Up

Number of Top Gauges:	0
Number of Bottom Gauges:	2
Height of Top Gauges [in]:	6
Height of Bottom Gauges [in]:	6
Height of Applied Load [in]:	42
Load Cell:	Dillon ED jr 10,000lb

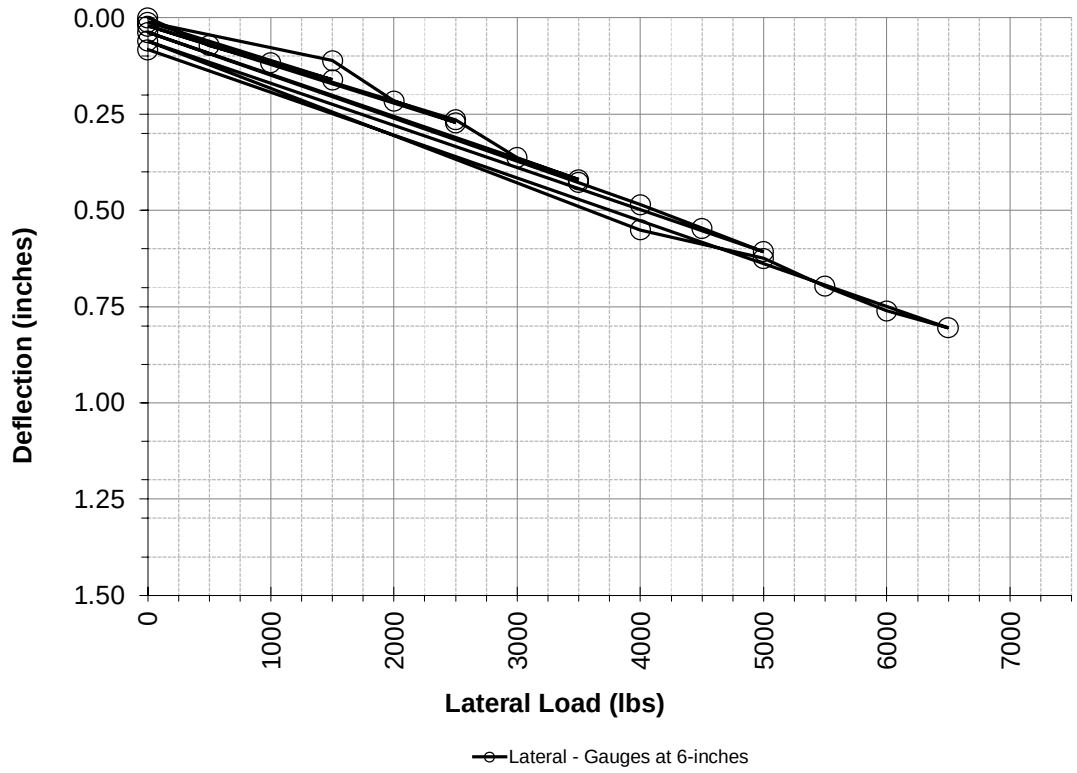
Test Date and Representative

Tested By Terracon Rep:	CS & SC
Date Tested:	8/22/2022

Pile Information

Pile ID:	PLT-006B
Latitude:	35.54313
Longitude:	-106.00830
Pile Type:	W6X9
Pile Embedment Depth [in]:	96
Pile Stick-Up [in]:	48
Lateral Design Load [lbs]:	7000
Drive Time [sec]:	75.7

% of Design Load	Lateral Load [lbs]	Deflection Δ (in.) Gauges #1 & #2	Comments
0%	0	0.000	
7%	500	0.073	
14%	1000	0.117	
21%	1500	0.162	
0%	0	0.012	
21%	1500	0.112	
29%	2000	0.217	
36%	2500	0.273	
0%	0	0.022	
36%	2500	0.265	
43%	3000	0.364	
50%	3500	0.421	
0%	0	0.039	
50%	3500	0.428	
57%	4000	0.486	
64%	4500	0.547	
71%	5000	0.608	
0%	0	0.061	
57%	4000	0.552	
71%	5000	0.625	
79%	5500	0.698	
86%	6000	0.761	
93%	6500	0.806	
100%	7000		
0%	0	0.084	



APPENDIX I
Double Ring Infiltration Test Results

Double Ring Infiltrometer Tests

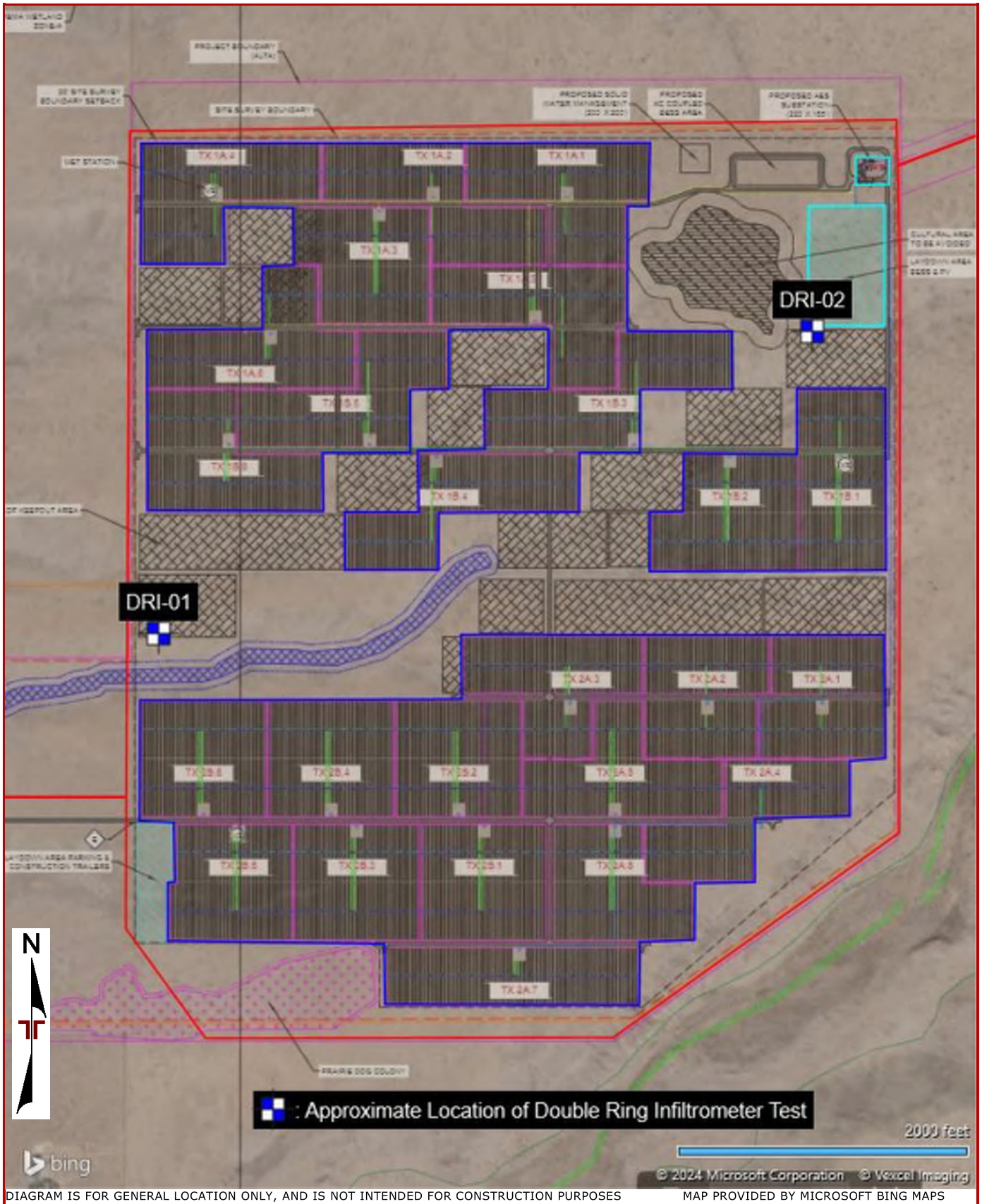


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

DOUBLE RING INFILTRATION TEST SUMMARY

Project

Project Name:	Rancho Viejo Solar
Project Location:	Santa Fe County, New Mexico
Project Number:	66225093

Test Details

Test No.:	DR -1
Depth (Elev.):	4 ft
Technician:	SL
Date:	10/6/2023
Weather:	Sunny
Liquid Type:	Water
Coordinates:	35.545011 -106.017882

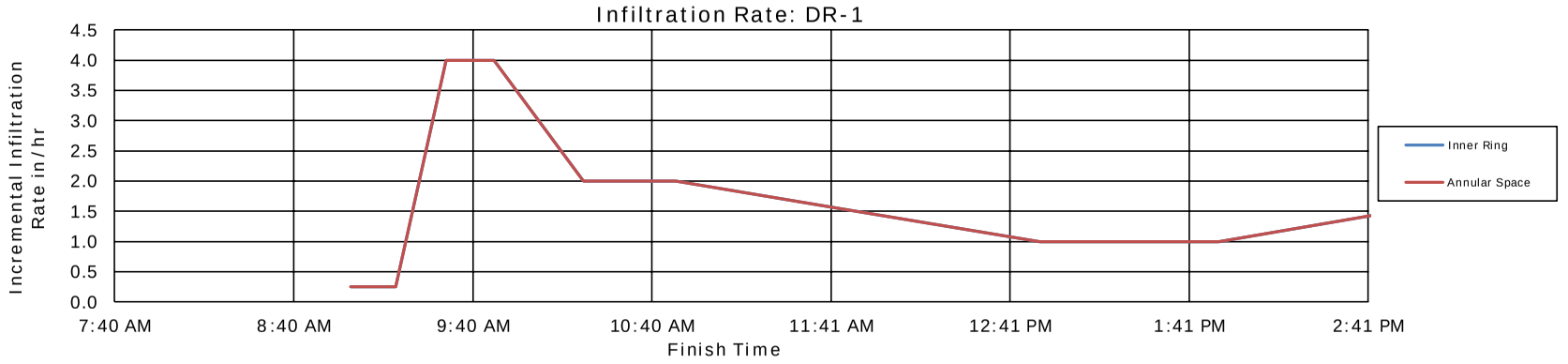
Soil Description

Depth:	4 ft
Description:	silty sand, light brown

Test Setup

Inner Ring Area:	113.1	in^2
Inner Ring Diameter:	12.0	in
Annular space between Outer and Inner rings:	339	in^2
Outer Ring Diameter:	24.0	in
Depth of Liquid Inner Ring:	7.00	in
Depth of Liquid Annular Space:	7.00	in

Trial No.	Time		Elapsed Time (hr:min:sec)	Volume Measurements				Infiltration Rate, in/hr	
				Start		Finish			
	Start	Finish		Inner Ring Volume, in^3	Annular Space Volume, in^3	Inner Ring Volume, in^3	Annular Space Volume, in^3	Inner Ring	Annular Space
1	8:45 AM	9:00:00 AM	0:15:00	792	2375	785	2354	0.25	0.25
2	9:00:00 AM	9:15:00 AM	0:15:00	792	2375	785	2354	0.25	0.25
3	9:17:00 AM	9:32:00 AM	0:15:00	845	2534	732	2195	4.00	4.00
4	9:33:00 AM	9:48:00 AM	0:15:00	845	2534	732	2195	4.00	4.00
5	9:48:00 AM	10:18:00 AM	0:30:00	845	2534	732	2195	2.00	2.00
6	10:19:00 AM	10:49:00 AM	0:30:00	845	2534	732	2195	2.00	2.00
7	10:49:00 AM	11:49:00 AM	1:00:00	873	2619	703	2110	1.50	1.50
8	11:51:00 AM	12:51:00 PM	1:00:00	845	2534	732	2195	1.00	1.00
9	12:51:00 PM	1:51:00 PM	1:00:00	845	2534	732	2195	1.00	1.00
10	1:51:00 PM	2:51:00 PM	1:00:00	873	2619	703	2110	1.50	1.50



DOUBLE RING INFILTRATION TEST SUMMARY

Project

Project Name:	Rancho Viejo Solar
Project Location:	Santa Fe County, New Mexico
Project Number:	66225093

Test Details

Test No.:	DR -2
Depth (Elev.):	4 ft
Technician:	SL
Date:	10/9/2023
Weather:	sunny
Liquid Type:	Water
Coordinates:	35.550217 -106.00271

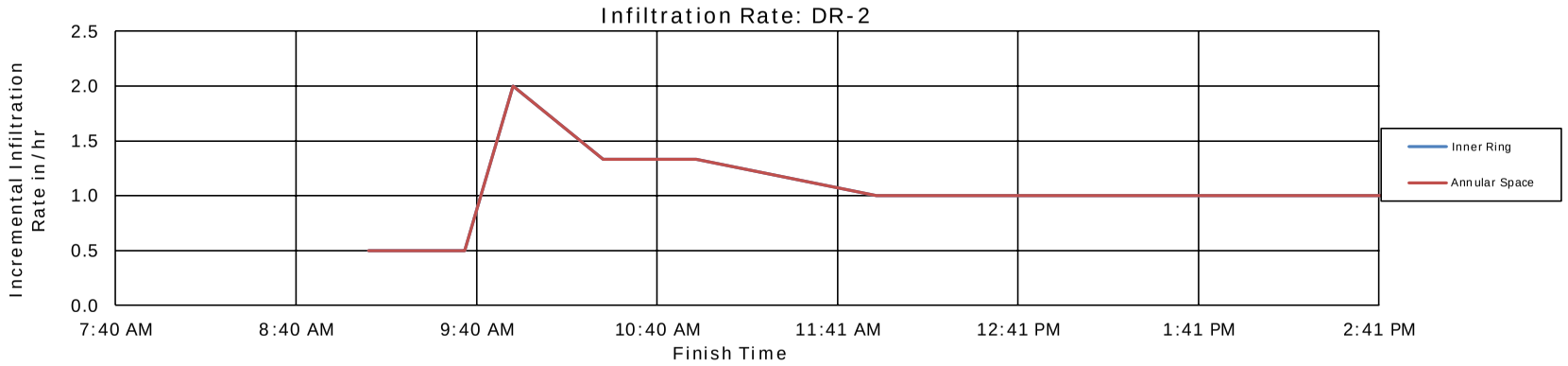
Soil Description

Depth:	4 ft
Description:	Silty sand, light brown

Test Setup

Inner Ring Area:	113.1	in^2
Inner Ring Diameter:	12.0	in
Annular space between Outer and Inner rings:	339	in^2
Outer Ring Diameter:	24.0	in
Depth of Liquid Inner Ring:	9.00	in
Depth of Liquid Annular Space:	9.00	in

Trial No.	Time		Elapsed Time (hr:min:sec)	Volume Measurements				Infiltration Rate, in/hr	
				Start		Finish			
	Start	Finish		Inner Ring Volume, in^3	Annular Space Volume, in^3	Inner Ring Volume, in^3	Annular Space Volume, in^3	Inner Ring	Annular Space
1	8:50 AM	9:05:00 AM	0:15:00	1018	3054	1004	3011	0.50	0.50
2	9:06:00 AM	9:21:00 AM	0:15:00	1018	3054	1004	3011	0.50	0.50
3	9:22:00 AM	9:37:00 AM	0:15:00	1018	3054	1004	3011	0.50	0.50
4	9:38:00 AM	9:53:00 AM	0:15:00	1039	3117	983	2948	2.00	2.00
5	9:53:00 AM	10:23:00 AM	0:30:00	1048	3145	973	2919	1.33	1.33
6	10:24:00 AM	10:54:00 AM	0:30:00	1048	3145	973	2919	1.33	1.33
7	10:54:00 AM	11:54:00 AM	1:00:00	1067	3202	954	2863	1.00	1.00
8	11:55:00 AM	12:55:00 PM	1:00:00	1067	3202	954	2863	1.00	1.00
9	12:55:00 PM	1:55:00 PM	1:00:00	1067	3202	954	2863	1.00	1.00
10	1:55:00 PM	2:55:00 PM	1:00:00	1067	3202	954	2863	1.00	1.00



APPENDIX J

JDH Corrosion Analysis

March 21, 2024

Terracon
6805 Academy Parkway, West NE
Albuquerque, New Mexico
Stenson.Lee@terracon.com

Attention: **Stenson Lee**
Staff Engineer

Subject: **Corrosion Engineering Services**
Soil Corrosivity for Steel Support Piles
Rancho Viejo Solar Project
Santa Fe, New Mexico

Dear Stenson,

Pursuant to your request, **JDH Corrosion Consultants, Inc**. has conducted a review of the soil data for the above referenced project site and we have provided herein our analysis and long-term corrosion control recommendations for the subject steel support piles for the photovoltaic solar project at this site.

PURPOSE

The purpose of this evaluation is to review the materials being proposed for use at the above referenced solar project for **Terracon** in order to determine their requirements for a 40-year expected life. This analysis will include below grade recommendations as follows:

Below Grade
- Determine the rate of corrosion for bare steel support piles (i.e. H-pile configuration)
- Determine the rate of corrosion for hot dipped galvanizing
- Provide recommendations for hot dipped galvanized piles as appropriate
- Provide recommendations for epoxy coated piles as appropriate

Above Grade
- Determine the rate of corrosion on hot dipped galvanized support structures

PROJECT BACKGROUND

The proposed Rancho Viejo Solar Project is located in Santa Fe, New Mexico.

Soil chemical data was extracted from the following report: Terracon Geotechnical Engineering Report, Rancho Viejo Solar Development, Project #66225093. This site has soils which have been reported in the geotechnical report as having the following electrical characteristics:

TABLE 1: Soil Chemical Analysis

Chemical Analysis	Range of Results	Corrosion Classification
Electrical Resistivity (In-Situ)	4,240 – 40,630 ohm-cm	Moderately to Progressively Less Corrosive
Minimum Resistivity (Laboratory)	1,273 – 6,700 ohm-cm	Corrosive to Moderately Corrosive
pH	6.35 – 8.35	Mildly to non-corrosive
Chloride	37 - 155 mg/kg	Non-Corrosive to Moderately Corrosive
Sulfate	24 - 133 mg/kg	Non-Corrosive

In-Situ Soil Resistivity Analysis

Corrosion of a metal is an electro-chemical process and is accompanied by the flow of electric current. Resistivity is a measure of the ability of a soil to conduct an electric current and is, therefore, an important parameter in consideration of corrosion data. Soil resistivity is primarily dependent upon the chemical content and moisture content of the soil mass.

The greater the amount of chemical constituents present in the soil, the lower the resistivity will be. As moisture content increases, resistivity decreases until maximum solubility of dissolved chemicals is attained. Beyond this point, an increase in moisture content results in dilution of the chemical concentration and resistivity increases. The corrosion rate of steel in soil normally increases as resistivity decreases. Therefore, in any particular group of soils, maximum corrosion will generally occur in the lowest resistivity areas. The following classification of soil corrosivity, developed by William J. Ellis[1], is used for the analysis of the soil data for the project site.

Resistivity (Ohm-cm)	Corrosivity Classification
0 – 500	Severely Corrosive
501 – 2,000	Corrosive
2,001 – 8,000	Moderately Corrosive
8,001 – 32,000	Mildly Corrosive
> 32,000	Progressively Less Corrosive

DISCUSSION

Corrosion is defined by the National Association of Corrosion Engineers (NACE) as the degradation of a material or its properties due to a reaction with its environment. Corrosion of a metal is an electro-chemical process which is accompanied by the flow of electric current. When steel is buried in soil, the soil is the electrolyte for this electro-chemical process. Resistivity of the soil is a measure of the ability of that soil to conduct an electric current and is, therefore, an important parameter in consideration of corrosion data. Soil resistivity is primarily dependent upon the chemical content and moisture content of the soil mass. The greater the amount of chemical constituents present in the soil, the lower the resistivity will be. Also, the moisture content in the soil is critical to the resistivity due to the fact that as moisture content increases, resistivity will decrease until maximum solubility of dissolved chemicals is attained.

Corrosion is usually not caused by a single factor, but is typically the result of numerous factors influencing the metal in question and oftentimes the factors affecting the rate of corrosion may not remain constant with time. It is, therefore, difficult to accurately predict the corrosion rate in soil.

The rates of corrosion for both the galvanizing and the bare carbon steel were determined based on the following:

- "Corrosion of Galvanized Steel in Soils" by Irving A Denison and Melvin Lauderdale Romanoff, Journal of Research of the National Bureau of Standards, Vo. 49, No. 5, November 1952.
- "Corrosion Resistance of Zinc & Zinc Alloys" by Frank C. Porter – ISBN 0-8247-9213-0 – 1994
- "Corrosion Guidelines", Version 2.0, November 2012, by California Department of Transportation.
- "Hot-Dip Galvanizing, In Soil", by American Galvanizers Association, 2011

Service Life of Galvanized Steel

There are countless soil types in the world, which makes predicting the performance of galvanized steel in soil difficult. A number of soil characteristics affect the corrosion rate of galvanized steel, and soil content conditions can vary significantly. These variances can lead to vastly different corrosion rates for zinc, ranging from 0.2 microns per year in very favorable conditions to 20 microns annually in very aggressive soils. Therefore, the key to understanding how long galvanized steel will last in buried applications is through classification of the soil.

As a general rule of thumb, galvanizing tends to perform well in brown, sandy soils, and not very well in gray, clay-like soils. The reason for this difference is sandy soils with larger particles wick moisture more rapidly, limiting the galvanized piece's exposure to wet conditions, while clay-like soils hold moisture for longer periods. Similar to atmospheric exposure, galvanized steel performs best when it is relatively dry.

The four variables with the most profound impact on the corrosion rate of hot-dip galvanized steel in soil include chloride concentration, moisture content, pH, and resistivity. The presence of chloride ions causes resistivity to be lower, making the zinc coating more susceptible to corrosion. Along with high moisture levels in the soil, high chlorides will increase the rate of the corrosion of the zinc coating. For hot-dip galvanized steel, the soil moisture content primarily affects the activity of the chloride ions. If the moisture content of the soil is below 17.5%, the chloride ion concentration does not significantly affect the corrosion rate of the zinc. For soils with moisture content above 17.5%, the chloride ion concentration has a significant effect on the corrosion rate of zinc. Soils with pH values less than 7.0 have a higher corrosion rate on zinc coatings. If the pH of the soil is above 7.0, then the corrosion rate of the soil yields a longer service life of the zinc coating. The resistivity parameter follows the chloride ion concentration in that higher resistivity often means lower chloride ion content and a lower corrosion rate of the zinc coating.

Corrosion Rate for Zinc (Galvanizing)

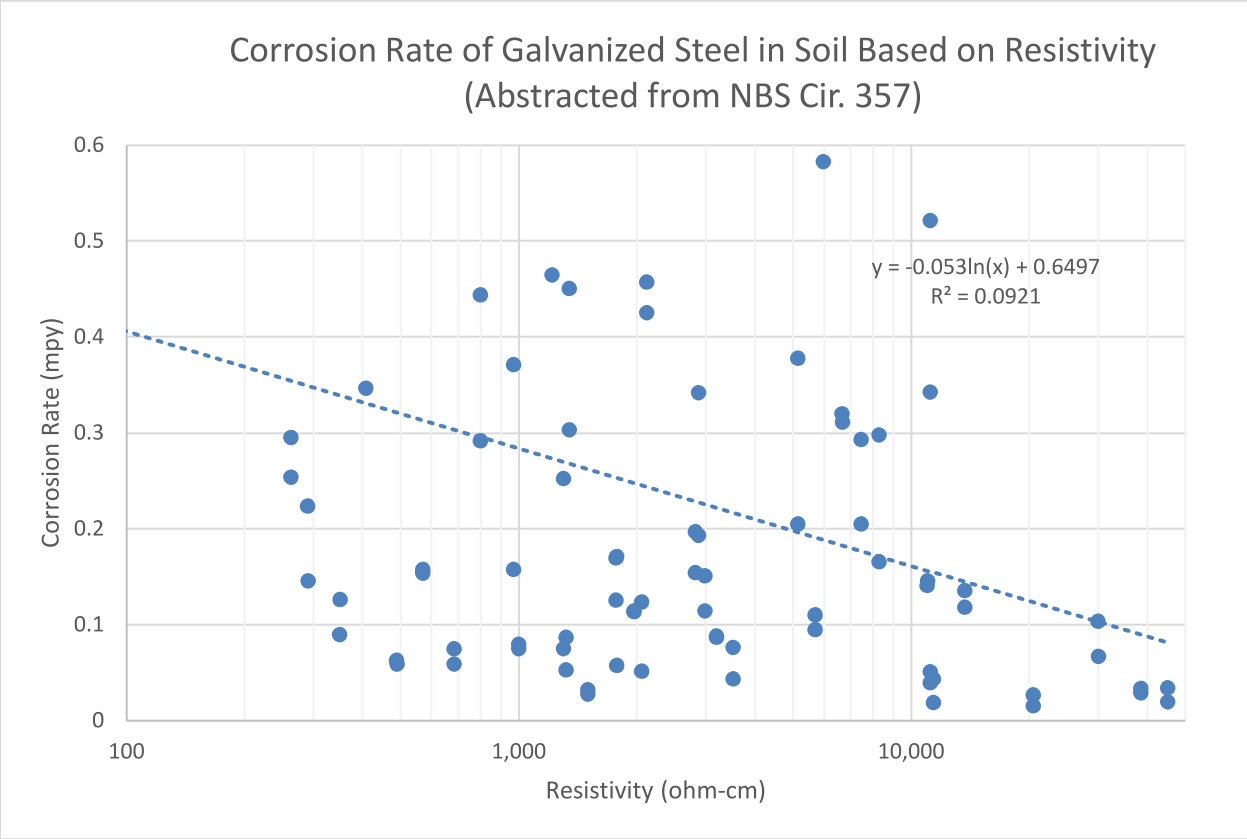


Figure 2 - Zinc loss vs. resistivity (abstracted from NBS Cir. 579, Romanoff)

The plot above indicates that for a soil of resistivity value of 4,240 ohm-cm (the lowest in-situ resistivity encountered) the corrosion rate will be roughly 0.21 mpy for the soil conditions. Accounting for any uncertainties in data, the addition of a 90% confidence interval applied brings the corrosion rate up to 0.25 mpy. This translates to a life of the hot dipped galvanized coating that meets ASTM A123 of approximately 3.5 mils, of approximately 13.9 years for the soil conditions. It is our professional opinion that this chart provides a relatively accurate representation of the annual average corrosion rate for HDG at the site, due to the resistivity levels found.

Corrosion Rate for Steel

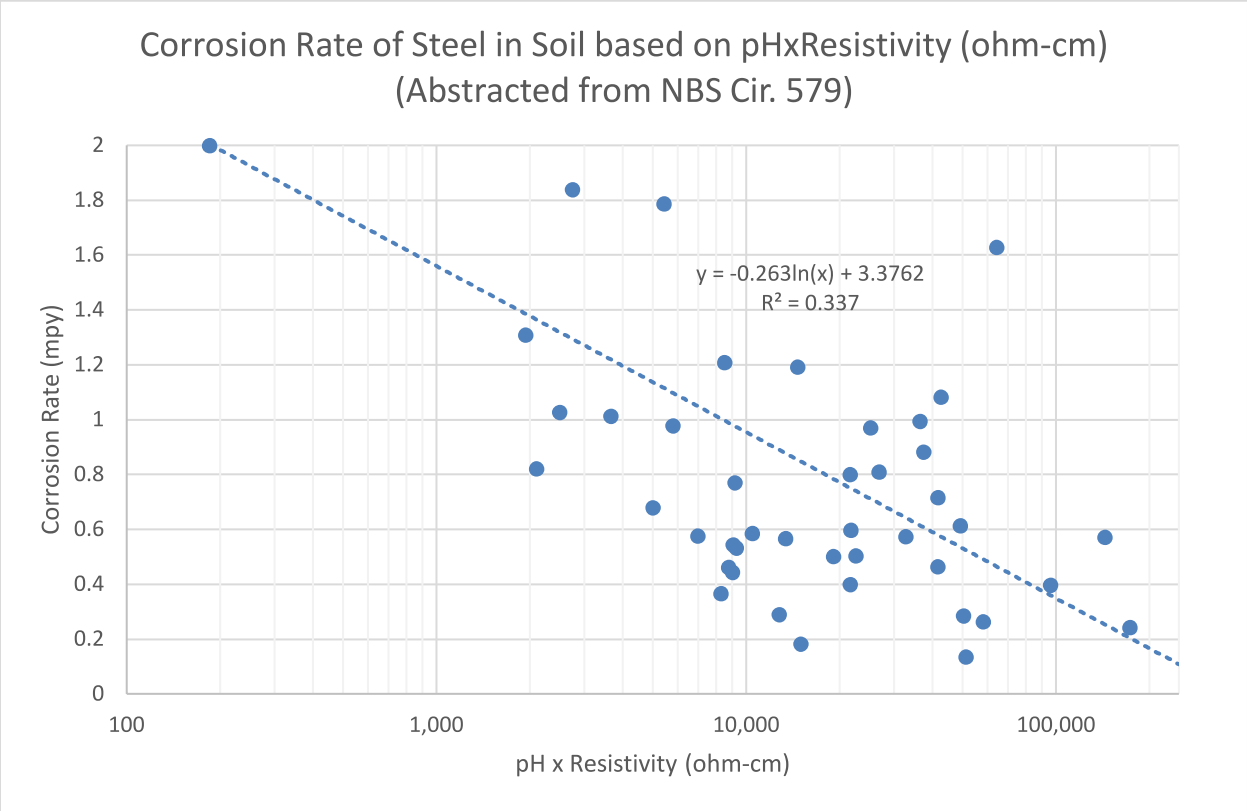


Figure 3 – Carbon Steel loss as a function of pH times resistivity (abstracted from NBS Cir. 579, Romanoff)

The plot above indicates that for a soil with a pH value of 6.35 (the lowest pH encountered), and a resistivity of 4,240 ohm-cm (the lowest in-situ resistivity), the corrosion rate will be approximately 0.69 mpy for the soil conditions based upon a pH*Resistivity = 26,924. Accounting for any uncertainties in data the addition of a 90% confidence interval applied bring the corrosion rate up to 0.84 mpy. It is our professional opinion that this is an accurate average annual corrosion rate for the 35-year design life of the site coupled with the fact that the site receives roughly 14 inches of rain per year along with the predominately moderate resistivity and neutral pH levels.

Summary of Corrosion Rates

Therefore, based on the afore-mentioned references, our review of the geotechnical reports for this site and our experience in studying piles in similar situations, the corrosion rates for these soils are determined to be as follows:

Summary of Corrosion Rates:

Steel: 0.84 mpy (mils per year)
Zinc: 0.25 mpy

STRATEGIES FOR 25-YEAR DESIGN LIFE

Option 1: Hot Dipped Galvanized Piles with Corrosion Allowance.

3.0 mils of HDG
Utilize a hot-dipped galvanized steel pile with hot dipped galvanized coating, of 3.0 mils, that meets ASTM A123. The zinc coating will provide an approximate 11.9-year life based on a corrosion rate of 0.25 mpy. This means that for a 25-year design life, 13.1 years of corrosion allowance must be accounted for. The corrosion allowance must consist of 0.84 mpy per face for a total thickness allowance of 1.68 mpy for both the flanges and the web of the H-pile, for these soil conditions. Therefore, because a corrosion allowance for 13.1 years is needed for the piles: 13.1 yrs x 0.84 mpy = 11.00 mils per side. Thus, the piles will need a total of 22.0 mils of corrosion allowance, along with the 3.0 mils of HDG.

3.9 mils of HDG
Therefore, because a HDG coating of 3.9 mils will last 15.5 years, a corrosion allowance of 9.5 years would be needed. 9.5 yrs x 0.84 mpy = 7.98 mils per side. Thus, the piles would need a total of 16.0 mils of corrosion allowance, along with 3.9 mils of HDG.

5.0 mils of HDG
Therefore, because a HDG coating of 5.0 mils will last 19.8 years, a corrosion allowance of 5.2 years would be needed. 5.2 yrs x 0.84 mpy = 4.4 mils per side. Thus, the piles would need a total of 8.7 mils of corrosion allowance, along with 5.0 mils of HDG.

Option 2: Ungalvanized piles with Corrosion Allowance.

Utilize an ungalvanized steel pile, this means that for a 25-year design life, 25 years of corrosion allowance must be accounted for. The corrosion allowance must consist of 0.84 mpy per face for a total thickness allowance of 1.68 mpy for both the flanges and the web of the H-pile, for these soil conditions. Therefore, because a corrosion allowance for 25 years is needed for the piles: 25 yrs x 0.84 mpy = 21 mils per side. Thus, the piles will need a total of 42 mils of corrosion allowance.

Option 3: Epoxy Coating

Coat the entire piles with a tough, durable and scratch resistant epoxy system such as 3M Scotchkote Abrasion Resistant Epoxy Costing 328 or a similarly tough polyurethane system such as Polyclad 777 by Carboline or other similar type of system. The coating shall be applied in a thickness of approximately 25-mils and extended at least 6" above grade to the bottom of the pile.

STRATEGIES FOR 35-YEAR DESIGN LIFE

Option 1: Hot Dipped Galvanized Piles with Corrosion Allowance.

3.0 mils of HDG
Utilize a hot-dipped galvanized steel pile with hot dipped galvanized coating, of 3.0 mils, that meets ASTM A123. The zinc coating will provide an approximate 11.9-year life based on a corrosion rate of 0.25 mpy. This means that for a 35-year design life, 23.1 years of corrosion allowance must be accounted for. The corrosion allowance must consist of 0.84 mpy per face for a total thickness allowance of 1.68 mpy for both the flanges and the web of the H-pile, for these soil conditions. Therefore, because a corrosion allowance for 23.1 years is needed for the piles: 23.1 yrs x 0.84 mpy = 19.40 mils per side. Thus, the piles will need a total of 38.8 mils of corrosion allowance, along with the 3.0 mils of HDG.

3.9 mils of HDG

Therefore, because a HDG coating of 3.9 mils will last 15.5 years, a corrosion allowance of 19.5 years would be needed. 19.5 yrs x 0.84 mpy = 16.38 mils per side. Thus, the piles would need a total of 32.8 mils of corrosion allowance, along with 3.9 mils of HDG.

5.0 mils of HDG

Therefore, because a HDG coating of 5.0 mils will last 19.8 years, a corrosion allowance of 15.2 years would be needed. 15.2 yrs x 0.84 mpy = 12.77 mils per side. Thus, the piles would need a total of 25.5 mils of corrosion allowance, along with 5.0 mils of HDG.

Option 2: Ungalvanized piles with Corrosion Allowance.

Utilize an ungalvanized steel pile, this means that for a 35-year design life, 35 years of corrosion allowance must be accounted for. The corrosion allowance must consist of 0.84 mpy per face for a total thickness allowance of 1.68 mpy for both the flanges and the web of the H-pile, for these soil conditions. Therefore, because a corrosion allowance for 35 years is needed for the piles: 35 yrs x 0.84 mpy = 29.4 mils per side. Thus, the piles will need a total of 58.8 mils of corrosion allowance.

Option 3: Epoxy Coating

Coat the entire piles with a tough, durable and scratch resistant epoxy system such as 3M Scotchkote Abrasion Resistant Epoxy Costing 328 or a similarly tough polyurethane system such as Polyclad 777 by Carboline or other similar type of system. The coating shall be applied in a thickness of approximately 35-mils and extended at least 6" above grade to the bottom of the pile.

Abrasion Resistance

The epoxy coating system is an abrasion resistant coating and as such will tend to minimize the amount of damage to the coating during the pile driving operations. The Hot Dip Galvanizing, however, is not an abrasion resistant coating and some degree of scraping was anticipated and will penetrate these coatings during the pile driving operations based on the geotechnical reports and this has been taken into account in our analysis and recommendations.

It should be understood that isolated scrapes and penetrations through both the, epoxy and HDG, coatings is anticipated and is not considered to be detrimental to the overall structural integrity of the piles during the desired design life. It is the overall section modulus of the piles that give them the strength to resist the design loads on the system and as such it is the overall loss of cross-sectional area that is of concern.

Concrete

Corrosion of the reinforcing steel and other embedded metals is the leading cause of deterioration in concrete. When steel corrodes, the resulting rust occupies a greater volume than the steel. This expansion creates tensile stresses in the concrete, which can eventually cause cracking, delamination, and spalling. Although steel's natural tendency is to undergo corrosion, the alkaline environment of concrete (pH of 12 to 13) provides the steel with a level of corrosion protection in the form of a thin oxide layer which passivates the steel. Carbonation occurs when carbon dioxide penetrates the concrete and reacts with hydroxides to form carbonates. This reaction reduces the pH of the concrete to as low as 8.5, which then the passive film on the steel is no longer stable, thus allowing the steel to begin corroding.

With regards to the corrosion potential to concrete at the site, ACI-318 categorizes the site as a S0 due to the non-corrosive Sulfate levels. However, due to the moderate resistivity we recommend 3" of cover for the reinforcing steel, and a good concrete mix design such as, a type II or MS cement, with a water to cement ratio of 0.50 or less with 4,000 psi.

ATMOSPHERIC CORROSION

The purpose of this evaluation is to analyze the atmospheric corrosion potential to the metallic system components resulting from the environmental factors outlined in this report and to determine the life expectancy of these components based on the corrosion potential.

Atmospheric corrosion of metals and alloys at any particular site depends on the environmental conditions, namely the moisture present (time of wetness) and the pollutants in the atmosphere (mainly sulfur dioxide in the marine-industrial sites and airborne salts along coastline regions).

Atmospheric data for this site was collected from the Santa Fe Municipal Airport Weather Station.

Atmospheres are classified according to ISO (International Standards Organization) in ISO 9223:

Corrosivity category	Corrosivity	Typical environments – Examples from ISO 9223	
		Indoor	**Outdoor**
C1	Very low	Heated spaces with low relative humidity and insignificant pollution, e.g. offices, schools, museums	Dry or cold zone, atmospheric environment with very low pollution and time of wetness, e.g. certain deserts, Central Arctic/Antarctica
C2	Low	Unheated spaces with varying temperature and relative humidity. Low frequency of condensation and low pollution, e.g. storage, sport halls	Temperate zone, atmospheric environment with low pollution (SO_2 < 5 µg/m^3), e.g. rural areas, small towns Dry or cold zone, atmospheric environment with short time of wetness, e.g. deserts, subarctic areas
C3	Medium	Spaces with moderate frequency of condensation and moderate pollution from production process, e.g. food-processing plants, laundries, breweries, dairies	Temperate zone, atmospheric environment with medium pollution (SO_2: 5 µg/m^3 to 30 µg/m^3) or some effect of chlorides, e.g. urban areas, coastal areas with low deposition of chlorides Subtropical and tropical zone, atmosphere with low pollution
C4	High	Spaces with high frequency of condensation and high pollution from production process, e.g. industrial processing plants, swimming pools	Temperate zone, atmospheric environment with high pollution (SO_2: 30 µg/m^3 to 90 µg/m^3) or substantial effect of chlorides, e.g. polluted urban areas, industrial areas, coastal areas without spray of salt water or, exposure to strong effect of de-icing salts Subtropical and tropical zone, atmosphere with medium pollution
C5	Very high	Spaces with very high frequency of condensation and/or with high pollution from production process, e.g. mines, caverns for industrial purposes, unventilated sheds in subtropical and tropical zones	Temperate and subtropical zone, atmospheric environment with very high pollution (SO_2: 90 µg/m^3 to 250 µg/m^3) and/or significant effect of chlorides, e.g. industrial areas, coastal areas, sheltered positions on coastline
CX	Extreme	Spaces with almost permanent condensation or extensive periods of exposure to extreme humidity effects and/or with high pollution from production process, e.g. unventilated sheds in humid tropical zones with penetration of outdoor pollution including airborne chlorides and corrosion-stimulating particulate matter	Subtropical and tropical zone (very high time of wetness), atmospheric environment with very high SO_2 pollution (higher than 250 µg/m^3) including accompanying and production factors and/or strong effect of chlorides, e.g. extreme industrial areas, coastal and offshore areas, occasional contact with salt spray

Figure 1: Categories of Corrosivity of the Atmosphere

Corrosivity classifications are determined through two methods: measurement or estimation of time of wetness, sulfur dioxide and chloride deposition rates, or direct exposure testing of metal coupons.

Based on either of the two methods corrosivity categories of atmosphere and then corrosion rates of various metals of interest can be derived utilizing the ISO 9223 guidelines and thus assigned a corrosion category (Fig. 1).

Corrosivity category	Comparative corrosion rates for steel and zinc from ISO 9223 r_{corr}		
	Unit	Carbon steel	Zinc
C1	g/(m^2·a)	$r_{corr} \leq 10$	$r_{corr} \leq 0.7$
	µm/a	$r_{corr} \leq 1.3$	$r_{corr} \leq 0.1$
C2	g/(m^2·a)	$10 < r_{corr} \leq 200$	$0.7 < r_{corr} \leq 5$
	µm/a	$1.3 < r_{corr} \leq 25$	$0.1 < r_{corr} \leq 0.7$
C3	g/(m^2·a)	$200 < r_{corr} \leq 400$	$5 < r_{corr} \leq 15$
	µm/a	$25 < r_{corr} \leq 50$	$0.7 < r_{corr} \leq 2.1$
C4	g/(m^2·a)	$400 < r_{corr} \leq 650$	$15 < r_{corr} \leq 30$
	µm/a	$50 < r_{corr} \leq 80$	$2.1 < r_{corr} \leq 4.2$
C5	g/(m^2·a)	$650 < r_{corr} \leq 1,500$	$30 < r_{corr} \leq 60$
	µm/a	$80 < r_{corr} \leq 200$	$4.2 < r_{corr} \leq 8.4$
CX	g/(m^2·a)	$1,500 < r_{corr} \leq 5,500$	$60 < r_{corr} \leq 180$
	µm/a	$200 < r_{corr} \leq 700$	$8.4 < r_{corr} \leq 25$

Figure 2: Comparative Corrosion Rates for Steel and Zinc

Time of Wetness

Atmospheric corrosion in normal temperatures is directly proportional to the amount of time that moisture is present on the subject metal. It is, therefore, important that all parts be designed so as not to retain any moisture as much as possible. The time of wetness may be estimated from the following guidelines based on the location of the subject metal and the environmental conditions such as temperature and relative humidity. Time of wetness is defined as the number of hours per year where the relative humidity is above 80% while the ambient temperature is above 0^0 C. The ISO 9223 ratings for time of wetness are as follows:

- T_1: <10 hours/year (Indoor climate with climate control)
- T_2: 10-250 hours/year (Indoor without climate control)
- T_3: 250-2500 hours/year (Outdoor dry or cold climate)
- T_4: 2500-5500 hours/year (Outdoor atmospheres in all climate)
- T_5: >5500 hours/year (Damp climates, humid conditions)

Based on the information available from the Rancho Viejo site, due to the average temperature of 11.62°C, and average annual humidity of 47.82%, time of wetness is considered to be as T_3.

Sulfur Dioxide in the Air

Sulfur dioxide is the most corrosive pollutant to zinc in the air. Sulfur dioxide is a pollutant product largely introduced through industrial manufacturing and fossil fuel combustion during large scale energy production, and thus is higher in concentration in regions where such processes occur. The following are typical deposition rates for rural, urban, and industrial atmospheres:

- Rural Atmosphere: 2 – 15 $\mu g/m^3$
- Urban atmosphere: 5 - 100 $\mu g/m^3$
- Industrial Atmosphere: 50 - 300 $\mu g/m^3$

The ISO 9223 ratings for sulfur dioxide deposition are as follows:

- P_0: <5 mg/ m^2 x day (Rural atmosphere)
- P_1: 5 - 30 mg/ m^2 x day (Urban atmosphere)
- P_2: 30 - 90 $\mu g/m^3$ (Industrial atmosphere)
- P_3: 90 - 250 $\mu g/m^3$ (Highly polluted industrial atmosphere)

Based on the location of the Rancho Viejo site, sulfur dioxide deposition is considered to be as P_0 as the site can be considered a Rural atmosphere due to its proximity to Albuquerque, NM.

Chlorides in the Air

Deposited chlorides on zinc surfaces contribute to corrosion by easily penetrating the passive oxide film by reacting with the normally protective zinc corrosion products to form soluble zinc chlorides. When the chlorides are washed away, fresh zinc is exposed, and the normal process of passivation through oxidation is prevented. For this reason, in regions along the coastline where the major pollutants in the air are chlorides, corrosion rates can be high. Rates decrease with distance from the sea coast as salt content in the air drops significantly. In general, at a distance of 0.6 miles from the shoreline, the corrosion rate of zinc is comparable to that measured inland. The ISO 9223 ratings for chloride deposition are as follows:

- S_0: <3 mg/ m^2 x day
- S_1: 3-60 mg/ m^2 x day
- S_2: 60-300 mg/ m^2 x day
- S_3: 300-1500 mg/ m^2 x day

Based on the information available from the Rancho Viejo site, chloride deposition is considered to be classified as S_0 due to its remote proximity to a source of chlorides, over 100 miles.

Atmospheric Corrosivity Characterization

Ratings for time of wetness, sulfur dioxide and chloride deposition are then used to determine the corrosivity classifications of C1 through C5 of a specific area, based on the Table 4.

Time of wetness = T_3.
Sulfur dioxide deposition = P_0.
Chloride deposition = S_0.

Table 4: Corrosivity Classifications - Based on Time of Wetness (Tx), Sulfur (Px) and Chloride (Sx) Deposition Rates

Corrosivity category	Corrosion rate: r_{corr} (1st year)[2] g/(m²·a)	Corrosion rate: r_{lin} (steady state)[3] µm/a	Time of wetness[1] expressed in hours where RH > 80 %, θ > 0 °C (h/a): $\tau \leq 10$ (class τ_1) Indoors, climatic control	$10 < \tau \leq 250$ (class τ_2) Indoors, no climatic control except in damp climates	$250 < \tau \leq 2\,500$ (class τ_3) Outdoors in dry, cold climates, ventilated sheds in temperate climates	$2\,500 < \tau \leq 5\,500$ (class τ_4) Outdoors in temperate climates, unventilated sheds in temperate climates, ventilated sheds in damp climates	$\tau > 5\,500$ (class τ_5) Outdoors in damp climates; humid, unventilated sheds
C 1	$r_{corr} \leq 10$	$r_{lin} \leq 0{,}1$					
C 2	$10 < r_{corr} \leq 200$	$0{,}1 < r_{lin} \leq 1{,}5$					
C 3	$200 < r_{corr} \leq 400$	$1{,}5 < r_{lin} \leq 6$					
C 4	$400 < r_{corr} \leq 650$	$6 < r_{lin} \leq 20$					
C 5	$650 < r_{corr} \leq 1\,500$	$20 < r_{lin} \leq 90$					

Airborne salinity[4]
Chloride deposition rate $[mg/(m^2 \cdot a)]$

Industrial pollution[5] by sulfur dioxide (SO_2) Concentration µg/m³	Category	Deposition rate mg/(m²·a)	S_0 $S \leq 3$	S_1 $3 < S \leq 60$	S_2 $60 < S \leq 300$	S_3 $300 < S \leq 1\,500$	S_0 $S \leq 3$	S_1 $3 < S \leq 60$	S_2 $60 < S \leq 300$	S_3 $300 < S \leq 1\,500$	S_0 $S \leq 3$	S_1 $3 < S \leq 60$	S_2 $60 < S \leq 300$	S_3 $300 < S \leq 1\,500$	S_0 $S \leq 3$	S_1 $3 < S \leq 60$	S_2 $60 < S \leq 300$	S_3 $300 < S \leq 1\,500$	S_0 $S \leq 3$	S_1 $3 < S \leq 60$	S_2 $60 < S \leq 300$	S_3 $300 < S \leq 1\,500$
$P_c \leq 12$	P_0	$P_d \leq 10$	1		1	1 or 2	1		2	3 or 4	3 or 4		3 or 4	4	3		4	5	3 or 4		5	5
$12 < P_c \leq 40$	P_1	$10 < P_d \leq 35$																				
$40 < P_c \leq 80$	P_2	$35 < P_d \leq 80$	1		1	1 or 2	1 or 2		2 or 3	3 or 4	3 or 4		3 or 4	4 or 5	4		4	5	4 or 5		5	5
$80 < P_c \leq 250$	P_3	$80 < P_d \leq 200$	1 or 2		1 or 2	2	2		3	4	4		4 or 5	5	5		5	5	5		5	5

NOTE – Corrosivity is expressed as the numerical part of the corrosivity category code (for example: 1 instead of C 1) – see table 6.

1) See table 1.
2) See table 5.
3) See ISO 9224 (steady state corrosion rate derived from long-term atmospheric exposure).
4) See table 3.
5) See table 2.

Based on the corrosivity category rating of C2, ISO 9224 provides the following corrosion rates for various metals, in Table 5 below:

Table 5: Guiding Corrosion Values for Corrosivity Categories

Values in micrometres per year

Metal	Average corrosion rate, r_{av}, during the first 10 years for the following corrosivity categories					
	C1	C2	C3	C4	C5	CX
Carbon steel	$r_{av} \leq 0{,}4$	$0{,}4 < r_{av} \leq 8{,}3$	$8{,}3 < r_{av} \leq 17$	$17 < r_{av} \leq 27$	$27 < r_{av} \leq 67$	$67 < r_{av} \leq 233$
Zinc	$r_{av} \leq 0{,}07$	$0{,}07 < r_{av} \leq 0{,}5$	$0{,}5 < r_{av} \leq 1{,}4$	$1{,}4 < r_{av} \leq 2{,}7$	$2{,}7 < r_{av} \leq 5{,}5$	$5{,}5 < r_{av} \leq 16$
Copper	$r_{av} \leq 0{,}05$	$0{,}05 < r_{av} \leq 0{,}3$	$0{,}3 < r_{av} \leq 0{,}6$	$0{,}6 < r_{av} \leq 1{,}3$	$1{,}3 < r_{av} \leq 2{,}6$	$2{,}6 < r_{av} \leq 4{,}6$
Metal	**Steady-state corrosion rate, r_{lin}, estimated as the average corrosion rate during the first 30 years for the following corrosivity categories**					
	C1	C2	C3	C4	C5	CX
Carbon steel	$r_{lin} \leq 0{,}3$	$0{,}3 < r_{lin} \leq 4{,}9$	$4{,}9 < r_{lin} \leq 10$	$10 < r_{lin} \leq 16$	$16 < r_{lin} \leq 39$	$39 < r_{lin} \leq 138$
Zinc	$r_{lin} \leq 0{,}05$	$0{,}05 < r_{lin} \leq 0{,}4$	$0{,}4 < r_{lin} \leq 1{,}1$	$1{,}1 < r_{lin} \leq 2{,}2$	$2{,}2 < r_{lin} \leq 4{,}4$	$4{,}4 < r_{lin} \leq 13$
Copper	$r_{lin} \leq 0{,}03$	$0{,}03 < r_{lin} \leq 0{,}2$	$0{,}2 < r_{lin} \leq 0{,}4$	$0{,}4 < r_{lin} \leq 0{,}9$	$0{,}9 < r_{lin} \leq 1{,}8$	$1{,}8 < r_{lin} \leq 3{,}2$

As the ISO standard determines that the corrosion category is C2. This is further evidence by the ISO Corrosivity Category Estimation Tool (ICCET) developed as part of the Environmental Severity Classification Study, conducted by the Department of Defense. Using their online tool, the site is confirmed to be a C2 environment as seen below.

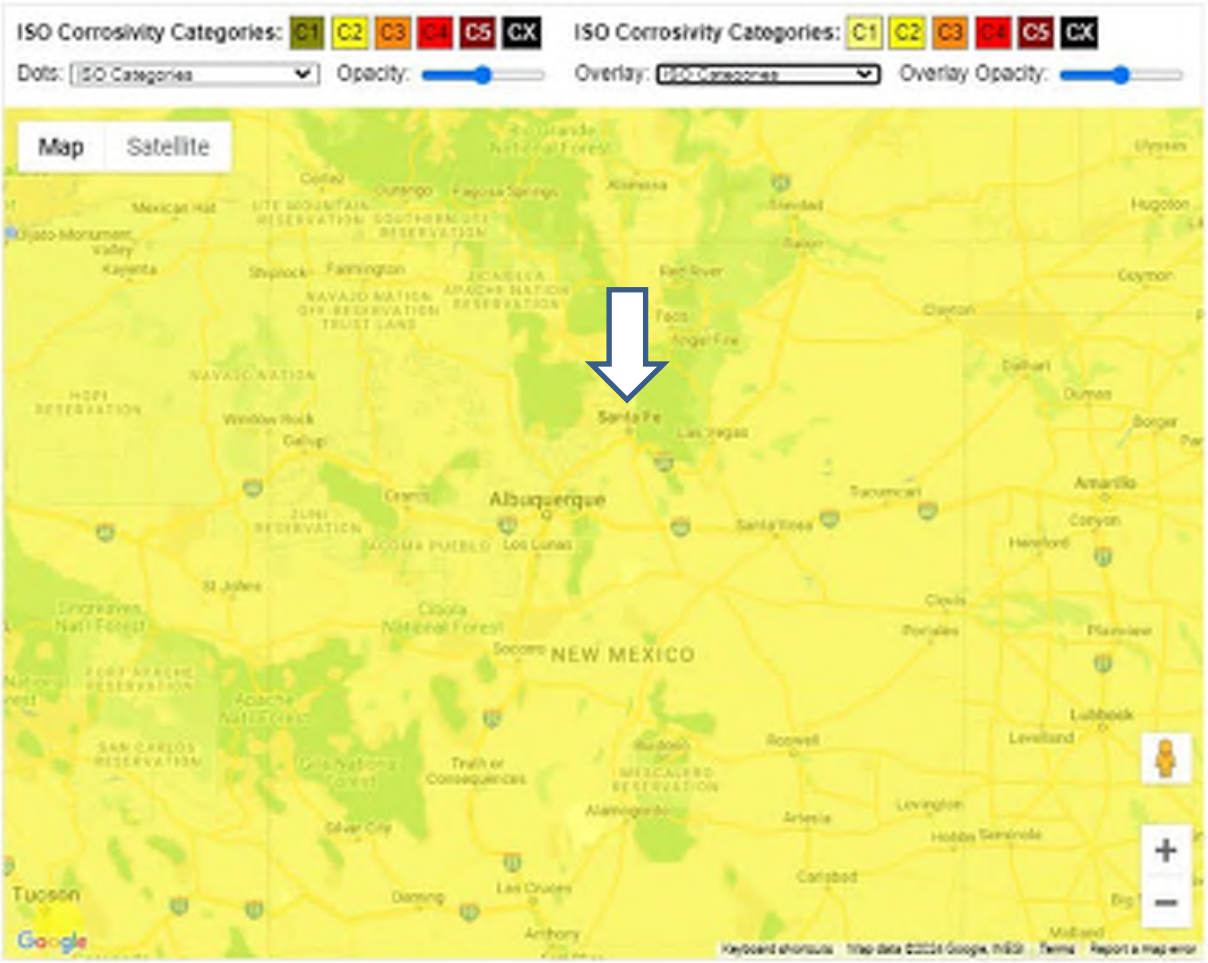


Figure 1 - ICCET Corrosion Categorization

Therefore, based on the above along with our professional experience, ISO 9223 and the ICCET, it is our opinion that the atmospheric corrosion rate for the Rancho Viejo Solar site is a C2.

Table 8: Atmospheric Corrosion Rates for a C2 Environments 30-year steady-state

Metal	Expected Steady State Corrosion Rates (micrometer per year)	Expected Steady State Corrosion Rates (mils per year)
Carbon Steel	4.9	0.19
Zinc	0.4	0.016
Copper	0.2	0.008

CONCLUSION

1. The corrosion rate for zinc in soil is determined to be 0.25 mils per year at this site.

2. The corrosion rate for steel in soil is determined to be 0.84 mil per year at this site.

3. For a 25- year design life

    a. The utilization of hot dipped galvanized piles with a coating thickness of 3.0 mils, that meets ASTM A123, along with a total corrosion allowance of 22.0 mils is suitable to meet the desired 25-year design life for this site.

    b. The utilization of hot dipped galvanized piles with a coating thickness of 3.9 mils, that meets ASTM A123, along with a total corrosion allowance of 16.0 mils is suitable to meet the desired 25-year design life for this site.

    c. The utilization of hot dipped galvanized piles with a coating thickness of 5.0 mils, that meets ASTM A123, along with a total corrosion allowance of 8.7 mils is suitable to meet the desired 25-year design life for this site.

    d. The utilization of an ungalvanized steel pile with a total corrosion allowance of 42 mils is suitable to meet the desired 25-year design life for this site.

4. For a 35- year design life

    a. The utilization of hot dipped galvanized piles with a coating thickness of 3.0 mils, that meets ASTM A123, along with a total corrosion allowance of 38.8 mils is suitable to meet the desired 35-year design life for this site.

    b. The utilization of hot dipped galvanized piles with a coating thickness of 3.9 mils, that meets ASTM A123, along with a total corrosion allowance of 32.8 mils is suitable to meet the desired 35-year design life for this site.

    c. The utilization of hot dipped galvanized piles with a coating thickness of 5.0 mils, that meets ASTM A123, along with a total corrosion allowance of 25.5 mils is suitable to meet the desired 35-year design life for this site.

    d. The utilization of an ungalvanized steel pile with a total corrosion allowance of 58.8 mils is suitable to meet the desired 35-year design life for this site.

5. With regards to the corrosion potential to concrete at the site, due to the moderate resistivity we recommend 3" of cover for the reinforcing steel, and a good concrete mix design such as, a type II or MS cement, with a water to cement ratio of 0.50 or less with 4,000 psi.

6. The atmospheric corrosion category for the Rancho Viejo Solar site is C2.

LIMITATIONS

The conclusions and recommendations contained in this report reflect the opinion of the author of this report and are based on the information and assumptions referenced herein, this report does not take grounding of the piles into consideration. All services provided herein were performed by persons who are experienced and skilled in providing these types of services and in accordance with the standards of workmanship in this profession. No other warrantees or guarantees either expressed or implied are provided.

We thank you for the opportunity to be of assistance on this important project. If you have any questions concerning this report or the analysis provided herein, please feel free to contact us at (925) 927-6630.

Respectfully submitted,

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APPENDIX E

Decommissioning Plan

Rancho Viejo Solar Project Decommissioning Plan

JULY 2024

PREPARED FOR

Rancho Viejo Solar, LLC

PREPARED BY

SWCA Environmental Consultants

RANCHO VIEJO SOLAR PROJECT
DECOMMISSIONING PLAN

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July 2024

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ACRONYMS AND ABBREVIATIONS

BESS	battery energy storage system
BMP	best management practice
LGP	low ground pressure
m	meter(s)
MW	megawatt

1 INTRODUCTION

Rancho Viejo Solar, LLC (Rancho Viejo), proposes to construct the Rancho Viejo Solar Project (project) in Santa Fe County, New Mexico. The project consists of an up to 96-megawatt (MW), alternating current utility-scale solar energy system, an up to 48-MW (4-megawatt-hour storage energy capacity) battery energy storage system (BESS), a 2.3-mile generation-tie line, and ancillary facilities. Project components include solar panels mounted on trackers arranged in multiple arrays, transformers, direct current to alternating current inverters, a collection system that connects the arrays to a BESS, a substation, an operations and maintenance building, and a switchyard. The solar facility project would be located on approximately 680 acres of private land in Santa Fe County, New Mexico, approximately 4.2 miles east of La Cienega (project area). Rancho Viejo is submitting this decommissioning/reclamation plan for the project in accordance with Chapter 12, Energy Systems, of the 2021 International Fire Code; Section 1207.2.3 of the Santa Fe Fire Code; and the applicable sections of the Santa Fe County Sustainable Land Development Code.

1.1 Triggering Events and Expected Lifetime of Project

Project decommissioning may be initiated by specific events such as the termination of the power purchase agreement or the completion of the project's operational life cycle. Furthermore, the project will be deemed abandoned if it remains non-operational and inactive towards achieving operational status for a consecutive 12-month period.

The anticipated lifespan of a utility-scale solar facility, if properly maintained, typically ranges from 25 to 35 years. However, with strategic equipment replacement and repowering, the project lifespan can be extended to 50 years or more. Flexibility exists for retrofitting the solar arrays with updated components, such as panels, frames, and tracking systems, to prolong the project's viability. In instances where retrofitting is not pursued or upon reaching the end of the project's useful life, decommissioning entails the removal of panels and associated components from the project site.

The value of individual components within the solar facility fluctuates over time. Generally, the highest component value is realized during the construction phase, gradually declining over the project's lifecycle. Throughout most of the project's duration, components (e.g., solar panels) can be resold in the wholesale market for reuse or refurbishment. As panels age or endure weathering, their efficiency and power production decrease, resulting in a corresponding decline in resale value. Secondary markets for used solar components cater to other utility-scale solar facilities, with similar designs requiring replacement equipment due to damage or wear over time, as well as to other buyers—such as developers and consumers—seeking a cost-effective option with a slightly reduced power output compared to new equipment.

Components of the solar facility retaining their resale value may be marketed in the wholesale market, while those lacking resale value will undergo salvage for recycling or disposal at an approved off-site licensed solid waste disposal facility (i.e., landfill). Decommissioning activities will include removing the arrays and associated components (see Section 2).

1.2 Decommissioning Sequence

Decommissioning/reclamation will commence according to the timelines specified in this plan. Decommissioning activities and reclamation activities are planned to be completed within 12 months of the end of electricity generation. Rancho Viejo assumes responsibility for these tasks. Continuous monitoring and site restoration efforts may extend beyond this period to ensure the successful

revegetation and rehabilitation of the project area. Although there may be an overlap of activities, the anticipated sequence of decommissioning and removal is outlined below:

1. Assess and reinforce access roads, if necessary, and prepare the site for component removal.
2. Implement erosion control measures, including the installation of fencing and other best management practices (BMPs), to safeguard sensitive resources and mitigate erosion during decommissioning activities.
3. De-energize the solar arrays.
4. Dismantle panels and racking.
5. Remove frames and internal components.
6. Excavate portions of structural foundations to a depth of at least 3 feet (36 inches) below the surface, and backfill the site as necessary. If steel piles to be used why not remove completly?
7. Remove inverter stations and associated foundations.
8. Extract electrical cables and conduits to a depth of at least 3 feet (36 inches) below the surface.
9. Remove BESS equipment and associated foundations. All cables need to be removed.
10. Demolish access and internal roads and grade the site as required.
11. Disassemble the substation.
12. Eliminate overhead transmission lines and poles.
13. De-compact subsoils as needed, and restore and revegetate disturbed land to preconstruction conditions to the extent feasible.

It is important to note that while the outlined sequence provides a structured approach, flexibility is maintained to accommodate any variations in the decommissioning process and to ensure effective execution.

2 DECOMISSIONING/RECLAMATION

This section outlines the solar facility components and decommissioning activities required to restore the project area, as closely as practicable, to its preconstruction conditions.

2.1 Overview of Solar Facility System

Rancho Viejo anticipates using approximately 205,712 solar modules, with a total nameplate generating capacity of approximately 96 MW. The project area encompasses approximately 680 acres. The generating facilities will be placed within approximately 400 acres of land bounded by perimeter fencing as shown on Figure 1 (preliminary design; subject to modification). The land within the perimeter fencing is predominantly used for cattle grazing. Statistics and estimates provided in this plan are based on a BYD Solar MLTK 560W module, although the final panel manufacturer has not been selected at the time of the writing of this report.

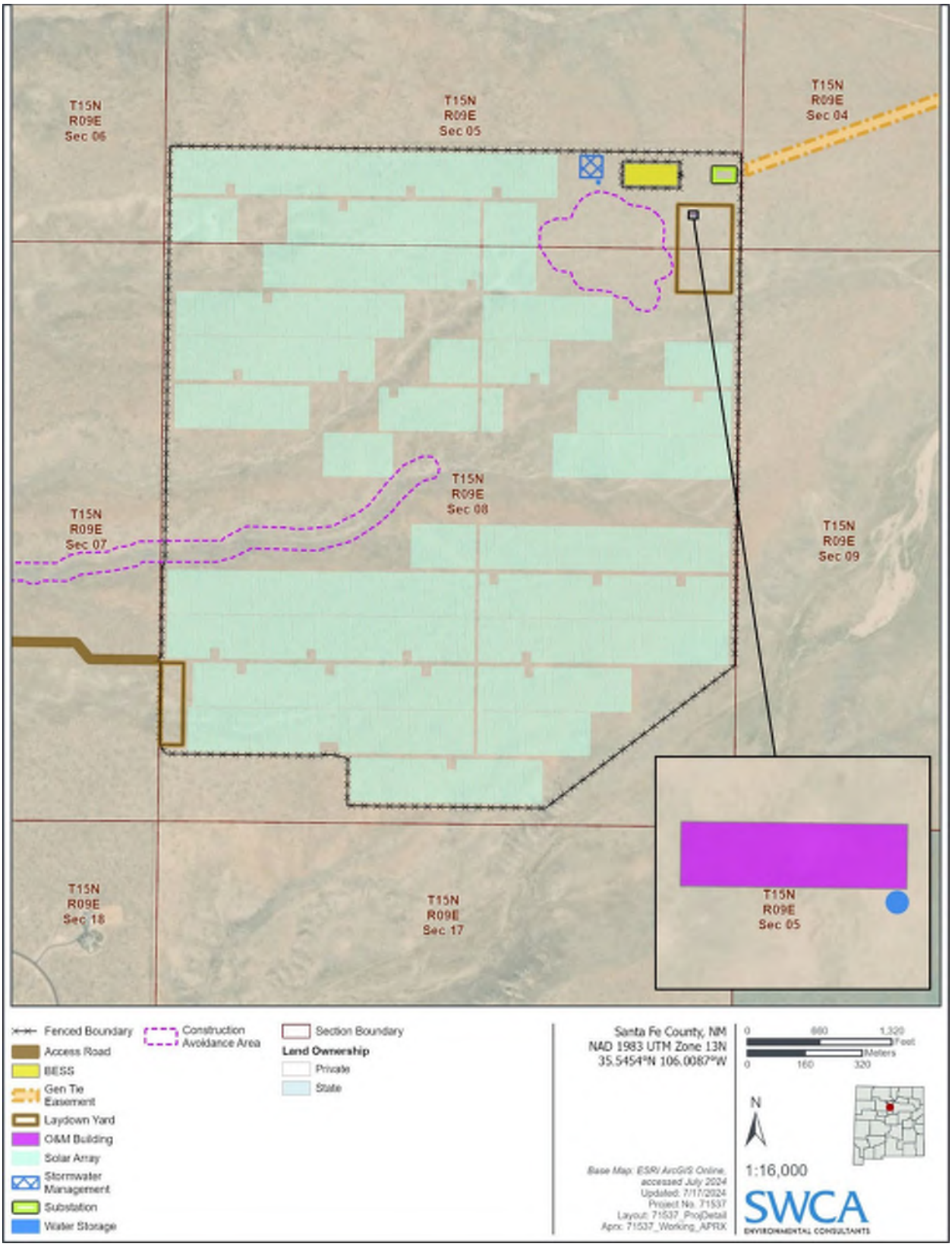


Figure 1. Site layout.

Collection cabling will be installed below the surface at a depth of approximately 3 feet (36 inches). Foundations, steel piles, and electric cabling and conduit that are less than 3 feet (36 inches) below the soil surface will be removed. Components and cabling deeper than 3 feet (36 inches) below the surface may be abandoned in place upon agreement with the landowner. Access roads may be left in place if requested and/or agreed to by the landowner in writing; however, for purposes of this assessment, it is assumed that all access roads will be removed. Public roads damaged or modified during the decommissioning and reclamation process will be repaired upon completion of the decommissioning phase. The estimated cost of repairing the public road is included in Section 4.1.

Estimated quantities of materials to be removed and salvaged or disposed of are included in this section and in Table 1. Many of the materials described have salvage value; although, some components will likely have no value at the time of decommissioning. Removed materials will be salvaged or recycled to the extent possible. Other waste materials will be disposed of in accordance with state and federal law in an approved licensed solid waste facility. Solar panels may have value in a resale market, depending on their condition at the end of the project's life. If the project is decommissioned prior to the anticipated 25 to 30–year timeframe, the resale value of components may be substantially higher than at the end of the projected project. Table 1 presents a summary of the primary components of the project included in this decommissioning plan.

Table 1. Primary Installed Facility Components

Component	Quantity	Unit of Measure
Solar Array		
Solar modules (approximation)	205,712	Each
Tracking system	2,022	Each
Steel piles	65,440	Each
Inverters	25	Each
Electrical cables and conduit	47,350	Linear feet
5,000-gallon water tank	1	Each
30,000-gallon water tank (fire suppression)	1	Each
O&M building (20' x 70')	1	Each
Septic system	1	Each
Perimeter fencing	22,884	Linear feet
Fence posts	2,288	Each
Access road	45,093	Linear feet
Substation	1	Each
Generation-Tie Line		
Transmissions poles	32	Each
Length of transmission cable	12,030	Linear feet
BESS		
40-foot battery container	38	Each
Battery module (Samsung SDI-E5S)	494	Each
Battery racks	723	Each
BESS cables	45,851	Linear feet

Inverters (MsWD3-V730)	19	Each

2.2 Solar Modules

Rancho Viejo Solar is deliberating the adoption of a mono bifacial half-cell panel (560 watts) from BYD Solar or a comparable module from other manufacturers for the project. Each module assembly (including frame) weighs approximately 29 kilograms (64 pounds) and measures about 2.2 × 1.1 meters (m) (7.5 × 3.6 feet). Each module assembly is mainly made up of nonmetallic materials such as silicon, glass, composite film, plastic, and epoxies, with an anodized aluminum frame; these modules comprise the solar array.

At the time of decommissioning, modules that are operational may undergo refurbishment and be sold in the secondary market, yielding a higher revenue compared to selling them as salvage material.

Nonfunctional modules will be shipped to either the manufacturer or a third party for recycling or disposal.

2.3 Tracking System and Support

The solar modules will be affixed to a single-axis tracking system, such as the Duratrack HZ v3 manufactured by Array Technologies, or an equivalent system. Each full, three-string tracker measures approximately 104 m (341 feet) in length and will support 303 solar modules per tracker. Smaller two-string trackers will accommodate 202 panels each and will be deployed at the periphery of the solar array layout to optimize space usage. Composed mainly of high-strength galvanized steel and anodized aluminum, with steel piles supporting the system, the tracking system will be deactivated and disassembled during decommissioning.

Salvageable materials from the supports, tracking system, and posts can be sold to generate revenue, thereby offsetting the decommissioning costs.

Non-salvageable materials will be sent to a metal recycling facility.

2.4 Inverter Stations

The combined inverters/transformers (inverter stations) will be situated on small concrete footings or piers supported by steel piles within the array. These stations will be deactivated, disassembled, and removed. It is assumed for this report that piers with steel piles will be employed. Depending on their condition, the equipment may be refurbished for reuse or salvaged. If not repurposed, they will be disposed of at an approved waste management facility.

2.5 Electrical Cabling and Conduits

The project's underground electrical collection system will be buried approximately 3 feet (36 inches) below the ground surface. Cabling at or above 3 feet (36 inches) will be salvaged, while deeper cables will be abandoned in place. No recovery cost has been assumed for the collection cabling, although it is likely to have a salvage value at the time of removal.

2.6 Project Substation

The project substation, encompassing an approximately 67 × 53–m (223 × 175–foot) footprint, will house a gravel pad, power transformer and footings, and electrical control house with concrete foundations. Salvageable components of the substation, such as the transformer, may be sold for reuse. Unsalvageable parts will be transported off-site for disposal.

Rancho Viejo will also install a 20-foot by 70-foot Operation and Maintenance (O&M) building containing offices, restrooms and conference room for onsite operations. This structure will contain recyclable materials particularly various metals, which will be included in the salvage efforts. Non-salvageable materials will be disposed of properly disposed of along with other construction waste.

2.7 Septic System

To support the onsite facilities Ranch Viejo will install a 5,000-gallon capacity water tank, this tank will be filled by trucking in water as needed. The tank will be installed behind the O&M building. Additionally, a septic system will be installed that will drain into a septic leach field to the west of the gravel pad supporting the O&M building and BESS system. During Decommissioning the water tank will be removed and sold and the septic system will be removed and the impacted ground will be regraded and restored to pre-construction conditions

2.8 Battery Energy Storage System

Rancho Viejo will be installing 48 MW of battery storage as part of the overall site development. The BESS will be installed within a 129 × 58–m (423 × 189–foot) fenced area in the northeast corner of the project adjacent to the project substation. This footprint will house the 38 Conex 40-foot containers, 19 inverters, and support infrastructure. The batteries planned for this will be Samsung SDI/E5S or equivalent. Salvageable materials from the Conex containers, inverters, and battery racks can be sold to generate revenue, thereby offsetting the decommissioning costs. Located west of the BESS will be a water storage tank (for fire suppression purposes) that will hold approximately 30,000 gallons of water and will be 26.3-feet diameter by 7.2-feet above ground. The water storage tank will meet the requirements of 2021 International Fire Code (IFC) Chapter 5, Fire Service Features, Section 507, Water Supply.

Non-salvageable materials will be sent to a metal recycling facility.

2.8 Transmission Line

Rancho Viejo will construct an approximately 2.3-mile, 115-kilovolt transmission line to connect the project substation to a point of interconnection substation. The line will be strung on 33, 50-foot H-frame structures, which consist of two steel poles per structure, or 23, 70-foot steel monopoles. Each leg of the H-frame steel poles would have a 9-foot-deep foundation. Each of the steel monopoles would have a 10-foot-deep foundation. Current decommissioning cost are based on the H-Frame structures.

Salvageable materials from the poles and cable can be sold to generate revenue, thereby offsetting the decommissioning costs.

Non-salvageable materials will be sent to a metal recycling facility.

2.9 Perimeter Fencing and Access Roads

The Rancho Viejo site will include a security fence around the perimeter of the site and exclusionary area. The fence will total approximately 4.3 miles in length. Access drives will provide direct access to the solar facility from local roads and along the inner perimeter of the arrays. Internal roads will be located within the array to allow access to the equipment. The site access drives will be approximately 20 feet wide and approximately 8.5 miles long. The access road lengths may change in the final Project design. To be conservative, the decommissioning estimate assumes that all access roads will be completely removed.

Unless the landowner states in writing that certain elements are to be retained, all fence parts and associated foundations, gravel pads, and access roads will be removed.

During installation of the project access roads, subgrade conditions may be stabilized by incorporating cement into soft ground. This plan assumes the cement materials will be incorporated into the top 10 inches of existing soil, which will then be capped with 2 inches of granular fill.

Decommissioning activities include removing and stockpiling aggregate materials on-site for salvage preparation. It is conservatively assumed that all cement-stabilized soil and aggregate materials will be removed from the project site and transported up to 10 miles from the project area. Following removal of the aggregate and cement-stabilized soil, the access road areas will be graded; loosened with a deep ripper or chisel plow (ripped to 18 inches); backfilled with native subsoil and topsoil, as needed; and graded as necessary. No mention of reseeding.

3 LAND USE AND ENVIRONMENT

All hazardous materials will be disposed of in a manner consistent with federal, state, and local laws.

Soil shall be tested once energy production has ceased but before any equipment is removed. At least five samples will be taken, and they shall be representative of the overall project area; outliers in terms of soil type, drainage, or plant growth shall be excluded. The samples from before and after the operation of the facility will be compared to determine what contaminants, if any, are present and to develop a remediation program if necessary.

3.1 Soils and Rangeland

Areas previously used for rangeland within the project will be generally restored to their preconstruction condition, aligning with landowner lease agreements. Restoration efforts will be guided by consultations with current landowners and compliance with applicable regulations at the time of decommissioning. Disturbed land will be restored to its preconstruction state. Any soil exposed during decommissioning will be stabilized in accordance with New Mexico Department of Transportation erosion control and stormwater quality standards.

3.2 Restoration and Revegetation

Excavated and backfilled project sites will undergo grading as previously detailed. Any voids or holes remaining after equipment removal will be filled. Soil compaction resulting from deconstruction activities will be rectified as needed to restore land to its preconstruction state. Damaged drain tiles, if present, will be restored to preconstruction condition. Disturbed areas will be enriched with topsoil and seeded with appropriate vegetation, in coordination with landowners. All work will adhere to conditions agreed upon

by Rancho Viejo and Santa Fe County, or as dictated by prevailing regulations at the time of decommissioning.

During decommissioning, disturbances or removal of additional native vegetation shall be avoided to the greatest extent practicable. And land disturbed during the decommissioning process and any land that is not intended to be returned to rangeland use will be revegetated or reseeded with native plants according to the Santa Fe County Sustainable Land Development Code, or with other species that provide ecological services. Revegetation will be completed within 1 year of the removal of equipment, with a 6-month extension available, if needed, to complete a growing season.

3.3 Surface Water Drainage and Control

Predominantly situated within rangeland, the proposed project area features relatively flat terrain. The project layout has been designed to circumvent wetlands, waterways, and drainage ditches to the greatest extent feasible. Project site conditions and proposed BMPs for safeguarding surface water features will be delineated in a project Stormwater Pollution Prevention Plan before construction begins.

Surface water conditions will undergo reassessment before decommissioning. Rancho Viejo will secure requisite water quality permits from the New Mexico Environment Department Surface Water Quality Bureau and the U.S. Army Corps of Engineers, if necessary, prior to project decommissioning. Additionally, construction stormwater permits will be obtained, and a Stormwater Pollution Prevention Plan will be developed to account for prevalent conditions at the decommissioning stage. BMPs may encompass construction entrances, temporary and permanent seeding, mulching (in non-agricultural areas), erosion control matting, silt fence, filter berms, and filter socks.

3.4 Major Equipment Required for Decommissioning

Decommissioning activities involve the removal of aboveground project components and subsequent restoration (see Sections 2 and 3.2).

Equipment needed for decommissioning the mirrors that were needed to construct the solar facility may include, but is not limited to, the following: small cranes, low ground pressure (LGP) track-mounted excavators, backhoes, LGP track bulldozers, LGP off-road end-dump trucks, front-end loaders, deep rippers, water trucks, disc plows, tractors for subgrade restoration, and ancillary equipment. Over-the-road dump trucks will facilitate material transport from the site to disposal facilities.

4 DECOMMISSIONING COST ESTIMATE SUMMARY

Expenses associated with decommissioning the project will be dependent on labor costs at the time of decommissioning. For this report, 2023 to 2024 average market value approximations were used to estimate labor expenses. Fluctuation and inflation of the labor costs were not factored into the estimates.

4.1 Decommissioning Expenses

Project decommissioning will incur costs associated with disposal of components not sold for salvage, including materials which will be disposed of at a licensed facility, as required. Decommissioning costs also include backfilling, grading, and restoration of the proposed project site as described in Section 2. Table 2 provides a summary of the estimated costs for the decommissioning activities associated with the major components of the project.

Table 2. Estimated Decommissioning Expenses

Activity	Unit	Quantity	Cost Per Unit	Total
Management oversight and permitting	Lump sum	1	$450,000.00	$450,000.00
Mobilization/Demobilization	Lump sum	2	$500,000.00	$1,000,000.00
Solar modules: disassembly and removal	Each	205,712	$4.88	$1,003,874.56
Tracker system: disassembly and removal	Each	2,022	$663.00	$1,340,586.00
Steel pile removal	Each	65,440	$10.29	$673,377.60
Inverter station removal	Each	25	$1,700.00	$42,500.00
Removal of O&M Building	Each	1	$12,500	$12,500
Removal of Septic System	Each	1	$7,500	$7,500
Removal of Water Tank	Each	1	$2,000	$2,000
Access roads and inverter foundation removal	Lump sum	1	$364,700.00	$364,700.00
Perimeter fence removal	Linear feet	22,884	$2.97	$67,965.48
Aboveground cable removal	Linear feet	93,201	$0.25	$23,300.25
Underground cable removal	Linear feet	196,193	$3.50	$686,675.50
Removal of transmission poles (9-foot foundation), including cables	Lump sum	1	$966,000.00	$966,000.00
Battery container removal	Each	13	$7,500.00	$97,500.00
Battery rack removal	Each	723	$478.00	$345,594.00
BESS inverter pad removal	Each	19	$1,700.00	$32,300.00
Site restoration (680 acres)	Lump sum	1	$850,000.00	$850,000.00
Project substation removal	Each	1	$350,000.00	$350,000.00
Repair of public roads	Lump sum	1	$225,000.00	$225,000.00
Trucking/Disposal fees	Lump sum	1	$350,000.00	$350,000.00
Total				**$8,891,373.39**

4.2 Decommissioning Revenues

Project revenue will be realized through the sale of the solar facility components and construction materials. Modules and other components may be sold within a secondary market or as salvage. The market value of steel and other materials fluctuates daily and has varied widely over the past 5 years. Salvage value estimates were based on the approximate 5-year average price of steel and copper derived from sources including online recycling companies and U.S. Geological Survey commodity summaries. The price used to value the steel used in this report is $253 per metric ton; aluminum is $0.40 per pound; silicon is $0.40 per pound; and glass is $0.05 per pound. The main component used in the tracking system and present in the piles is assumed to be salvageable steel. Solar panels are estimated to contain approximately 75% glass, 8% aluminum, and 5% silicon. A 70% recovery rate is assumed for aluminum and all panel components, due to the processing required to separate the panel components. Alternative and more efficient methods of recycling solar panels are anticipated before this project is decommissioned, given the large number of solar facilities that are currently being developed. Table 3 summarizes the potential salvage value for the solar array components and construction materials at end of life.

Table 3. Estimated Decommissioning Revenues

Item	Unit	Salvage Price Per Unit	Units Per Item	Total Salvage Price Per Item	Number of Units	Total
Panels - silicon	Average number of pounds per panel (item)	$0.40	1.7	$0.68	205,712	$139,884.16
Panels - aluminum	Average number of pounds per panel (item)	$0.40	2.8	$1.12	205,712	$230,397.44
Panels - glass	Average number of pounds per panel (item)	$0.05	26.1	$1.31	205,712	$268,454.16
Panels - other	Average number of pounds per panel (item)	$0.50	2.4	$1.20	205,712	$246,854.40
Tracking system, transmission poles, and posts (mixed metals)	Tons	$215	1	$215	200	$43,000.00
Cables	Tons	$3,000	1	$3,000	50	$150,000.00
Inverters	Each	$80	1	$80	43	$3,440.00
Substation/BESS Containers/O&M Building metal	Lump sum	–	–	$200,000	1	$200,000.00
Total						**$1,282,030.16**

4.3 Decommissioning Cost Summary and Financial Assurance

A summary of the net estimated cost to decommission the project, using the information detailed in Sections 4.1 and 4.2, is provided in Table 4. Estimates are based on 2023 to 2024 prices; market fluctuations and inflation were not included in the estimate.

Table 4. Net Decommissioning Summary

Item	Total
Decommissioning expense	$8,891,373.39
Potential revenue – salvage value of panel components and recoverable materials	$1,282,030.16
Net Decommissioning Cost	**$7,609,343.23**

Will need to bond for this amount.

APPENDIX F

Revegetation and Weed Management Plan

Vegetation and Noxious Weed Management Plan for the Rancho Viejo Solar Project in Santa Fe County, New Mexico

JULY 2024

PREPARED FOR

Rancho Viejo Solar, LLC

PREPARED BY

SWCA Environmental Consultants

VEGETATION AND NOXIOUS WEED MANAGEMENT PLAN FOR THE RANCHO VIEJO SOLAR PROJECT IN SANTA FE COUNTY, NEW MEXICO

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1 INTRODUCTION

Rancho Viejo Solar, LLC (Rancho Viejo), is proposing to build the Rancho Viejo Solar Project (Project) in Santa Fe County, New Mexico (Figures A-1 and A-2 in Appendix A). The Project will be approximately 3 miles south of Santa Fe city limits and approximately 4.2 miles east of La Cienega. The energy supplied by the solar facility is intended to replace part of the fossil-based assets of the Public Service Company of New Mexico.

This Vegetation and Noxious Weed Management Plan (Plan) summarizes the vegetation-related work that is expected to occur during the pre-construction, construction, and post-construction phases of the Project and provides specific restoration, reclamation, and management guidelines for contractors completing restoration and reclamation. This Plan includes an overview of acceptable restoration, reclamation, and management techniques and the criteria for selecting each technique. However, it is incumbent upon Rancho Viejo and/or the selected contractor(s) to implement these techniques as appropriate. In addition, methods for the control, treatment, and eradication of noxious weeds are included in this Plan. Noxious weed populations pose a threat to native plant populations and often diminish the habitat and quality of forage for wildlife as well as livestock. Limiting the spread and establishment of noxious weeds is a crucial goal of the Plan; in fact, the primary reason for replanting disturbed areas is to control noxious weeds. The term "noxious weed" is used throughout this document to refer to both regulated invasive plants (at a federal, state, and/or local level) and otherwise undesirable non-native plant species; however, the responsible party is only statutorily required to treat and control regulated invasive species.

1.1 Regulatory Authority and Requirements

The authority guiding this Plan is provided under the following:

7 United States Code (USC) 2801-2814, Federal Noxious Weed Act of 1974. This act provides for the control and eradication of "any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish or wildlife resources of the United States or the public health." This act gives the Secretary of Agriculture broad powers in regulating transactions in and movement of noxious weeds into or throughout the United States.

7 USC 7701-7786, Plant Protection Act of 2000. This act specifies that the Secretary of Agriculture may prohibit or restrict the importation, entry, exportation, or movement in interstate commerce of any noxious weed if it is determined "that the prohibition or restriction is necessary to prevent the introduction into the [U.S.] or the dissemination of a plant pest or noxious weed within the [U.S.]," and authorizes the issuance of implementing regulations.

New Mexico Statutes Annotated (NMSA) 1978 76-7-1, Noxious Weed Control Act, 1959. This act establishes noxious weed control districts who may designate noxious weed species for control, determine the time and method of control, and prescribe the areas subject to control measures.

NMSA 1978 76-7-1, Noxious Weed Act of 1963. This act makes it unlawful to sell, give away, or plant designated noxious weeds in New Mexico.

NMSA 1978 76-7D-1, Noxious Weed Management Act, 1998. This act aims to improve the state economy and environment by managing noxious weeds in New Mexico.

New Mexico Noxious Weed Memo and List, 2020. This list identified plant species to be targeted as noxious weeds for control or eradication pursuant to the Noxious Weed Management Act. The list includes 47 species divided into the following groups:

- Class A species are currently not present in New Mexico or have limited distribution. Preventing new infestations of these species and eradicating existing infestations is the highest priority.
- Class B species are limited to portions of the state. In areas with severe infestations, management should be designed to contain the infestation and stop any further spread.
- Class C species are widespread in the state. Management decisions for these species should be determined at the local level, based on feasibility of control and level of infestation.
- Watch List species are species of concern in the state. These species have the potential to become problematic, and more data is needed to determine if these species should be listed. If these species are encountered, their locations should be documented and appropriate authorities should be contacted.

1.2 Plan Development

Development of this Plan included the use of resources from federal and state guidance, as well as industry and scientific papers, to identify proven methods for effective reclamation and noxious weed management. In addition, Rancho Viejo has developed resource-specific environmental protection measures as part of the Project's Environmental Impact Report (SWCA Environmental Consultants [SWCA] 2023) to avoid and minimize significant impacts from the Project. Environmental protection measures relevant to vegetation and noxious weed management have been integrated into this Plan in appropriate sections, and all measures are summarized in Appendix B. This Plan was also designed to meet requirements and commitments included in the Project's Stormwater Pollution Prevention Plan (SWPPP), issued under the National Pollutant Discharge Elimination System permit program.

2 PROJECT SETTING

2.1 General Characteristics

The biological resources in the Project area, including vegetation, wildlife species, and habitat, are typical of the grassland and pinyon (*Pinus* spp.)-juniper (*Juniperus* spp.) savanna–dominated ecoregion that is common throughout northern New Mexico. The Project area and surrounding landscape have been previously disturbed by two-track roads, cattle grazing, State Route 14, and transmission lines. No unique vegetation, wildlife, or habitat features were identified during the biological survey (April 4–11, 2022) of the analysis area (SWCA 2023). The analysis area includes the Project area plus an additional survey area buffer (see Figure A-2 in Appendix A).

The Project area is located in the North-Central New Mexico Valleys and Mesas ecoregion, which encompasses central New Mexico. The elevation in the Project area is approximately 6,420 feet above mean sea level. The climate for this area, based on the climatic records for the Santa Fe 2 station in Santa Fe County, New Mexico (COOP Station No. 298085), has an average annual maximum temperature of 64.9 degrees Fahrenheit (°F) and an average annual minimum temperature of 36.0°F. The average annual rainfall is 13.68 inches, with the majority occurring between May and October, while the average annual total snowfall is 21.0 inches, which largely occurs between November and March (Western Regional Climate Center 2024). Weather during the biological survey was approximately 41°F to 71°F, and sunny to cloudy with western, northwestern, and eastern winds of approximately 0 to 35 miles per hour (SWCA 2023).

2.2 Ecology

The Project area is located within the Arizona/New Mexico Plateau: North-Central New Mexico Valleys and Mesas U.S. Environmental Protection Agency Level IV ecoregion (Griffith et al. 2006). During the biological survey, SWCA biologists identified two distinct habitat types within the analysis area. Habitat 1 is grasslands dominated by blue grama (*Bouteloua gracilis*), prickly Russian thistle (*Salsola tragus*), and rubber rabbitbrush (*Ericameria nauseosa*) and features approximately 61% vegetative cover composed of approximately 1% shrub cover, 60% herb/grass cover, and approximately 39% bare ground (see Photographs 1 and 2 in Appendix C). Habitat 2 is pinyon-juniper savanna dominated by blue grama, twoneedle pinyon (*Pinus edulis*), oneseed juniper (*Juniperus monosperma*), and rubber rabbitbrush and features approximately 21% vegetative cover composed of approximately 15% tree cover, 20% shrub cover, 40% herb/grass cover, and 25% bare ground (see Photographs 3 and 4 in Appendix C). These habitats are typical of vegetative communities of the North-Central New Mexico Valleys and Mesas ecoregion, except for the dominance of prickly Russian thistle in Habitat 1.

2.3 Baseline Noxious Weed Observations

During the biological survey, no U.S. Department of Agriculture–listed noxious weed species or New Mexico Department of Agriculture (NMDA)–listed invasive or nonnative plant species were observed within or around the analysis area (NMDA 2020; U.S. Department of Agriculture 2010). Prickly Russian thistle was observed during the biological survey and was noted as a dominant species in Habitat 1. Prickly Russian thistle is not a designated noxious weed but is a nonnative and invasive species found throughout New Mexico (Natural Resources Conservation Service [NRCS] 2024a). Protection measures, such as noxious weed washing stations, can be utilized to reduce the introduction of noxious, invasive, and nonnative plants.

3 PROJECT DESCRIPTION

The Project includes the construction of an 680-acre, 96-megawatt solar generation facility, a 2.3-acre, 48-megawatt battery energy storage system, a 1-acre collector substation, a 2.3-mile-long generation tie-in transmission line (gen-tie), a 2.1-mile-long associated access road, a 26.3-feet diameter by 7.2-feet above ground water storage tank, and a 1,400-square-feet by approximately 18 feet above ground Operations Building (see Figure A-2 in Appendix A). Construction of the facility will include transportation of equipment, site preparation, clearing, grubbing, grading, and equipment installation. Interim reclamation would occur in areas not required for long-term operations and maintenance. Operations and maintenance of the facility would include routine maintenance and inspection. Maintenance of the facility may include periodic washing of solar panels, general equipment maintenance, and vegetation trimming.

3.1 Disturbance Types

This plan defines two types of disturbance conditions—permanent use and temporary use. Before beginning any construction activity or other ground-disturbing activity, all areas to be disturbed will have boundaries marked using stakes, flagging, and/or fencing spaced to maintain a sightline, and all disturbances will be confined to the marked areas in accordance with the Santa Fe County Sustainable Land Development Code (SLDC) (Ordinance No. 2016-9). All Project personnel will be instructed that their activities must be confined to the marked areas, and no grading is permitted within 1 foot of a property line, except for roads driveways and utilities in accordance with the Santa Fe County SLDC. Disturbance beyond the marked areas will be prohibited. If sensitive resources are observed within the

area to be disturbed, construction will proceed in a different area until an approved resource specialist has evaluated the find.

3.1.1 Permanent Use Areas

The use of these areas is long term, and the landscape will be permanently altered as a result of removing vegetation, leveling the site, and constructing the facility, battery energy storage system, substation, gen-tie, water storage tank, and Operations Building. Permanent disturbance also includes constructing access roads needed for routine maintenance of the facility.

3.1.2 Temporary Use Areas

Temporary use is defined as using an area only for the amount of time it takes to construct the Project. This will include using various types of heavy equipment movement within the Project area to install solar panels, fencing, and gen-tie poles, parking vehicles and equipment, and storing materials in designated staging areas. These areas will be restored following the completion of construction.

4 VEGETATION MANAGEMENT

Vegetation management planning for the Project includes an evaluation of site conditions and development of site-appropriate revegetation approaches in accordance with the Project's Environmental Impact Report (SWCA 2023).

4.1 Revegetation Constraints

Revegetation constraints within the Project include 1) shallow low-nutrient mineral soils that are readily mobilized by local eolian forces, 2) low average annual precipitation levels, and 3) high average summer temperatures.

4.2 Revegetation Approach

In order to overcome the constraints identified in Section 4.1, appropriate native or similar species common within the ecoregion will be used to reseed the post-construction temporary use areas to the greatest extent practicable. Though soil stabilization will occur in accordance with the Project's associated SWPPP, compacted soils will be restored as closely as possible to preconstruction conditions as required for ground stabilization and erosion control. This also supports the success of revegetation activities following construction. Rancho Viejo will consult with local agencies, experts, or landowners to determine appropriate seed mixtures of native or similar species and seeding rates for the Project area. Seed mixes will be applied with mulch, organic amendment, and tackifiers to increase revegetation success. A recommended seed mix and application rates for the Project are provided in Table 1. The Project seed mix to be used will be approved by the Santa Fe County Administrator prior to application in accordance with the Santa Fe County SLDC.

Table 1. Recommended Seed Mix and Application Rate

Common Name	Scientific Name	Application Rate (Pure Live Seed/Acre)
Blue grama, Alma*	*Bouteloua gracilis*	2.54
Buffalograss, Texoka	*Bouteloua dactyloides*	1.905
Cool season cover crop "Smoothgrazer" wheat/triticale blend	*Pseudoroegneria spicata* and *X triticosecale*	7.0
Green sprangletop, Van Horn	*Leptochloa dubia*	1.905
Little bluestem	*Schizachyrium scoparium*	0.635
Plains bristlegrass	*Setaria leucopila*	0.635
Sand dropseed	*Sporobolus cryptandrus*	0.635
Sideoats grama	*Bouteloua curtipendula*	1.905
Warm season cover crop German millet	*Setaria italica*	7.0
Western wheatgrass	*Pascopyrum smithii*	2.54

*'Alma' blue grama is the preferred variety. If the necessary quantities are not available in the market at time of planting, New Mexico origin VNS blue grama will be used.

4.3 Revegetation Methods

Topsoil will be placed separately from subsoils/bedrock during excavation to the greatest extent practicable. Rancho Viejo will aim to store native topsoil stockpiles on-site in sufficient quantity to ensure that all revegetation areas have enough native soil prior to hydroseed and mulch application, in accordance with the Santa Fe County SLDC. The topsoil should be scarified, tilled, or harrowed to a depth of approximately 3 to 4 inches below ground surface, creating a suitably roughened seedbed for germination and establishment of seed. All materials used for the Project will be certified weed-free. Seed, mulch, organic matter, and tackifier will be loaded into the hydroseeder tank and agitated based on manufacturer specifications. Residence time of seed within the hydroseeder tank will be minimized by only adding seed to the hydroseed tank immediately prior to initiation of hydroseeding. The hydroseeding slurry, including tackifier, mulch, organic matter, and seed, will be evenly applied as a slurry to the revegetation areas at the rates listed in Table 1.

4.4 Revegetation Watering

Supplemental watering will be conducted concurrently with hydroseeding and mulching application, which will utilize a minimum of 1,500 gallons of water per acre. Additional supplemental watering may also occur if the monthly precipitation falls below 60% of average during the first growing season (April–October) and/or if site inspection indicates that seeded plants are drought-stressed. In this case, supplemental watering will be administered to the revegetation areas at 1-week intervals and a maximum of 1 acre-inch per application, until indicators of plant drought stress are diminished or total water input (from precipitation and irrigation) equals the average precipitation. For example, if June precipitation is 0.5 inch below average and this precipitation shortfall is documented or anticipated to substantially decrease revegetation success, then a supplemental July watering event, equaling 0.5 acre-inch, will be planned for the Project.

Supplemental water will be provided by watering trucks equipped with a hose and/or spray gun to allow for administration of water within revegetation areas from outside of the revegetation areas. The rate of watering will not exceed the soil infiltration rate or cause surface water runoff, and supplemental watering will not be conducted after 3 years post-construction.

4.5 Revegetation Monitoring

Monthly precipitation monitoring will be conducted during the first growing season to ensure the revegetation efforts are not adversely impacted by drought, as described in Section 4.4. Revegetation success monitoring will occur annually until the native vegetation cover and diversity within revegetation areas is equal to or greater than 70% of vegetation cover found in adjacent undisturbed areas. Additionally, in accordance with the Santa Fe County SLDC, disturbed areas not stabilized by landscaping shall be permanently revegetated to approximate the density and species or vegetation at the site prior to grading.

Monitoring results will be used to determine if the revegetation program is achieving success. Should the results show that changes need to be made to the Plan to advance toward achieving the Plan goals, a scientifically based adaptive management approach will be implemented. Annual evaluation of revegetation success and adaptive management methods during the post-construction monitoring efforts will be summarized in a brief report.

5 NOXIOUS WEED MANAGEMENT

Many weed species are, by their nature, adapted to colonizing disturbed ground—whether disturbed by natural or anthropogenic processes—and thus it is no surprise that many large construction projects require some level of active weed management. However, an abundance of weed infestations or recurring infestations can be symptomatic of certain land management, project management, and/or environmental conditions. When facing a weed infestation, it is important to identify and correct (to the extent feasible) the underlying causes of weed infestation and take steps to counter them. If the factors permitting weed establishment and expansion are not addressed, weed problems will continue indefinitely. A single control technique is rarely sufficient to control a particular weed species. The best results in weed control are usually obtained by combining different control methods in a coordinated effort (Colorado Department of Agriculture 2000).

5.1 Best Management Practices

The following measures will be implemented by Rancho Viejo and/or their contractor(s) to prevent the spread of weed propagules and inhibit their germination.

5.1.1 Equipment Cleaning

To prevent the spread of noxious weed species into new habitats, Rancho Viejo or their contractor(s) will ensure that construction equipment is cleaned of dirt and mud that could contain weed seeds, roots, or rhizomes. Prior to entering the Project work areas, equipment will be inspected by Rancho Viejo or their contractor(s) to ensure it is free of dirt or mud that could contain weed seeds. Prior to construction, all equipment tracks, feet, tires, and undercarriage will be carefully washed, and special attention will be paid to axles, frames, cross members, motor mounts, underneath steps, running boards, and front bumper/brush guard assemblies. Other construction vehicles (e.g., pick-up trucks) that will be frequently entering and exiting the site will be inspected and washed on an as-needed basis prior to entering the Project area.

All vehicles will be washed off-site by Rancho Viejo or their contractor(s). However, if necessary, an on-site cleaning station will be set up to clean equipment before entering the work area. Cleaning stations would use high-pressure water and/or air to remove dirt and mud from equipment and vehicles and would be located away from any sensitive plant populations.

Additionally, ingress and egress of equipment and vehicles will be limited to designated routes.

5.1.2 Site Soil Management

Soil will be managed by limiting ground disturbance to the minimum feasible and implementing fugitive dust mitigation measures to minimize the spread of noxious weed seeds. Cleared vegetation and salvaged topsoil will be stockpiled adjacent to the area from which they are stripped to eliminate the transport of soil-borne noxious weed seeds, roots, or rhizomes. Dust palliatives (e.g., water) will be used during construction to minimize the spread of airborne noxious weed seeds, especially during very windy days, a characteristic of the Project vicinity. As appropriate, temporary drift fences may be installed to help control sand movement during construction. Because sand accumulating along these fences will provide a hospitable microsite for noxious weed seed germination, as well as capture higher densities of seeds, concentrated control measures will be implemented along such structures (and any others that trap sand and seeds) to prevent establishment of noxious weed populations.

Additionally, Rancho Viejo or their contractor(s) will limit disturbance areas to the minimum required to perform work to conserve natural vegetation and ground covers, keeping soils naturally stabilized to the extent possible.

5.1.3 Weed-Free Products

Rancho Viejo or their contractor(s) will ensure that any straw or hay bales used for sediment barrier installations are obtained from sources that are certified free of primary noxious weeds. Other products, such as gravel, mulch, and biosol or compost, may also carry noxious weeds. Such products will be obtained from suppliers who can provide certified weed-free materials. Where feasible, mulch will be generated from native vegetation cleared from the Project area. Soil will not be imported into the Project area.

5.1.4 Personnel Training

Noxious and invasive weed management will be incorporated as a part of mandatory site training for groundskeepers and maintenance personnel. Training will include weed identification and the impacts on agriculture, livestock, wildlife, and fire frequencies. Training will also cover the importance of preventing the spread of noxious weeds.

5.2 Infestation Containment and Control

While no State of New Mexico or federal noxious weeds were observed during field surveys of the Project area in April 2022, prickly Russian thistle (a nonnative and invasive species) was observed as a dominant species in Habitat 1. In addition, development activities may introduce noxious weeds to the site. Weed species should be controlled before they set seed and before they shade and outcompete desirable and native plants in the Project area. The following measures will be implemented in order to prevent their establishment and spread in areas of soil disturbance, if encountered.

5.2.1 Manual Treatment

Where noxious weeds are encountered, Rancho Viejo or their contractor(s) will remove plants or seed heads with hand tools. Certain specialty hand tools may be used as well, such as those reviewed by The Nature Conservancy (2011). This treatment technique is considered ideal because it has the least potential for unwanted impacts on the natural environment. Special care will be taken to find tools that will remove

weeds effectively, while not disturbing desirable and native vegetation. Both vegetative and root systems will be removed where feasible. Removal efforts will be timed appropriately for each species, before seed set. Timing will also be flexible to reflect rainfall events and other factors that may speed up or delay population maturation for a given year. Multiple removal events may be necessary to ensure that late-germinating plants are also removed. Invasive plants will be disposed of by bagging and will either be incinerated (if permitted by air quality standards) or transported to a permitted waste facility.

5.2.2 Mechanical Treatment

Rancho Viejo may implement mechanical treatment to control noxious weed populations, such as hand weed trimmers or mowing, only where manual treatment techniques are ineffective. Mechanical treatment would take place only where terrain allows for safe handling of machines; heavy equipment will not be used in natural, undisturbed areas. Mechanical methods will not be used during periods of high fire risk and will only be used with implementation of fire prevention measures. Timing of efforts will ideally coincide with manual treatment, and when possible, areas where weeds have been removed will be revegetated to hinder a future reemergence of weeds in the same location.

5.2.3 Chemical Treatment

Herbicide chemical control methods may also be used to control noxious weed populations. If herbicides are required, a state-certified herbicide applicator will be contracted and herbicides will be selected and applied in accordance with the New Mexico Pesticide Control Act, Chapter 76 Article 4 NMSA.

Chemical treatment will be used judiciously in reclaimed areas as an adjunct to manual treatment. Timing is critical for both pre-emergent and post-emergent herbicide application. In the Project area, pre-emergent herbicides would be applied prior to weed germination. Post-emergent herbicides must be applied while the weed is actively growing, most effectively in the early seedling stage, but always prior to seed set. Herbicides will be used along with manual and mechanical means for post-emergent elimination. When possible, selective herbicides will be used to target specific weed species, rather than all vegetation.

Herbicide spray drift (drift) can be an unwanted side effect of the chemical treatment techniques. Drift can occur as vapor or particle drift. Vapor drift can be minimized by selecting product formulations resistant to vaporizing and applying herbicides at ideal temperature and humidity conditions. Generally, high temperatures and low relative humidity increase vapor drift, and so any herbicide application should ideally occur in the early morning during most of the year. Particle drift is a function of application method and equipment. Droplet size and pressure of the herbicide applicator will be controlled carefully to minimize particle drift. Herbicides will also, to the extent practicable, be applied on low-wind days (below 10 miles per hour or less as required by law or local regulations).

5.3 Monitoring

5.3.1 Noxious Weed Survey Methods

Rancho Viejo or their contractor(s) will conduct noxious weed surveys throughout the Project area and targeting the perimeter fence and all roadways of the Project area during the growing season. The approximate growing season in the region is April 30 through October 17 according to the NRCS Wetlands Climate Tables (WETS Station: Santa Fe 2, New Mexico) (NRCS 2024b). Monitoring for noxious weeds will occur at least quarterly from the start of construction for a minimum of 3 years post-construction or until the success standard is met (see Section 5.4), and to the lesser of 50 meters beyond

the facility perimeter or the boundary of the Rancho Viejo–owned property during the growing season. All noxious weed populations encountered will be mapped and, to the extent practical, will be treated or removed immediately with the control methods described in Section 5.2 above.

5.3.2 Construction Monitoring

During construction, Rancho Viejo or their contractor(s) will review the New Mexico Noxious Weed List (NMDA 2020) and plant identification materials monthly during the growing season to be aware of the noxious weed species that have a potential to occur within the Project area. Monitoring will be conducted as described in Section 5.3.1, and any noxious weed populations observed will be documented and mapped. In accordance with New Mexico's Noxious Weed Management Act, particular noxious weed species will be reported to the appropriate authorities as required if observed during monitoring. A management strategy and methods will be developed for each specific noxious weed species observed in the Project area. Observations of noxious weed populations during construction monitoring efforts, as well as any treatment methods performed, will be summarized in a brief report.

5.3.3 Post-construction Monitoring

Noxious weed monitoring and control will be ongoing for the life of the Project. Noxious weed monitoring will continue quarterly during the growing season for 3 years post-construction. If Plan success is determined after the initial 3 years of operations post-construction, the weekly growing-season monitoring frequency may be reduced appropriately. Noxious weed monitoring will continue to include recording observed noxious weed infestations and reporting observations to the appropriate authorities as required for the life of the Project. Observations of noxious weed populations, treatment locations, and treatment methods during the 3-years of post-construction monitoring efforts will be summarized in a brief report. If additional years of monitoring and treatments are conducted, these efforts will also be reported.

5.4 Success Standard Thresholds

No plant species from the 2020 New Mexico Noxious Weed List (NMDA 2020) were observed during field surveys of the Project area in April 2022; however, prickly Russian thistle was observed. While it should be noted that these surveys are not considered comprehensive weed inventories, the overall goal for the Project is containment of noxious weed species to a degree that desirable and native plants can establish on-site and stay in compliance with applicable noxious weed regulations. Noxious weed species can interfere with the establishment and growth of desirable and native plants and affect ecosystem processes like soil cover, nutrient cycling, fire regimes, and hydrology. These ecosystem changes can result in biodiversity loss and eventually extinction (Weidlich et al. 2020). Noxious weed species will be managed, but if noxious weed species establish in the Project area, total eradication may not be feasible given the possibility of infestation from nearby and potentially uncontrolled sources. Noxious weed species are likely to be transported between sites by vehicle traffic and personnel during construction and operation, as well as from wind, water, and avian distribution.

The Project goal is to eradicate infestations or at a minimum, minimize establishment and spread of noxious weeds in the Project area that can be attributed to Project activities. If at 3 years of operation the noxious weed densities in the Project area are eradicated or establishment is minimized, the Plan will be considered successful. If the Plan is not successful after 3 years of operation, continued monitoring and control, with modified techniques as necessary, will be implemented through an adaptive management process.

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APPENDIX A

Figures

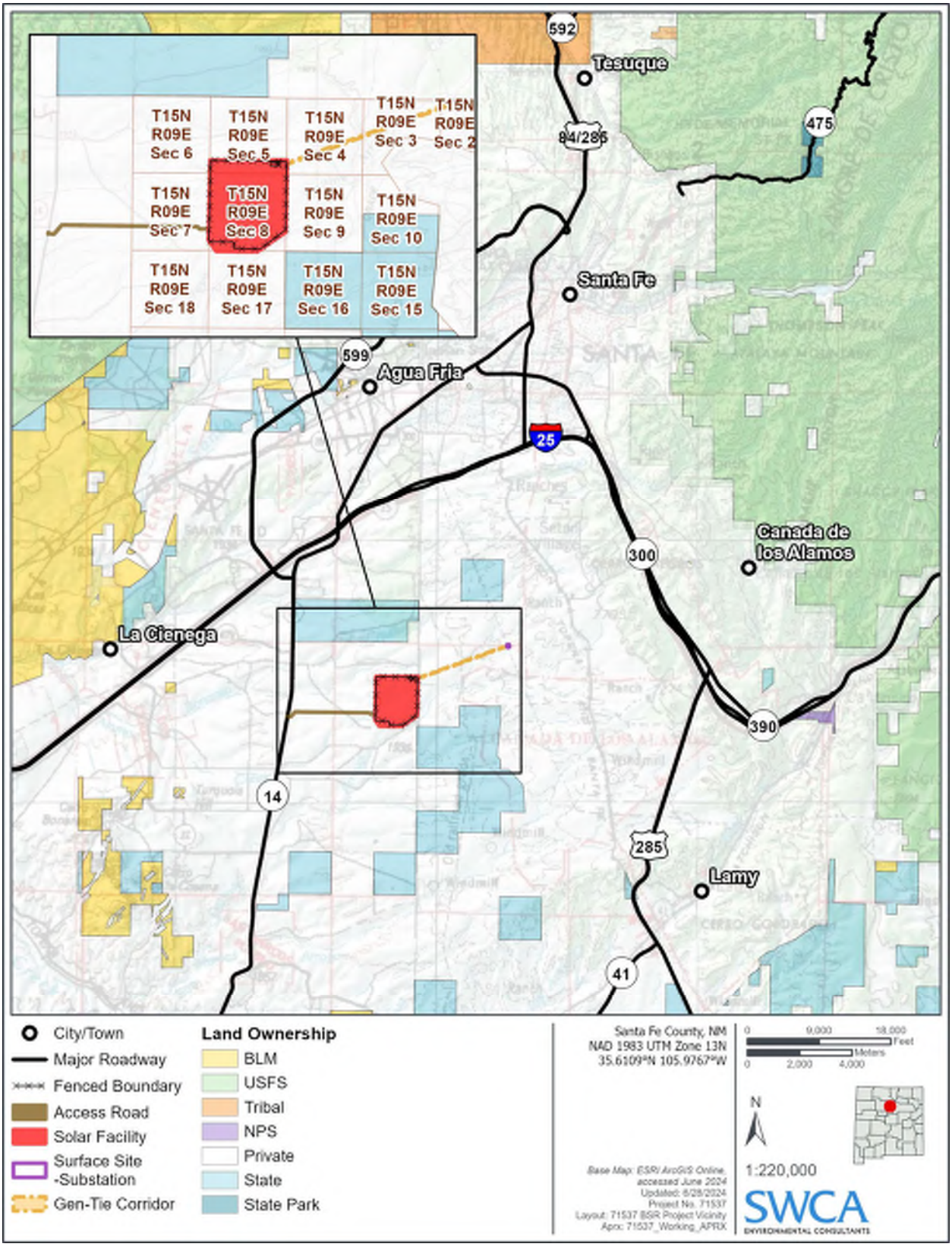


Figure A-1. Project vicinity map.

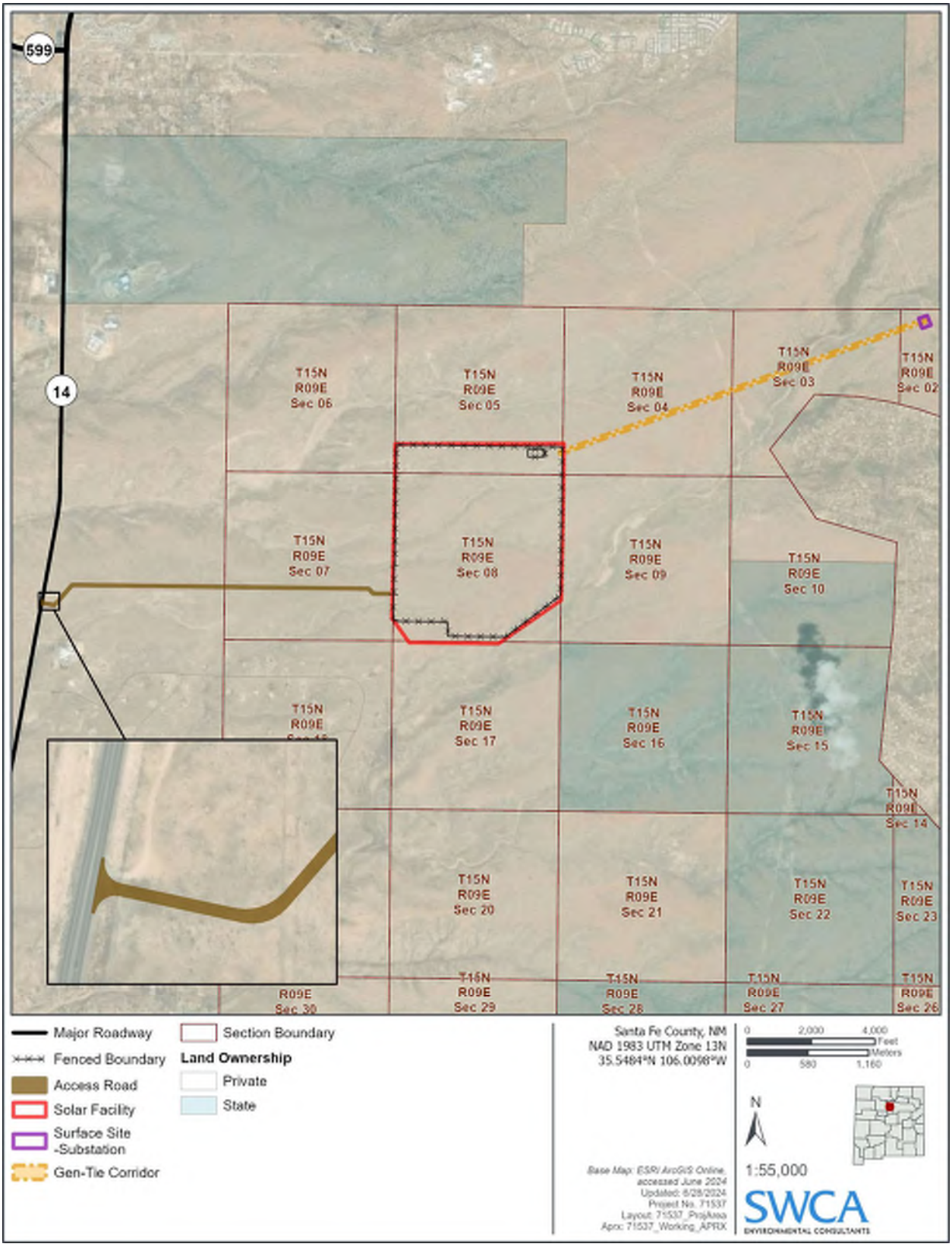


Figure A-2. Project area disturbance footprint.

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APPENDIX B

Environmental Protection Measures

Environmental Protection Measures

The following Environmental Protection Measures identified in the Project Environmental Impact Report (SWCA 2023) are related to vegetation and noxious weed management and will be implemented to avoid and minimize impacts to resources:

- Temporarily disturbed areas will be revegetated to the extent practicable in order to meet SWPPP requirements and performance standards for runoff and erosion control. Seed mixture and seeding rates will be developed through consultation with the local agency, experts, or landowner.
- Compacted soils will be restored as closely as possible to preconstruction conditions as required for ground stabilization and erosion control.
- Rancho Viejo will develop and implement the Vegetation and Noxious Weed Management Plan for the control of noxious weeds and invasive species that could occur as a result of new surface disturbance activities at the site. Performance standards will be used to evaluate the success of the Vegetation and Noxious Weed Management Plan.
- If required as part of the SWPPP, a native seed mixture will be applied to all temporary disturbance areas, followed by applications of mulch as required to provide additional erosion control.
- To the extent practicable, topsoil will be placed separately from subsoils/bedrock during excavation and not commingled and will be replaced in reverse order of excavation.
- Erosion will be reduced by applying and maintaining standard erosion and sediment control methods. These may include using certified weed-free straw wattles and bale barriers and silt fencing. Specific erosion and sediment control measures will be specified in the SWPPP. The SWPPP will include performance standards to evaluate the success of erosion control measures.
- Rancho Viejo will implement appropriate erosion control measures in areas with slopes, as provided in the SWPPP. To the extent practicable, temporary access roads will be designed following existing landform contours, where practicable, and revegetated with native or similar grasses, shrubs, or forbs, or as agreed to with the landowner.

APPENDIX C

Photographs



Photograph 1. View of Habitat 1 (grasslands) within the Project area, facing north.



Photograph 2. View of Habitat 1 (grasslands) within the Project area, facing east.



Photograph 3. View of Habitat 2 (pinyon-juniper savanna) within the Project area, facing north.



Photograph 4. View of Habitat 2 (pinyon-juniper savanna) within the Project area, facing west.

APPENDIX G

First Responder Mitigation Guidelines

First Responder Mitigation Guidelines

AES – Global Insurance

RANCHO VIEJO SOLAR & BATTERY ENERGY STORAGE SYSTEM

1452 NM 14, Santa Fe, NM 87508

Report Date: August 2024

Prepared By: AGIC ER&PIP TEAM

Approving Manager: Ron Woodfin

Document Control Number: Rancho Viejo -

Revision Number: 0

Revision History

Revision Number	Authored By	Sections Revised	Reviewed By	Approved By	Revision Date
00	AGIC BESS PIP Team	Whole Document	Ron Woodfin Mark Andronis Shane Cornwell David Hope		8-27-2024

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1. Introduction

The AGIC Emergency Response Pre-Incident Planning Evaluation and First Responder Mitigation Guidelines were developed to provide specific Battery Energy Storage System (BESS) response guidance, emergency planning and training to first responders and AES BESS personnel and contractors for incidents involving BESS, specifically lithium-ion (li-ion) batteries and associated hazards (i.e., fire, explosion, toxic chemicals, arc flash, etc.).

First Responders may include ANY Organization responding to the **Rancho Viejo site.** (Santa Fe, NM). These include Emergency Services (First Responders, HazMat, Rescue, EMS, etc.), AES / BESS Personnel, and third-party contractors.

2. Purpose

The purpose of this document is to provide First Responders with awareness of typical but not exhaustive Risks & Hazards related to Energy Storage Systems during potential failure scenarios.

Wherever national, state, or local regulations or buyer or subcontractor health, safety, and environmental requirements differ from those described herein, the more stringent requirements shall apply. All employees, vendors, contractors, subcontractors, and visitors shall comply with applicable Health and Safety requirements. Failure to do so may result in personal injury or death.



READ THIS PROCEDURE BEFORE ENTERING THE SITE

WARNING!

REMAIN OUTSIDE THE FRONT GATE UNTIL ENTRY IS GRANTED BY THE AES / Ranch Viejo PERSONNEL.

1. *Unless Rescue Operations Are Intended, BESS Container Fires Will Normally Require Defensive Suppression Activities with Exposure Protection.*

2. *If a horn/strobe of a Container is alarming, wait 6 hours before approaching, with AES / Rancho Viejo Personnel approval and escort, then evaluate the affected equipment using Gas Detectors and Thermal Imaging Cameras. At that point, if there are any elevated heat or gas measurements, wait another 4 hours.*

3. *In the event that the horn/strobe of a Container is not alarming, the site can be accessed with AES / Rancho Viejo Personnel approval and escort.*

4. *Ensure First Responders wear the proper PPE, (e.g., Electrical, Fire, HazMat).*

5. *Proceed with caution, visibly look for signs of overheating, white smoke/fog, or hissing sounds and evacuate if fire or smoke is observed from a Container, maintaining a minimum distance of 100ft (~30m) between all personnel and the affected Container. White fog or smoke could indicate off gassing batteries.*

6. *Several Safety Systems associated with the Energy Storage run on the Auxiliary Power supply to the site. Therefore, this must never be disconnected, unless done so by AES / Rancho Viejo Personnel.*

3. Site Emergency Contacts

NOTE: *To access the BESS, contact the numbers below and await AES / Rancho Viejo Personnel at front gate for escort.*

3.1 Rancho Viejo Emergency Contacts

EMERGENCY CONTACTS	CONTACT INFORMATION
Local and State Emergency Response Agencies	**Emergency: 911** AES Remote Operations Control Center (ROCC) (855) 679-3553
Fire Departments	Santa Fe County Fire Department 35 Camino Justicia, Santa Fe, NM 87508 Non-Emergency: 505-992-3070
Police Department	Santa Fe County Sheriff Department 35 Camino Justicia, Santa Fe, NM 87508 Non-Emergency: 505-428-3720
Ambulance	Santa Fe County Fire Department 35 Camino Justicia, Santa Fe, NM 87508 Non-Emergency: 505-992-3070
Medivac (medical air transport)	Air Methods, Care Flight 121 Aviation Drive Santa Fe, NM 87507
Level I Trauma Center Medical Care & Work Injuries:	**Local Hospital** Presbyterian Santa Fe Medical Center 4801 Beckner Rd, Santa Fe, NM 87507 505-772-1234 **Regional Medical Center** St. Vincent Regional Medical Center 455 St Michaels Dr, Santa Fe, NM 87505 505-913-3361
Site Subject Matter Expert	TBD

Table 1 – Rancho Viejo Emergency Contacts

3.2 Remote Monitoring

Remote monitoring is provided by AES Clean Energy (AESCE) and the Salt Lake City UT ROC, Remote Operation Center. Contact via +1 855-679-3553, or Saltlake.rocc@aes.com.

4. Solar & Battery Energy Storage System (BESS)

4.1 Rancho Viejo Site Overview

The Rancho Viejo site is comprised of ~680 acres. This area contains BESS Containers, Solar, and other associated critical equipment. The combined rating of the site is 96 MWAC PV Solar, and 48 MWAC BESS.

AES Clean Energy Development is developing a 96 MWAC Solar PV and 48 MWAC Battery Storage System (BESS) project in Santa Fe, NM.

The project is expected to achieve Commercial Operation by 12-31-2028. Rancho Viejo Solar project will connect to substation where the output will be collected and stepped up from 34.5 kV to 115kV.

Rancho Viejo Solar	Rancho Viejo BESS
• 96 MWAC Panel System • 205,712 Jinko Solar, JKM590N-72HL4-BDV Solar Modules • ATI Tracker, Dura Track HZ V3 • 104 1Px78 Trackers • 1900 1Px104 Trackers • 26 Modules in Series • 7912 Strings	• 48 MWAC 4-hour BESS • 38 CEN Enclosure Units • Batteries: SAMSUNG SDI-E5S • Deflagration Wall Panels • Novec 1230 Suppression • Smoke, Heat, & Gas Detection • F-Stops

Table 2 - Equipment Quick View

4.1.1 Rancho Viejo Solar & BESS Details

Rancho Viejo Solar is a project with 96 MWAC of photovoltaic (PV) system that is ac-coupled with a 48 MWAC 4-hour of Battery Storage System (BESS). The PV part of Rancho Viejo will have 25 SMA Sunny Central 4400 UP-US Inverters each sized 4750 A at ~35℃ - ~60℃ at the inverter terminals.

The PV Solar Panels are manufactured by Jinko Solar. They are Mono Bifacial Half Cell type; model JKM590N-72HL4-BDV, with a 590W rating. There are a combined total of 205,712 panels at this site.

The Rancho Viejo BESS Facility is a system that comprises multiple lithium-ion battery modules in racks, which are located inside temperature-controlled enclosures. The modules within a rack are connected in series and multiple racks within a container are connected in parallel to a DC busbar. Multiple containers are connected in parallel to the DC side of inverters. The AC side of the inverters are connected to step-up transformers before being connected to the grid.

There are 38 CEN Containers containing an Emergency Shutdown (F-Stop), Fire/Smoke Detection Systems, Gas Detection, Deflagration Panels. One Container houses 216-240 battery modules with capacity to house up to 252, along with air conditioners and liquid cooling via chiller. The Batteries are Lithium ion- Samsung SDI-E5S Battery Modules.

Main System Components:

The Rancho Viejo Site contains:

- (38) CEN Solutions Containers.
    - 9.5-foot-wide x 40-foot-long x 8-foot-high Metal Shipping Type Container.
- (205,712) Jinko JKM590N-72HL4-BDV Solar Modules.
- (1) 34.5 kVA, 690 V / 2000 kVA, Aux Transformer.
- (19) GPTech 3MsWD3-V730, 3.607 MVA Rated / 1500VDC, Inverters (BESS)
- (19) 3210 MVA 34.5kV - 730V Oil based MVTs
- (25) SMA Sunny Central 4400 UP-US Inverters 4400 MVA Rated/ 1500 V DC, Air cooled Inverters. (Solar)
- (25) 4.400 MVA MV XMFR, 34.5kV - 645V, Oil based
- (7056) Lithium ion- Samsung SDI-E5S Battery Modules.

Fire & Safety Components:

Each BESS container is fitted with:

- Air Conditioners and Liquid Cooled Chillers

- Dehumidifier
- Interior lights
- Interior and exterior receptacles
- Deflagration panels
- NC 1230 (Novec) fire suppression
- Smoke detectors
- Horn/Strobe
- Manual fire extinguishing release controls mounted externally in weatherproof boxes.
- Gas detectors, monitoring carbon monoxide (CO) and hydrogen (H2).
- All fire/gas detection and suppression equipment is connected to a Simplex 4004r fire detection and release panel within each container.
- E-Stops

The BESS units are provided by CEN Solutions and comprise a standard 40-foot shipping container, modified to contain the 12 modules in each of the 20 strings within the structure.

The BESS containers are adequately separated by approximately 22 feet which meets FM-Data Sheet 33 - *LITHIUM-ION BATTERY ENERGY STORAGE SYSTEMS* separation requirements.

The Novec 1230 is an extinguishing agent, where discharge contains a colorless, nearly odorless, non-conductive, and fast-evaporating liquid that extinguishes the fire thanks to a cooling effect, reducing the flame's thermal power and interrupting the combustion reaction.

The fire suppression system(s) at the BESS containers are designed to suppress small fires within the ancillary equipment and there is no expectation that a thermal runaway type fire within the battery banks will be suppressed. Thermal runaway produces explosive gasses prior to ignition, and it is anticipated that early warning will be provided by the gas detection system within each container.

5. Hazards

Lithium-Ion Batteries (NFPA 855 Appendix B)

Rancho Viejo BESS uses Samsung SDI ESS Li-ion battery modules, utilizing Lithium Nickel Cobalt Aluminum Oxide (NCA) chemistry.

5.1 Fire Hazards

Normal Conditions

Fire hazard are present from potential electrical equipment failure and thermal runaway

Abnormal Conditions

Thermal runaway potential exists during abnormal conditions as well as increased risk for short circuiting.

Thermal runaway is one of the primary risks related to lithium-ion batteries. It is **a phenomenon in which the lithium-ion cell enters an uncontrollable, self-heating state**. Thermal runaway can result in: Ejection of gas, shrapnel, and/or particulates (violent cell venting) and extremely high temperatures.

Under abnormal conditions batteries may be subjective to the production of off gases to include, but not limited to Hydrogen, Hydrogen Fluoride, Hydrogen Chloride, Carbon Monoxide, Methane, Ethane & Ethylene gases which may result in smoke, fire, and/or explosion. **Due to various gases present (listed above) appropriate PPE, including SCBA, protective clothing should be worn.**

5.2 Electrical Hazards

Normal Conditions

A Battery Energy Storage site contains electrical equipment with voltage ratings up to 34.5kV or above. Arc flash labels are present on all devices where arc flashes may occur.

Arc flash labels are present on all devices where arc flashes may occur.

Battery equipment contains stranded or stored electrical energy during routine maintenance, even when disconnected. **Batteries can only be isolated by trained AES site personnel.**

Abnormal Conditions

Battery equipment contains stranded or stored electrical energy even when disconnected. **Batteries can only be isolated by trained AES personnel. Relocation or moving of equipment is hazardous and can result in serious injury unless performed by AES personnel. This includes operations associated with fire extinguishment overhaul.**

Power Disconnect- Container power can be isolated from the main breaker using the (F-STOP) button.

5.3 Physical Hazards

Normal Conditions

High Voltage Lines

Abnormal Conditions

Lithium-ion batteries may present fire and explosion hazards.

Containers with deflagration panels will direct explosion pressure to the sides.

Limited physical hazards associated battery trays.

6. Action Plan



1. ***Information in this section is to be reviewed alongside a NFPA 1660 (1620) compliant Pre-Incident Plan (PIP)***
2. ***The action plan describes the recommended personnel response during an emergency event based on its progression. The process flow illustrates the recommended actions as shown below:***

6.1 Pre-Incident Activities

Familiarization Tour – Fire department (FD) response is provided by Santa Fe County Fire Department, 35 Camino Justicia, Santa Fe, NM 87508. Site tours should be scheduled and completed annually.

The purpose of the tours are site and hazard identification and familiarization with review of the PIP and this guide. **At a minimum, the tours include, but not limited to:**

- Site overview and operation by AES (PPE requirements etc.)
- Hazard Familiarization (normal and abnormal conditions)
- Site review (points of entry, roadways, staging location, utilities, overhead hazards)
- Emergency Shut Down Location (AES Use Only)
- Means to monitor temperatures and LEL
- AES procedure for Entry
- FD policy and procedure for Utility Response
- Identification of Signage
- Validation of the latest Pre-Incident Plan revision shall be validated.

Emergency Response Notebook –The Fire departments shall be given a Response Notebook containing the BESS Pre-Incident Plan (PIP) and First Responder Mitigation Guidelines.

Emergency Indication – Upon indication of smoke, fire, Emergency Medical or HazMat incident the AES personnel will notify the fire department.

6.2 Incident Activities

Incident Notification – Upon notification of incident at, the Fire Department are recommended to respond with the appropriate emergency response.

Prior and During Response – The Fire Departments are recommended to review the Response Notebook for Emergency Response data pertinent to the BESS.

If a horn/strobe of a Container is alarming, wait 6 hours before approaching, with AES / Rancho Viejo Personnel approval and escort, then evaluate the affected equipment using Gas Detectors and Thermal Imaging Cameras. At that point, if there are any elevated heat or gas measurements, wait another 4 hours.

Staging – Upon arrival at the Rancho Viejo BESS site, The FD will stage at the main gate and await escort to the BESS. **DO NOT PROCEED WITHOUT ESCORT.**

Analyze the incident with AES personnel and identify the hazardous materials that could be present (See abnormal conditions in the hazard section).

- Are there any known personnel within the BESS area? Have all personnel been accounted for and documented?
- Identify from AES the nature of the incident. Seek firsthand discussion with persons identifying the incident if available.
- Has the Suppression System or Fire Detection System activated?
- Has visible smoke been detected?
- Is there Visible Fire?
- Survey the hazard/incident and predict likely behavior of the hazardous materials that could be present during abnormal conditions (see section 5).
    - Is there venting of off gases?
    - Are the utilities active?
    - Is there a potential for deflagration?
    - What are the Container temperatures and LEL measurements?

Initial Entry – **During an event (heat, smoke, or fire) there will be no entry, unless there is a rescue operation**. When approved for initial entry into the BESS; Utilize Self Contained Breathing Apparatus (SCBA), Gas detectors (i.e., Hydrogen, etc.), and Thermal Imaging Cameras; Ensure Personal Protective Equipment (PPE) worn protects against thermal, electrical and HazMat hazards. **Unless Rescue Operations Are Intended, Containers Fires Will Normally Result in Defensive Suppression Activities with Exposure Protection Priorities.**

> **NOTE: Stranded Energy Will Be Present, Even After BESS Power Has Been Disconnected "Batteries Are Still Energized."**

Battery Failure – Impending Battery Failure Signs include bulging and overheating, white smoke/fog & hissing; **Immediately Evacuate BESS Area (Should maintain minimum of 100 ft distance from the effected BESS**.

Suppression – If Management and fire department(s) decide to fight the fire to enable rescue operations, utilize Water Fog Pattern @ 10-degree angle @ 5-ft minimum distance AND DO NOT physically come in contact with the Batteries and Battery Frames. **Unless rescue operations are intended, containers fires will normally result in defensive suppression activities with exposure protection priorities.**

BESS Fire Protection System – The Battery Storage Containers are provided with a Novec 1230 gaseous fire suppression system.

Fire Extinguishers – Do NOT utilize Class D Fire Extinguishers.

FD Salvage and Overhaul Operations – Do NOT perform Salvage Operations (Stranded Energy, continues to exist).

7. Site Graphics

7.1 Site Access Point

NOTE: *To access the site please contact the Emergency Numbers noted in Section 3.1.*

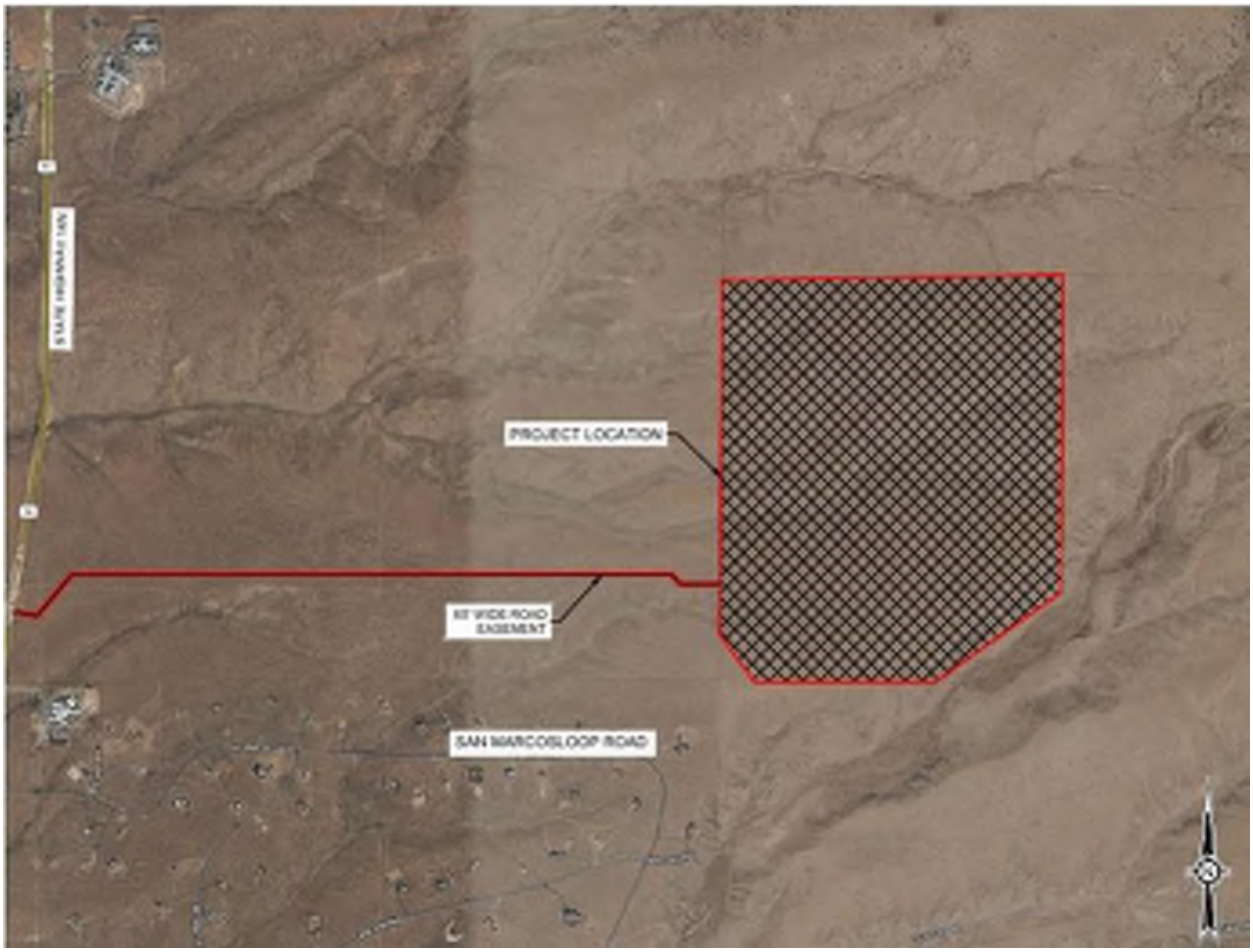


Figure 1 – Projected Site Access Point

7.2 Overview Drawing

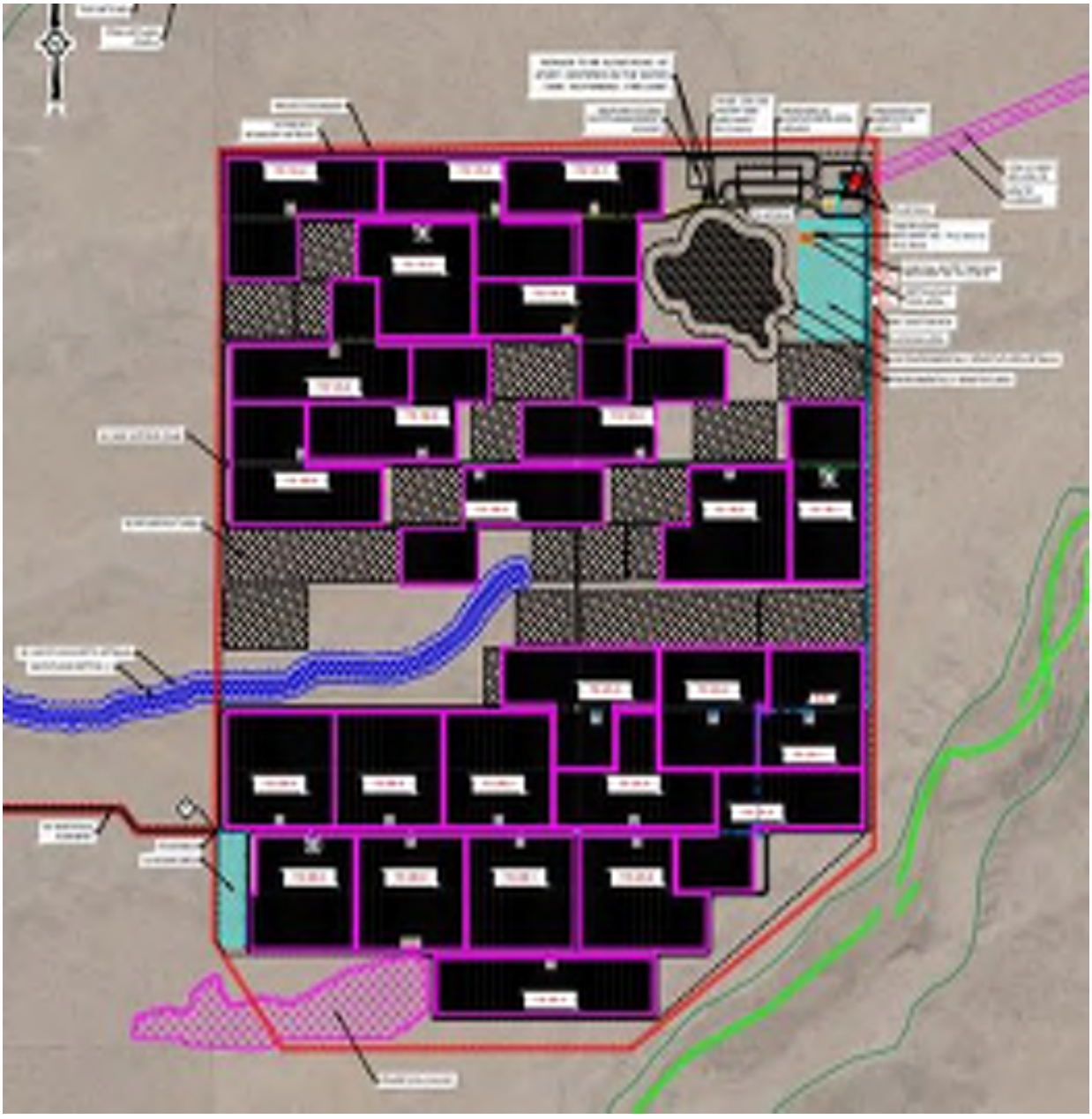


Figure 2 – Projected Site Aerial View

7.3 Fire Protection Features

TBD

Figure 3 – Projected Fire Alarm Panel (F) STOP

TBD

Figure 4 – Projected Fast Stop Button Closeup

TBD

Figure 5 – Projected FACP Interface

TBD

Figure 6 – Projected Smoke Detection

TBD

Figure 7 – Projected Novec 1230 Fire Suppression System

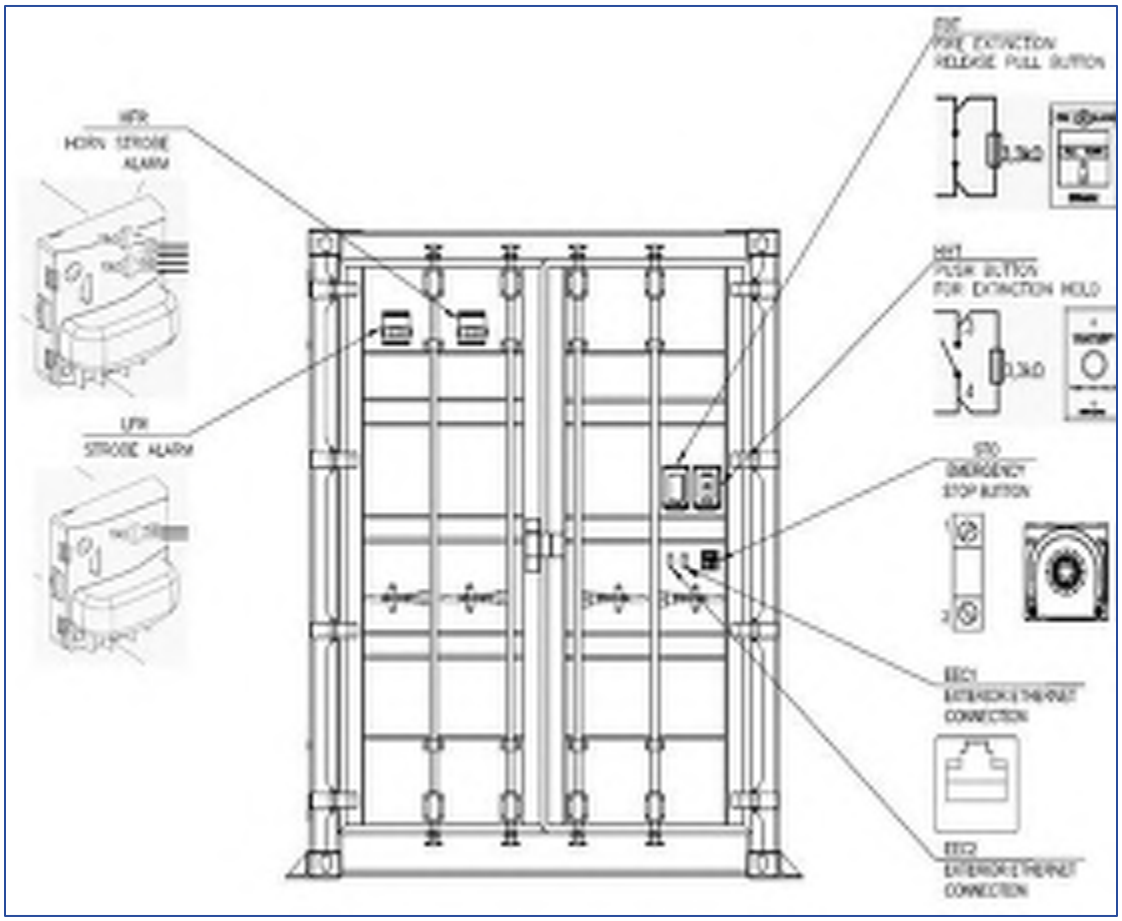


Figure 8 – Projected CEN Exterior Emergency Devices

8. Emergency Response Protocols

Summary of report of smoke or fire (also see Pre-Incident Plan)

Rancho Viejo solar project BESS fire and rescue response is provided by Santa Fe County Fire Department (SFCFD). SFCFD has both paid and volunteer firefighters/EMS personnel.

SFCFD has several stations throughout the county. The first response on report of smoke or fire is station # 60 located at 39 Rancho Viejo Blvd 5.7 miles/8 minutes with four personnel including one engine and a medic. Additionally, station # 61 located at 58 County Road 62, 10.9 miles/15 minutes will respond as requested. Three additional stations are within a twenty-minute response time as well as the City of Santa Fire Department if requested.

SFCFD does not have a HAZMAT team but utilizes the City of Santa Fe Fire Department 16 miles/24 minutes.

Santa Fe County Fire Department

1. Both paid and volunteer personnel

2. Additional equipment/personnel available on as needed basis from other SFFD stations.

3. All are State Certified FF1/FF11, EMT-B, AEMT, Paramedic, Wildland S-130/190.

4. SFCFD career units are paramedic level Advanced Life Support (ALS) response.

6. Air Ambulance, available through Air Methods Care flight 5, located at Santa Fe Regional Airport. 9 miles/14 minutes ETA.

7. The nearest Trauma Center to the facility is Presbyterian Medical Center located at 4801 Beckner Road. 6.6 miles/11 minutes

St Vincents Hospital located at 455 St Michaels Drive. 12.7 miles/17 minutes

POC: Bobby Montoya, Asst. Chief SFCFD

Email: bmontoya@santafecountynm.gov

NOTE: See Rancho Viejo Solar Project Pre-Incident Plan for additional information.

9. Appendix A

Battery Safety Data Sheet(s)

APPENDIX H

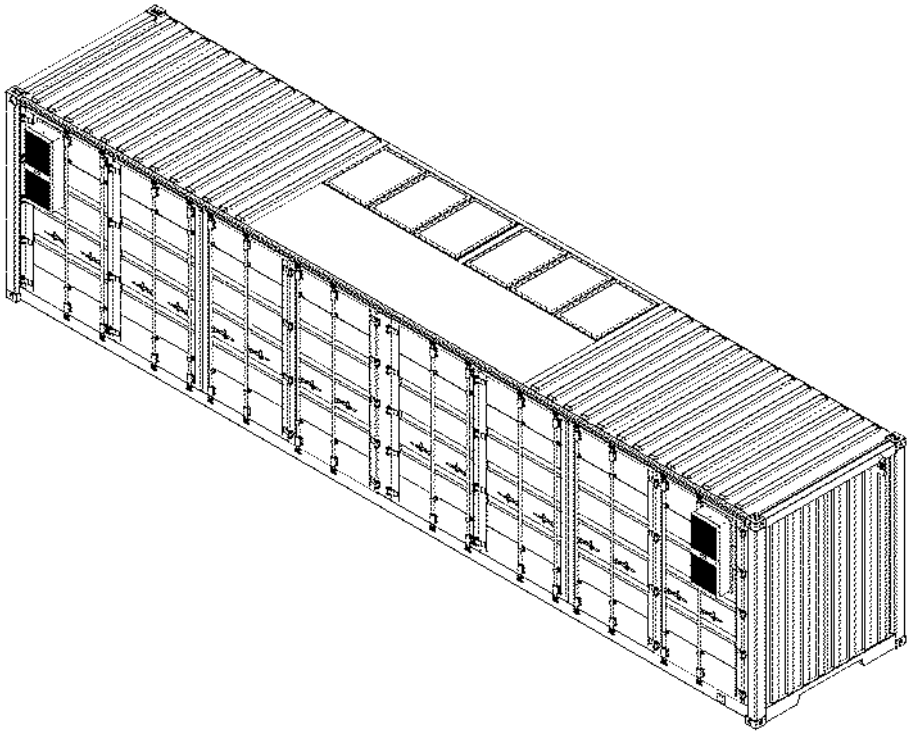
PRELIMINARY HAZARD MITIGATION ANALYSIS

COFFMAN ENGINEERS

Draft Preliminary HMA Report

Rancho Viejo Solar Utility BESS

August 13, 2024
Revision A



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Draft Preliminary HMA

Rancho Viejo

August 13, 2024
Revision A

Coffman Project Number: 241470

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Prepared by: Coffman Engineers, Inc.

Revision History		
Revision	**Date**	**Description of Revision**
A	7/24/2024	Preliminary HMA 1St Draft
A1	8/13/2024	Preliminary HMA Revised Draft

EXECUTIVE SUMMARY

This Hazardous Mitigation Analysis (HMA) evaluates the conformance of the AES Rancho Viejo Solar Utility Battery Energy Storage System (BESS) project site with respect to the HMA requirements of NFPA 855, *Standard for the Installation of Energy Storage Systems* and IFC, *International Fire Code*.

ANALYSIS FAILURE MODES

The failure modes considered in this analysis are based on the specific failure modes required to be evaluated when completing an HMA per the 2021 edition of IFC and the 2023 edition of NFPA 855. The failure modes analyzed are as follows and discussed further in Appendix A for how they directly correspond to the failure modes within the two codes:

1. A thermal runaway or mechanical failure in a single ESS unit.
2. Failure of an energy storage management system or protection system that is not covered by the product listing failure modes and effects analysis.
3. Failure of a required protection system including, but not limited to, ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, fire suppression, or gas detection.
4. Voltage surges on the primary electric supply.
5. Short circuits on the load side of the ESS.

ANALYSIS ACCEPTANCE CRITERIA

The acceptance criteria used in this analysis aligns to the HMA approval criteria listed in the 2021 edition of IFC and the 2023 edition of NFPA 855. The acceptance criteria applied in this analysis is described below and in further detail in Appendix A for how it directly corresponds to the criteria within the two codes:

1. Fires and products of combustion will not prevent occupants from evacuating to a safe location.
2. Deflagration hazards will be addressed by an explosion control or other system.

ANALYSIS APPROACH

This evaluation implements a bowtie methodology to holistically evaluate the CEN BESS enclosure against the identified acceptance criteria. This hazard model follows the guidance provided in NFPA 855 Section G.4. Bow tie modeling is a common hazard mitigation analysis tool used in the maritime, oil and gas, and utility industries. The strength of the bowtie approach comes from its visual nature, which evaluates the chronological pathways leading from threats to critical hazard events to consequences with the associated mitigative and preventative barriers in place to reduce or eliminate the said consequences.

ANALYSIS APPROVAL

Demonstration of conformance with the acceptance criteria is as described below:

1. Fires and products of combustion will not prevent occupants from evacuating to a safe location.

   The CEN enclosure features a sufficient quantity of safety barriers to limit the rate of propagation of an escalating fire or thermal runaway event and provide adequate situational awareness to facility occupant to permit evacuation to a safe location.

2. Deflagration hazards will be addressed by an explosion control or other system.

   This analysis has identified that a propagating cell failure event poses a deflagration hazard. The CEN enclosure will be equipped with a NFPA 68 compliant deflagration venting system to release

the combustion gases and pressure resulting from a deflagration within the enclosure so that structural and mechanical damage is minimized.

Conformance with acceptance criteria described above is intended to demonstrate compliance with the HMA requirements of NFPA 855 and the IFC.

MAJOR ANALYSIS ASSUMPTIONS AND LIMITATIONS

This hazard study documented in this report is subject to the following major assumptions and limitations:

- **Unknown Failure Modes** – Major BESS failures modes not known by industry at the time of this analysis and not otherwise considered in this report may exist.
- **Outside Event effecting more than one unit** – The compounding effect of failure modes affect more than one enclosure at a time is not directly considered.
- **Hazards during Construction, Shipping and Storage** – The hazards associated with the construction, off-site storage and shipping of the BESS enclosures are not evaluated.
- **Continued Maintenance** – All BESS systems are assumed to be inspected, tested and maintained to minimum standards.
- **Installed per code** – Protection systems inside the BESS enclosure and site wide protection systems are assumed to be installed and maintained per minimum regulatory requirements. Coffman is not scoped to verify code compliance within the BESS enclosure.

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ABBREVIATIONS AND ACRONYMS

AC	Alternating Current
AES	AES Clean Energy
AHJ	Authority Having Jurisdiction
BESS	Battery Energy Storage System
BCU	Battery Control Unit
BMS	Battery Management System
CID	Current Interrupt Device
DC	Direct Current
ESS	Energy Storage System
FACP	Fire Alarm Control Panel
FEMA	Failure Modes and Effects Analysis
HMA	Hazard Mitigation Analysis
HRR	Heat Release Rate
HVAC	Heating, Ventilation & Air Conditioning
IDLH	Immediately Dangerous to Life or Health
IFC	International Fire Code
IP	Ingress Protection
LFL	Lower Flammability Limit
NFPA	National Fire Protection Association
PLC	Programmable Logic Controller
ROCC	Remote Operations Control Center
SCADA	Site Supervisory Control and Data Acquisition
SME	Subject Matter Expert
SOC	State of Charge
SOH	State of Health
UPS	Un-interruptible Power Supply
VRLA	Valve-Regulated Lead Acid

1.0 INTRODUCTION

This Hazard Mitigation Report has been prepared by Coffman Engineers, Inc. (Coffman) to evaluate the conformance of the AES Rancho Viejo Solar Utility Battery Energy Storage System (BESS) project site against the Hazardous Mitigation Analysis (HMA) requirements of the National Fire Protection Association (NFPA) 855, *Standard for the Installation of Energy Storage Systems* (2023 edition), and the *International Fire Code* (2021 edition). This evaluation assesses the anticipated overall effectiveness of the provided protective barriers to prevent and mitigate the consequences of a battery related failure.

This analysis is based on conversations with AES Clean Energy (AES) personnel as well as the provided drawings and documents listed in the Referenced Documents section at the end of this report.

1.1 APPLICABLE CODES AND STANDARDS

This analysis evaluates the AES Rancho Viejo Solar Utility site against the requirements found in the codes and standards referenced below:

- *International Fire Code* (IFC), 2021 edition, as adopted by Sante Fe County Ordinance 2023-06
- *Sante Fe County Ordinance 2023-06 as adopted by the Board of County Commissioners*
- *Sante Fe County Ordinance 2023-09 as adopted by the Board of County Commissioners*
- *International Wildland Urban-Interface Code* (IWUIC), 2021 edition, as adopted by Sante Fe County
- NFPA 855, *Standard for the Installation of Energy Storage System*, 2023 edition
- NFPA 68, *Explosion Protection by Deflagration Venting*, 2013 edition
- NFPA 72, *National Fire Alarm and Signaling Code*, 2019 edition
- NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2018 edition
- UL 9540A, *Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems*, 4th Edition, November 12, 2019

1.2 OTHER REFERENCED CODES, STANDARDS AND RECOMMENDED PRACTICES

The following industry standards and recommended practices are referenced throughout this report in addition to the adopted codes and standards referenced above.

- ISO IEC 31010, *Risk Assessment Techniques*, 2019 edition

1.3 ANALYSIS GOALS AND OBJECTIVES

In accordance with NFPA 855 Section 9.4.1 and IFC Section 1207.5, an approved HMA is required to permit outdoor lithium-ion Energy Storage Systems (ESS) installations with a capacity exceeding 600 kWh. The objective of this HMA is to evaluate the consequences of the site-specific failure modes.

The single mode failure modes considered in this analysis are described in Table 1, below. The failure modes described in the table align to the single mode failure modes listed in the 2023 edition of NFPA 855 and the 2021 editions of the IFC. See Appendix A for a detailed description of how the selected failure modes correlate to specific IFC and NFPA 855 requirements.

Table 1: Analysis Failure Modes	
Failure Mode	**Failure Mode Description**
1	A thermal runaway or mechanical failure in a single ESS unit.
2	Failure of an energy storage management system or protection system that is not covered by the product listing failure modes and effects analysis (FMEA).
3	Failure of a required protection system including, but not limited to, ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, fire suppression, or gas detection.
4	Voltage surges on the primary electric supply.
5	Short circuits on the load side of the ESS.

The acceptance criteria applied in this analysis is described in Table 2. The acceptance criteria described in the table aligns to the HMA approval criteria listed in the 2023 edition of NFPA 855 and the 2021 edition of the IFC. See Appendix A for a detailed description of how the selected acceptance criteria correlate to specific IFC and NFPA 855 requirements.

Table 2: Analysis Acceptance Criteria	
Acceptance Criteria	**Acceptance Criteria Description**
1	Fires and products of combustion will not prevent occupants from evacuating to a safe location
2	Deflagration hazards will be addressed by an explosion control or other system

2.0 SITE DESCRIPTION

2.1 SITE INFORMATION

The AES-Rancho Viejo Solar Utility BESS project site is located in Santa Fe County, New Mexico. A site plan of the battery energy storage system layout is shown in **Figure 1**.

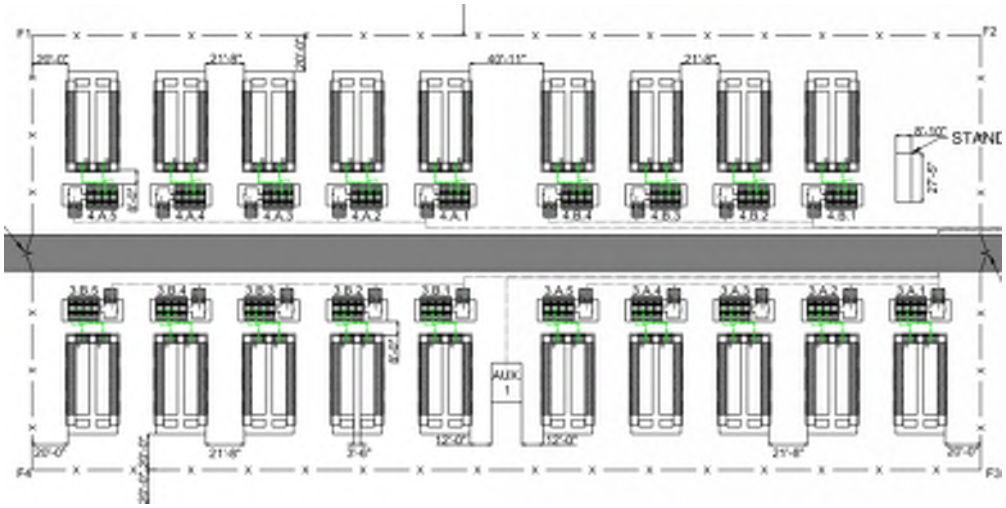


Figure 1 - Rancho Viejo BESS Site Plan

The site will include CEN enclosures manufactured by AES containing lithium-ion battery technology. The energy storage system proposed for this project is the Samsung SDI / E5S ESS. The details of the Rancho Viejo BESS facility are summarized in Table 3 below.

Table 3: CEN BESS System Specification Summary	
Owner:	AES
Overall BESS Capacity:	48 MW for 4 hours / 192 MWh
Number of BESS Enclosures:	38
Total Site Area:	2.94 Acres

2.2 FIRE DEPARTMENT ACCESS

Fire department roads will be provided on site to meet the spatial criteria of the IFC as noted below and shown in **Figure 2**:

- Unobstructed width of at least 20 feet
- Unobstructed vertical clearance of 13 feet 6 inches
- Dead ends more than 150 feet will be provided with an approved turn around area

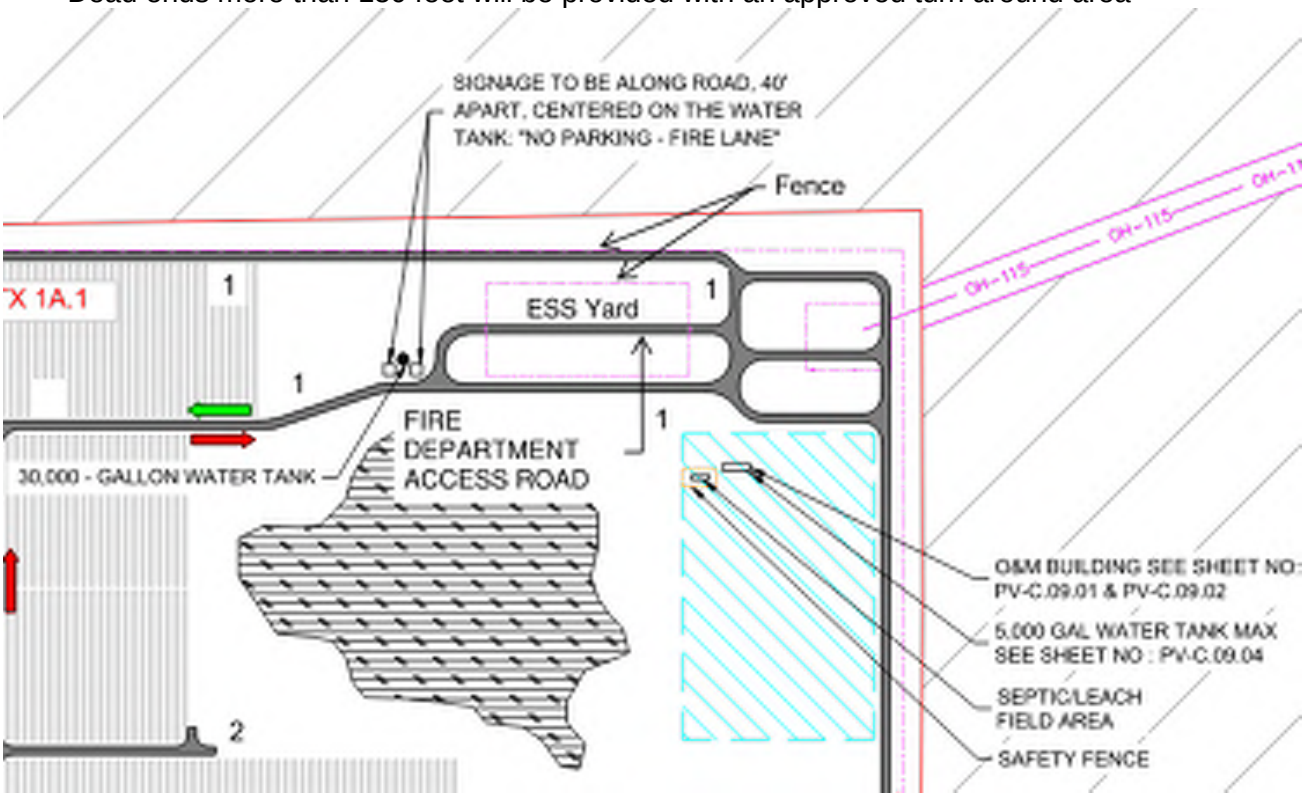


Figure 2 - Fire Department Features Site Map

2.3 LOCAL CLIMATE CONDITIONS

ASHREA data for the nearest airport at Albuquerque International shows a 1% extreme wind speed of 28.2 mph and 0.4% annual occurrence high temperature of 95.2º F. The overall site is relatively flat and does not pose additional risks.

3.0 ENERGY SYSTEM DESCRIPTION

The CEN enclosure is an 8,068 kWh lithium-ion BESS. The CEN enclosure utilizes lithium-ion cells manufactured by Samsung featuring lithium nickel cobalt aluminum oxide chemistry. The CEN enclosure is a non-walk-in style ground mounted outdoor BESS enclosure. Primary equipment included within the enclosure includes lithium-ion battery modules, DC disconnect switch, control and communications

panel, AC/DC electrical panel, dehumidifiers, chilled water-cooling lines, and a fire suppression system. An image of the CEN enclosure is shown in Figure 3 – CEN BESS Enclosure (Exterior View)and Figure 4, below. The CEN enclosure specifications are summarized in Table 4.

Table 4: E5S BESS System Specification Summary			
ESS System Manufacturer:		AES	
ESS Model #:		AES Spec CEN-E5S	
ESS Electrical Ratings:		8,068 kWh	
ESS Max Voltage:		1494 Vdc	
ESS Enclosure Dimensions:		40’-0” (L) x 8’-0” (W) x 9’-6” (H)	
ESS Layout / Construction:		Non-Occupiable, Non-Walk-in, Non-Combustible 252 Modules per enclosure	
Cell		**Module**	
Manufacturer:	Samsung SDI CO LTD	Manufacturer:	Samsung SDI CO LTD
Model No:	CP1495L101A	Model No:	E5S (MS3204L101A)
Electrical Rating:	3.68 Vdc, 145 Ah	Electrical Rating:	110.4 Vdc, 290 Ah
Chemistry:	$LiNiCoALO_2$	Cells per Module:	60
Format:	Prismatic	Module Dimensions:	388 x 1751 x 155 mm

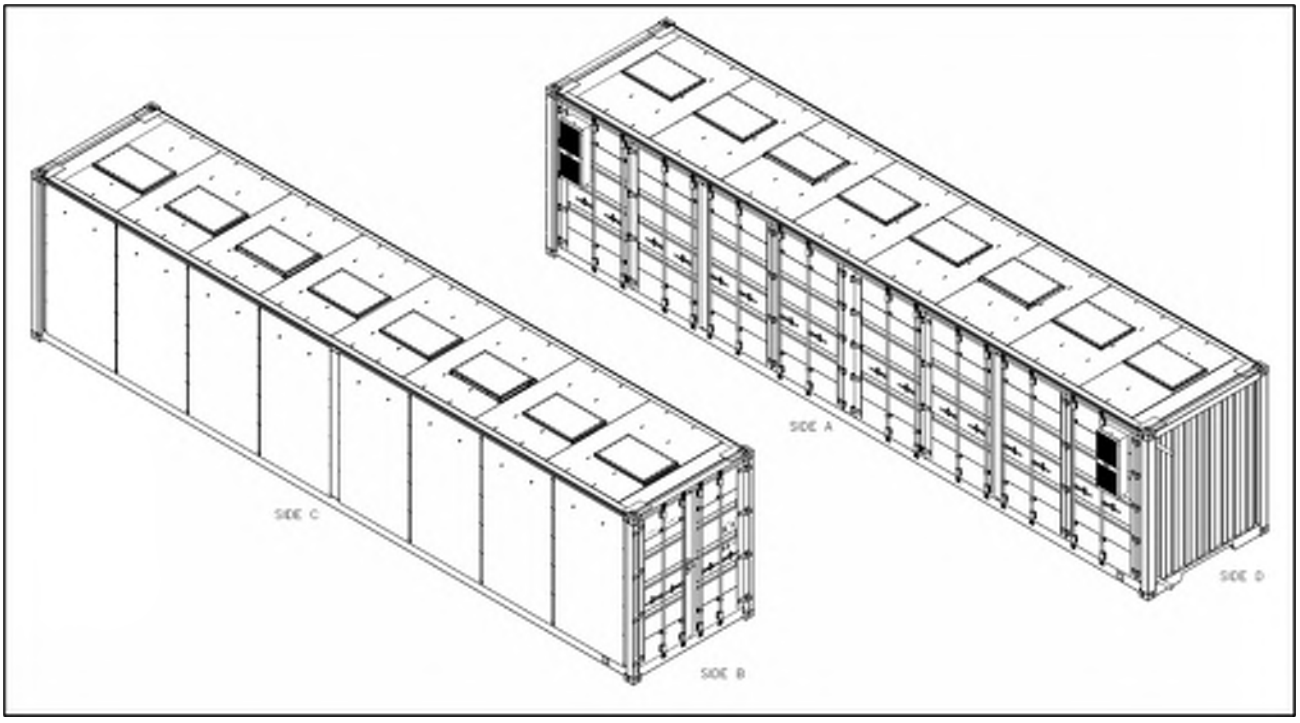


Figure 3 – CEN BESS Enclosure (Exterior View)

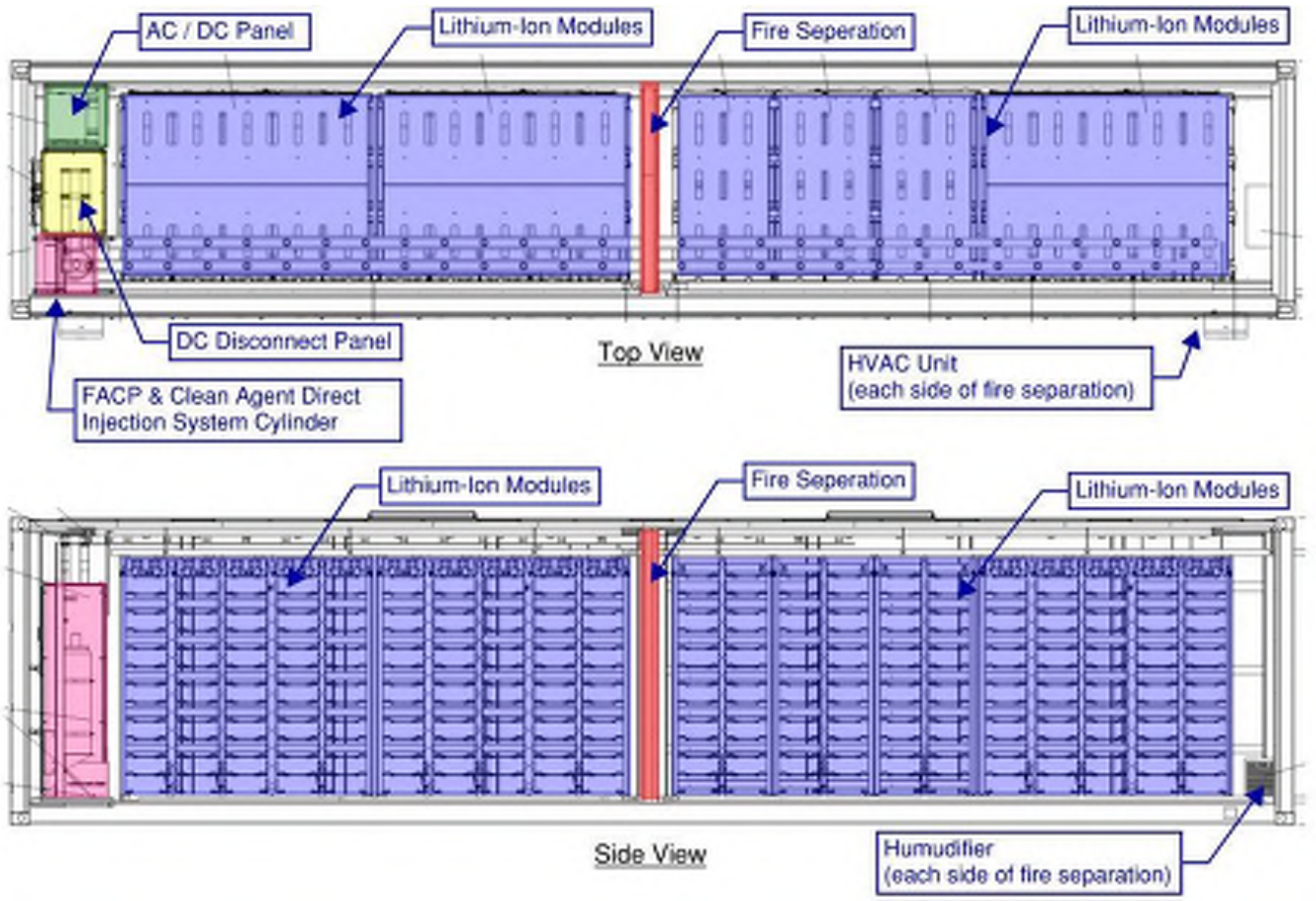


Figure 4 – CEN BESS Enclosure (Internal View)

3.1 ESS ENCLOSURE AND EQUIPMENT DESCRIPTION

The CEN enclosure consists of a 40’-0” long x 8’-0” wide x 9’-6” high, IP 55 rated, ISO container (See Figure 3). The enclosure features openable doors three sides. Deflagration panels are provided on the enclosure roof. The enclosure is subdivided by a fire separation constructed utilizing a metal faced mineral wool panel. The ceiling, wall and door panels are equipped with an FM Global approved Class 1 insulation material.

The enclosure contains 252 lithium-ion battery modules, each containing 60 cells. The modules are located on racks as shown in Figure 4. Each battery rack includes 12 battery modules and a battery control unit (BCU). The BCU contains the battery management system (BMS), contactor and fuse for the respective battery rack.

A DC disconnect switch panel containing the main DC fuses and disconnect switch is located on side B of the enclosure (See Figure 4). Also located on side B of the enclosure is an AC/DC electrical panel and an 1800 W un-interruptible power supply (UPS). The UPS is equipped with valve-regulated lead acid (VRLA) batteries. The fire alarm control panel (FACP) and fire suppression tank are also located in this area.

The enclosure is provided with humidifier and externally mounted HVAC units. Heating within the enclosure is provided by electric resistance heating. Cooling to the battery modules is provided by a liquid cooling system connected to a remote external chiller. The cooling system utilizes a 50/50 ethylene glycol mixture. No flammable refrigerants will be used within the enclosure.

3.2 FIRE AND THERMAL RUNAWAY SAFETY FEATURES

The CEN enclosure will include the following fire and thermal runaway features.

3.2.1 Battery Management System

The CEN enclosure includes an integrated BMS. The BMS system monitors state of charge (SOC), rate of charge/discharge, state of health (SOH), voltage and temperature. The BMS is capable of disconnecting individual battery racks when faults are detected. BMS data is communicated via a programmable logic controller (PLC) and site supervisory control and data acquisition (SCADA) system to an off-site Remote Operations Control Center (ROCC).

3.2.2 Deflagration Protection System

The CEN enclosure is equipped with six roof mounted deflagration panels to provide pressure relief from overpressure events related to the ignition of flammable gases released during lithium-ion thermal runaway. The deflagration protection system has been designed in accordance with the 2023 edition of NFPA 68.

3.2.3 Smoke Detection

A smoke detection system is provided in the enclosure. A photoelectric smoke detector is provided at the roof level of the enclosure above each battery rack. Enclosure smoke detectors are monitored by the enclosure FACP. Alarm signals are communicated to the ROCC via the site SCADA system as well as communicated directly to the site FACP.

3.2.4 Gas Detection

The enclosure is provided with carbon monoxide and lower explosive limit (LEL) flammable gas detection. LEL gas detection is accomplished utilizing catalytic bead detectors which are sensitive to both hydrogen and hydrocarbon gases. Alarm signals are communicated to the ROCC via the site SCADA system as well as communicated directly to the site FACP.

3.2.5 Facility Occupant Notification

A combination horn/strobe is located on the exterior of each CEN enclosure for notifying nearby facility occupants of a hazardous condition within the enclosure. Activation of the notification device occurs upon detection of a low gas level, activation of a single smoke detector or discharge of the thermal runaway propagation suppression system.

3.2.6 Thermal Runaway Propagation Suppression System

A direct injection clean agent system is provided to limit propagation of a thermal runaway event. The system utilizes Novec 1230 (FK 5-1-12) clean agent. The system includes a pressurized storage cylinder and piping network to discharge agent directly above each cell vent area. The system is intended to cool a thermal runaway event, extinguish flames generated by an exothermic reaction, and limit propagation to adjacent cells by keeping cell surfaces below critical onset temperatures. The direct injection system is configured to be released by the FACP upon activation of two or more smoke detectors or activation of the manual pull releasing station located on the exterior of the enclosure. The effectiveness of the direct injection system was evaluated as a part of the installation level UL9540a test discussed in Section 4.0.

3.2.7 Electrical Fault Protection

Each module is equipped with a fusible link. Fuses are present on both the positive and negative terminals of each battery rack. Additionally, fuses are provided for each enclosure DC connection.

3.2.8 Emergency Stop

Final details to include details of how e-stop will be accomplished will be provided in final HMA report.

3.2.9 Site Specific Protections

The following features related to the project site provide additional protection:

3.2.9.1 Facility Layout

As shown in **Figure 5** below, the CEN enclosures are grouped in side-by-side pairs with 3.5 feet of space between each enclosure. Each pair is then spaced 29.67 feet from the next pair in groups totaling 5 pairs (10 CEN enclosures) with the exception of the top right group which includes only 4 pairs (8 CEN enclosures). The site consists of 4 total groups of enclosures separated by a minimum of 48 feet of space between them. If a fire evolves to the point it spreads beyond an enclosure, it is highly likely the pair will become involved. It is recommended that defensive firefighting be provided to mitigate further spread to adjacent pairs of enclosures. The additional separation between the pairs and the groups of enclosures helps to mitigate the potential for fire to spread throughout the site.

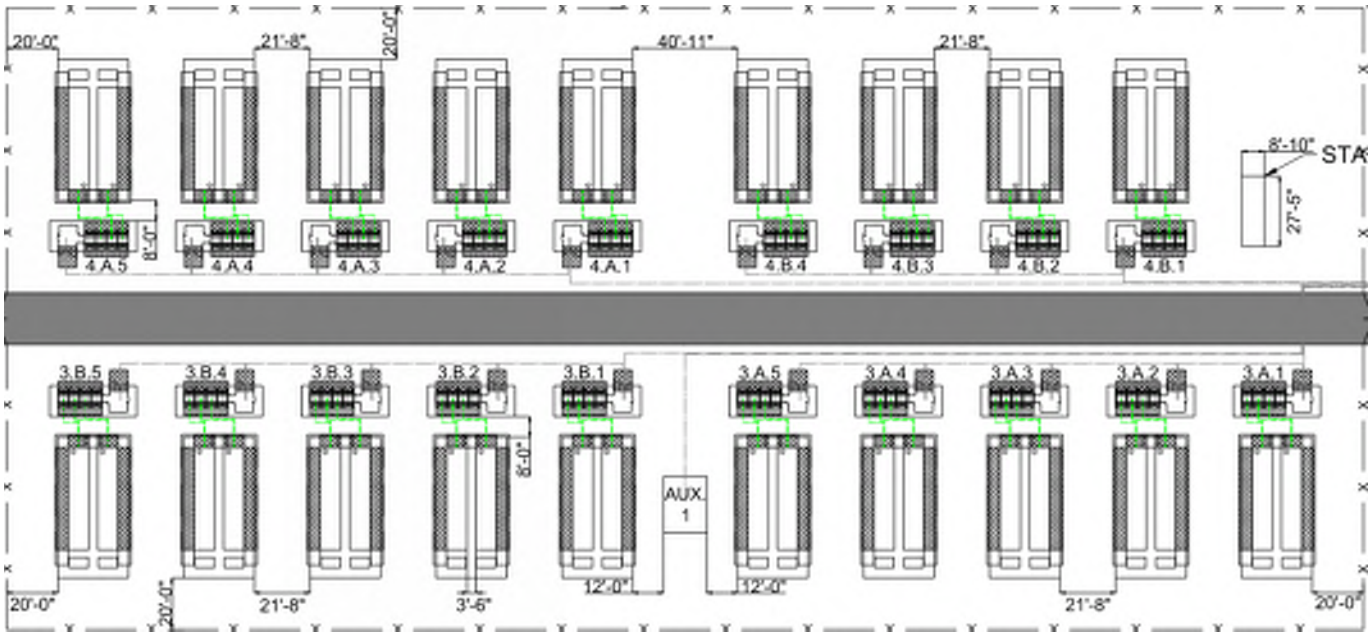


Figure 5 - E5N Enclosure Spacing

3.2.9.2 Vegetation Control

There will be a minimum 10-foot clearance between each side of the outdoor BESS units and combustible vegetation and other combustible growth as required by NFPA 855 section 9.5.2.2.

In accordance with 2021 IWUIC and Sante Fe County Ordinance 2023-06, a defensible space of 30 feet is required around the BESS enclosure structures given a moderate hazard classification as determined using the Santa Fe County Community Wildfire Protection Plan map. This may require modifications to the surrounding fuels such as vegetation to maintain the space in accordance with the requirements of IWUI Section 603. This will limit the potential for wildfires from surrounding areas to affect the BESS enclosures and vice versa. Additional defensible space can be provided around the BESS yard for additional protection beyond the code requirements.

3.2.9.3 Fire Water

The water supply at the Rancho Viejo site will be provided by a NFPA 1142 code compliant ground level water storage tank. The water tank will be provided with a water level gauge. The tank will be located west of the BESS field as shown in Figure 2. The water storage tank will be provided with a fire hose connection for fire department use; however, the site will not have any fire hydrants on the public water system. The water tank will have a 29,093-gallon nominal capacity.

The water supply is intended to provide fire flow to protect the energy storage system from incidental fire exposure from a non-energy storage system source or for defensive cooling of nearby equipment from an energy storage system related fire event. See below for three different fire scenarios analyzed to determine the appropriate water tank size to provide an adequate supply for emergency responders.

Fire Scenario #1 – Power Conversion System (PCS) Fire Incident

In this scenario, it is proposed that a fire is developing from a single PCS. It is assumed a PCS fire will require the same water supply as a transformer fire. FM Global DS 5-4, section 2.3.2.3 suggests a 1-hour hose stream flowing at 250 gpm for transformers holding FM approved liquids or up to 1,000 gallons of mineral oil. See below for the recommended fire water storage required for a PCS fire.

250 gpm x 60 minutes = 15,000 gallons of fire water

Fire Scenario #2 – Exposure Fire Incident

In an exposure fire incident, it is expected that a fire is emanating from a car or non-PCS equipment. In this scenario, two (2) handlines flowing at 200 gpm for 1-hour will have the capability to suppress a large exposure fire. See below for the recommended fire water storage required for an exposure fire:

200 gpm x 2 handlines x 60 minutes = 24,000 gallons of fire water

Fire Scenario #3 – BESS Fire Incident

In this scenario, it is proposed a fire originates from an BESS enclosure. The water volumes calculated above could assist emergency responders in intermittently cooling nearby exposures, control smoke, or extinguish small vegetation fires. For example, 24,000 gallons of fire water could intermittently (50% of the time) provide one (1) handline flowing at 200 gpm for 4-hours to cool nearby exposures. Alternately, if a fog nozzle is utilized, 24,000 gallons of fire water could provide two (2) handlines flowing 100 gpm intermittently (50% of the time) for a duration of 4-hours.

3.2.9.4 Site-Wide Fire Alarm System

While each individual CEN enclosure is installed with a FACP to monitor the local conditions and activate the internal suppression system, the site will also be provided with a site-wide fire alarm system and FACP capable of monitoring and reporting signals from each enclosure. The site-wide fire alarm system will be designed in accordance with NFPA 72 and will be capable of notifying the fire department during a fire event at an enclosure so that a response can be initiated. The fire alarm system will also be capable of notifying occupants within the BESS yard to alert them of a potential hazard.

3.2.9.5 Fire Department Response

The fire department will be automatically notified of an event at the project site via the FACP to assist in reducing the overall response time.

4.0 FIRE TESTING REVIEW

Full-scale fire testing provides a basis for the evaluation of thermal runaway fire propagation and the effectiveness of the fire protection strategy in mitigating potential harmful conditions arising from a thermal runaway event.

4.1 UL9540A TESTING

The CEN BESS system has been subject to testing utilizing the methods of UL 9540A at the cell, module, unit and installation levels. The UL 9540A test results are summarized below. Refer to the UL 9540A Cell, Module and Unit level test reports for detailed information. Full UL 9540A test reports are provided for review in Appendix F.

- **Cell Level Testing** – Cell level testing indicates that [redacted] of gas may be released per cell when thermal runaway occurs. Testing indicates that the gas is primarily composed of [redacted] with a LFL of [redacted] at ambient temperature. Refer to the *UL 9540A Cell Level Report* for detailed gas composition data. The average cell surface temperature at thermal runaway was [redacted]. The cell vent gas fundamental burning velocity, S_u, was determined to be [redacted] with a maximum pressure, P_{max}, of [redacted].

- **Module Level Testing** – Module level testing demonstrated that thermal runaway initiation of a single cell is capable of propagation throughout a majority of the cells within the module. The testing resulted in flaming combustion, flying debris, explosive discharge of gas and sparks or electrical arcs. A peak heat release rate (HRR) of [redacted] was achieved during testing.

- **Unit Level Testing** – Unit level testing did not result in propagation of a thermal runaway event from the failure of a single cell. External flaming combustion was observed with a peak HRR of [redacted]. Release of flammable gas with an associated explosion was not observed. The maximum enclosure wall surface temperature observed was [redacted].

- **Installation Level Testing** – The installation level test is intended to collect information regarding the performance of the ESS's fire protection features. The installation level test included the operation of the direct injection clean agent cooling system. The installation level test did not result in propagation of a thermal runaway event from the failure of a single cell. No flaming or flying debris was observed outside of the enclosure. The maximum enclosure wall surface temperature observed was [redacted].

4.2 BESPOKE FIRE AND DEFLAGRATION TESTING

Bespoke Fire and Deflagration testing was conducted for this project. Test results are being processed and updates will be provided in the final version of the HMA report. The results will be evaluated and compared to local ambient conditions.

5.0 FIRE SAFETY ANALYSIS

This fire safety analysis is intended to provide a record of the decision-making process in determining the fire prevention, fire protection and explosion prevention measures for the identified hazards associated with the CEN BESS enclosure.

5.1 ANALYSIS METHODOLOGY

This analysis implements a bowtie methodology to holistically evaluate the CEN BESS enclosure against the analysis acceptance criteria identified in Table 2. The bowtie hazard assessment model developed in this analysis is described in ISO IEC 31010 Section B.21 and NFPA 855 Section G.4.

Bow tie modeling is a common hazard mitigation analysis tool used in the maritime, oil and gas, and utility industries. The strength of the bowtie approach comes from its visual nature, which evaluates the chronological pathways leading from threats to critical hazard events to consequences with the associated mitigative and preventative barriers in place to reduce or eliminate the said consequences. In this analysis, many of these threats parallel the hazards addressed by the fire code, such as unexpected thermal runaway.

As all threats and consequences tie into a single hazard event, the shape of the model resembles a bow tie. The length of the pathway on either side is dependent on the number of barriers that exist to prevent that threat from reaching the hazard event or the hazard event from devolving into the full consequence.

When assessed, the strength of each barrier is assessed in a qualitative manner. Barrier strength may vary depending upon the nature and stage of failure being assessed.

Refer to Appendix B for a full general description of the Bowtie methodology.

5.2 BOW TIE MODEL DEVELOPMENT

The bow tie model described in this section was used to evaluate the failure modes found in Table 1 against the noted analysis acceptance criteria found in Table 2.

5.2.1 Hazard and Top Event

The primary hazard of concern in this analysis is the considerable amount of energy contained with the BESS enclosure.

The top event is the moment when control over the hazard or its containment is lost. The central hazard event used in this analysis is defined as a single cell failure which begins to propagate through the system. This propagation may occur as the initiation of thermal runaway in adjacent cells or damage to adjacent equipment inside or outside the enclosure, or harm to personnel.

5.2.2 Threats and Preventative Barriers

The threats are arranged into four separate categories (primarily for presentation purposes), these include, threats resulting from thermal runaway or mechanical failure events, control and prevention system failure events, external impact failure events and electrical failures.

Table 5 and Table 6, below provides a brief summary of the threats and associated preventative barriers considered in this analysis. See Appendix C for a detailed review of each threat and preventative barrier. The resulting bow tie diagrams can be found in Appendix E. An assessment of the general strength of each individual barrier is also provided. While a general assessment is provided, the criticality and effectiveness of the barriers may vary based on the associated threat pathway.

Table 5: Threat Summary		
Threat	**Threat Description**	**Threat Category**
Single-Cell Thermal Runaway	A single cell has entered thermal runaway resulting in flames and combustion or production of flammable gases.	Thermal Runaway & Mechanical Failure
Multi-Cell Thermal Runaway	Multiple cells have entered thermal runaway.	Thermal Runaway & Mechanical Failure
Internal Defect / Failure (No Thermal Runaway)	A cell has failed as a result of an internal defect, creating a short circuit, open circuit, or other electrical condition or off-gas but not entering thermal runaway.	Thermal Runaway & Mechanical Failure
Hazardous Temperature Condition (Cell)	High temperature at the cell level during normal operations without thermal runaway.	Thermal Runaway & Mechanical Failure
Hazardous Temperature Condition (Module)	High temperature in the module during normal operation without failure / thermal runaway.	Thermal Runaway & Mechanical Failure
Hazardous Temperature Condition (Enclosure)	High temperature in the room or enclosure during normal operations	Thermal Runaway & Mechanical Failure
Electrical Hotspot / Loose Connection	Loose connections in the system may increase resistance and cause hotspots. Hotspots may form in other ways for unknown reasons. These hotspots will then conduct via bus bars or mechanical contact into cells.	Thermal Runaway & Mechanical Failure
Impact	Something has struck, sharply or as blunt force, the battery system, causing mechanical damage or deformation.	External Impact Failures
Water Damage (Flooding)	The system is flooded with water as a result of cooling system failure.	External Impact Failures
Water Damage (Condensation)	The system is subject to uncontrolled condensation of water via dehumidifier failure, internal condensation of moisture, or from natural reasons.	External Impact Failures
External Fire Impingement	An external fire that is impinging on the system from outside the containment.	External Impact Failures
Dust / Dirt / Particulate Accumulation	Accumulation of dust, dirt, or particulate that results in an adverse condition inside the system.	External Impact Failures
Human Factors	An adverse condition caused by the result of human interaction, error, or imperfection.	External Impact Failures
Module Cooling or HVAC System Failure	Mechanical or electrical failure of the module cooling or enclosure HVAC system resulting in high temperatures throughout system.	Control & Prevention System Failure
Sensor Failure	A sensor inside the system fails, resulting in incorrect reporting of system properties.	Control & Prevention System Failure
BMS Failure	Cell / module level monitoring and control fails, resulting in inability to shut down, report adverse conditions, properly monitor, balance, or protect the system resulting in an adverse condition.	Control & Prevention System Failure
Enclosure PLC Failure	Failure of the enclosure PLC controller resulting in adverse condition to the system or inability to detect or protect against adverse conditions under its purview.	Control & Prevention System Failure

Table 5: Threat Summary		
Threat	**Threat Description**	**Threat Category**
Site Control / Balance of Plant / PLC Failure	Failure of the master site controller or other balance of system controller resulting in adverse condition to the system or inability to detect or protect against adverse conditions under their purview.	Control & Prevention System Failure
Shutdown / Isolation Failure	Failure of the system to shut down or isolate itself when an adverse condition is detected.	Control & Prevention System Failure
Hazardous Voltage Condition	This could include high line voltages, floating ground issues, or other high voltage issues at the cell, module, or rack level.	Electrical Failure
Ground Fault / Isolation Fault	This could include localized shorting of cells, shorting between modules, shorting of entire racks or systems and ground fault shorting.	Electrical Failure

Table 6: Preventative Barrier Summary	
Barrier	**Preventative Barrier Description**
Passive Module Protections	Module fuses which may open the circuit in the case of failure as well as the general resilience of design to withstand adverse electrical conditions.
Liquid Cooling System	The liquid cooling system is an active cell protection which may prevent thermal runaway propagation.
Enclosure Dehumidification System	The enclosure's dehumidification system acts to prevent the buildup of condensation that may pose a short circuit hazard.
Direct Injection Clean Agent System	The direct injection clean agent system is an active cell protection which may prevent thermal runaway propagation.
Cell Thermal Abuse Tolerance	Ability of the cells to withstand thermal abuse without going into failure themselves.
Cell Quality Control	Overall quality of the cell such that internal defects are minimized, and cells maintain rigidity and shape during operations. Also includes tight tolerances with respect to degradation and new capacity.
BMS Control	Includes monitoring and shutdown/isolation capabilities of the affected BMS / module or system.
Temperature Monitoring and Alarms	Thermal monitoring within the enclosure.
System Shutdown / Disconnect	Ability of system to actively shut itself down or disconnect itself. This is the aggregate of the BMS ability as well as physical disconnects and the Balance of System controller's ability to shut down.
Preventative Maintenance and Commissioning	Proper maintenance and monitoring of the system in conjunction with adequate commissioning and site acceptance testing to reduce likelihood of loose connections or other transportation- or construction-related defects.
Passive Circuit Protection and Design	Breakers and fuses which may open the circuit in the case of failure as well as general resilience of design to withstand adverse electrical conditions.
Cell Electrical Abuse Tolerance	Ability of the cell to withstand electrical abuse such as overcharge, over discharge, high currents, or other adverse electrical abuse.
Redundant Failure Detection / System Intelligence	The ability of the system to determine a sensor has failed, to operate safely without that sensor to shut down, or operate safely indefinitely without sensor. This may include Checksums, additional sensors, or the ability to pull data from other sensors.

Table 6: Preventative Barrier Summary	
Barrier	**Preventative Barrier Description**
Human Factors / Process Control	Quality control or other processes put in place to prevent mishandling of systems that may result in adverse or hazardous conditions or mishandling.
Enclosure / Structural Resiliency	Resiliency of the system and enclosure of the system to withstand impacts or strikes.
Module Resiliency	Resiliency of the individual modules to withstand impacts, shocks, or other mechanical abuse.
Cell Physical Abuse Tolerance	Ability of the cell to withstand thermal, physical, or mechanical abuse.
Humidity Monitoring	Monitoring within the enclosure which may detect high humidity, water condensation or water leakage.
System Maintenance	Proper preventative maintenance to minimize the impact of adverse, long term or slow acting environmental effects resulting in degradation.
SME Training	Proper training procedures, availability of subject matter expertise and system competence, and clear jurisdictional hierarchy for managing situations.
Voltage Monitoring	Overall effectiveness of the voltage monitoring scheme of the system. Includes resilience to errors, error checking, and other measurement intelligence.
Insulation Monitoring	Continual, or active, monitoring of insulation integrity, ground versus float voltage, and other practices to prevent insulation or isolation degradation.

5.2.3 Consequences and Mitigative Barriers

Table 7 and Table 8, below provides a brief summary of the consequences and associated mitigative barriers considered in this analysis. See Appendix D for a detailed review of each consequence and mitigative barrier. The resulting bow tie diagrams can be found in Appendix E. An assessment of the general strength of each individual barrier is also provided. While a general assessment is provided, the criticality and effectiveness of the barriers may vary based on the associated consequence pathway.

Table 7: Consequence Summary	
Consequence	**Consequence Description**
Cell / Module Combustion	A battery cell or module has failed and is now producing flame or combusting.
Multi-Module / Rack Fire	Multiple modules have begun producing flame or combusting.
Fire Spread Beyond Enclosure Fire Partition	A fire within the system has spread from one side of the enclosure fire separation to the modules/rack and equipment on the opposite side within the same enclosure.
Fire Spread Beyond Enclosure	A fire within the system has spread beyond the enclosure to adjacent BESS enclosures or other structures.
Cell Off-Gassing / Explosions	A cell or multiple cells have failed or entered thermal runaway and is now producing off-gas.
Accumulation of Off-Gasses / Delayed Explosions	A cell or multiple cell failure which may or may not have propagated has resulted in the accumulation of potentially explosive off-gas within the enclosure.
Balance of System Fire	A fire that either is initiated in or results in the involvement of a balance of system fire such as wire insulation, electrical components, or plastic inside the system.
Environmental / HAZMAT Issues	A large-scale system fire has resulted in an environmental or hazardous material incident which requires hazardous material response.

Table 8: Mitigative Barrier Summary	
Barrier	**Mitigative Barrier Description**
Enclosure Smoke Detection	Activation of the enclosure's smoke detection system and communication via the FACP. System activation provides both situational awareness to facility operators, personnel in the vicinity of the enclosure, and first responders as well as activation of the enclosure's direct injection clean agent system.
Enclosure Gas Detection System	Activation of the enclosure's gas detection system and communication of alarm signal to the SCADA system. System activation provides situational awareness to facility operators, personnel in the vicinity of the enclosure and first responders.
Occupant Notification	Activation of the alarm notification device on the exterior of the enclosure and activation of the facility's site wide alarm system if provided.
BMS Data Availability	Includes BMS measurements available to first responders, Facility Operations Center or other SMEs. Effectiveness based on what is detected and how well, how this information is being conveyed, and robustness of sensors in case of failure.
Direct Injection Clean Agent System	Activation of the direct injection clean agent system may limit or reduce the rate of a propagating thermal runaway event.
Deflagration Protection	Activation of the enclosures deflagration venting system.
Thermal Isolation (Enclosure Insulation)	Passive thermal propagation protection provided by insulation installed on the boundaries of the enclosure.
Thermal Isolation (Enclosure Fire Separation)	Passive thermal propagation protection provided the enclosure's fire separation.
Thermal Isolation (Module / Rack Separation)	Passive thermal propagation protection provided by physical separation between modules within a rack and physical separation between racks within the enclosure.
Facility Design and Siting	Placement of the facility such that adverse environmental effects such as flooding, vehicle impact, and fire impingement are mitigated or avoided. The strength of this barrier is dependent upon the site-specific aspects of the facility layout.
Emergency Response Plan / First Responders	System operator plan to handle any and all emergency events. A site-specific emergency response plan should be developed. Effectiveness based on level of the subject matter expert (SME) / first responder training, knowledge of the specific BESS undergoing failure, coordination with fire department, etc.
Fire Service Response	Fire department response including active firefighting suppression. Effectiveness based on level of department knowledge and training to effectively respond both offensively and defensively during an BESS incident.

5.3 FAULT CONDITION ANALYSIS

The fault condition analysis below uses the four bow tie diagrams shown below as Figure 6 through Figure 9 for evaluation of the failure modes against the acceptance criteria identified in Table 2. See Appendix E for enlarged versions of the bow tie diagrams.

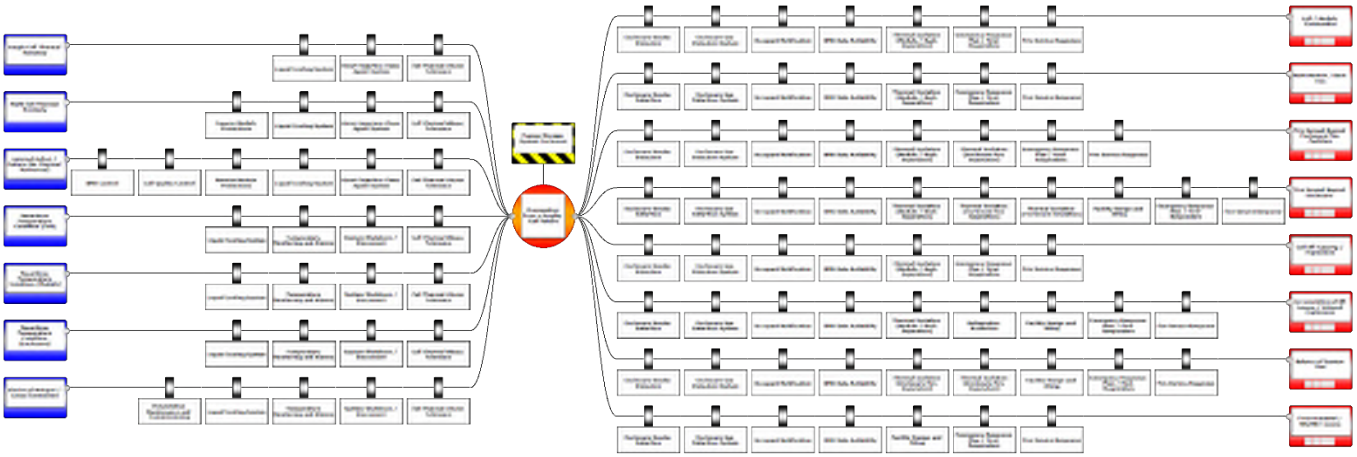


Figure 6 – Thermal Runaway and Mechanical Failure Bow Tie Diagram

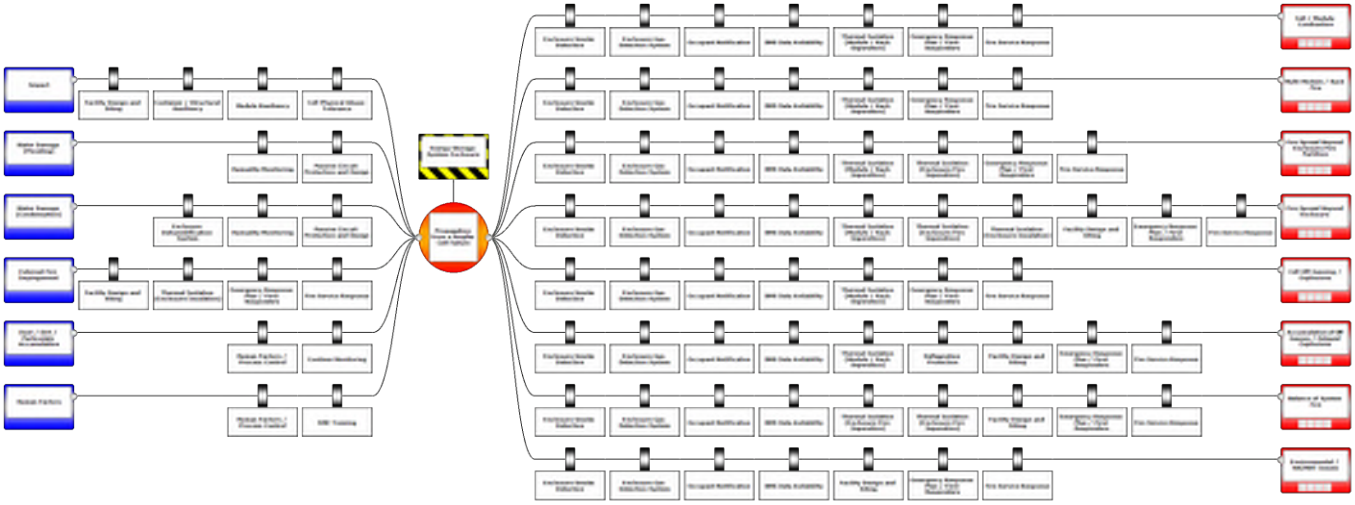


Figure 7 – External Impact Failures Bow Tie Diagram

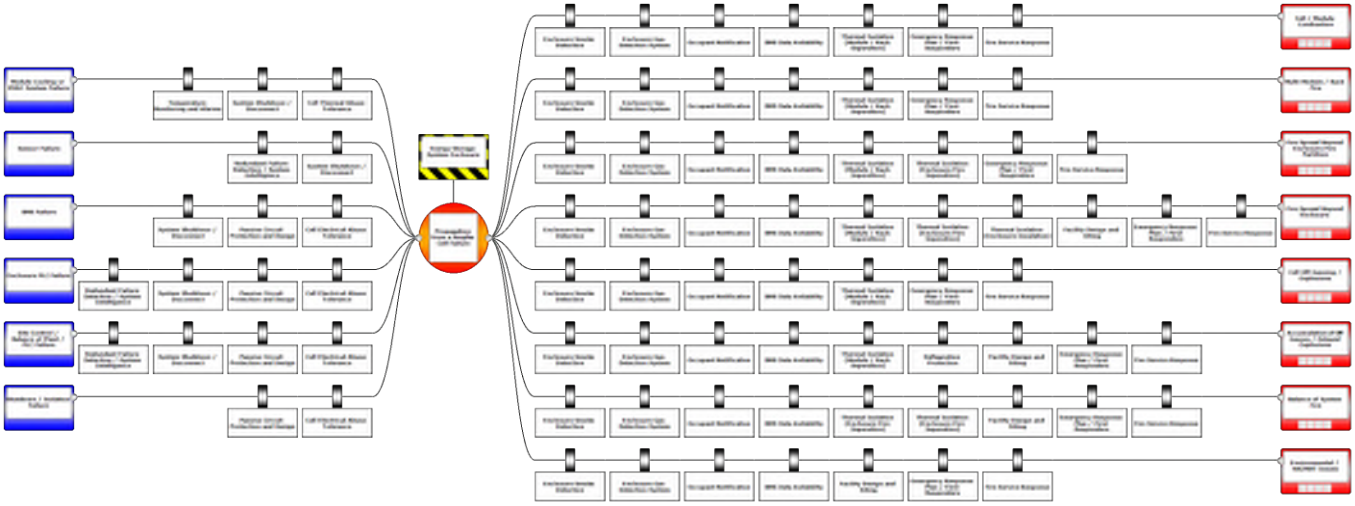


Figure 8 – Control and Prevention System Failure Bow Tie Diagram

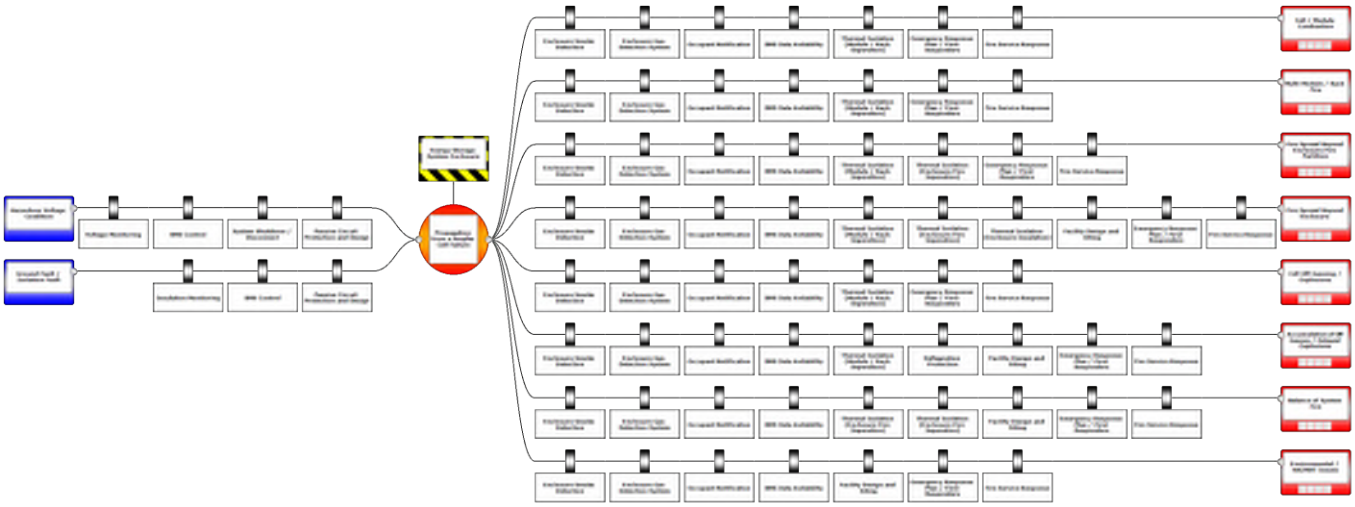


Figure 9 – Electrical Failure Bow Tie Diagram

5.3.3 Failure Mode 1: Single BESS unit Thermal Runaway or Mechanical Failure

Failure Mode 1 considers a thermal runaway or mechanical failure in a single BESS unit. The analysis for this failure mode primarily uses the thermal runaway & mechanical failure (see Figure 6), and the external impact threat pathway (see Figure 7) bow tie diagrams.

The threats identified in Figure 6 and Figure 7 can lead to a thermal runaway event in a single or group of cells due to a direct cell failure or indirectly from other root causes. Specific threats include conditions arising from within the enclosure such as internal cell defects and high heat conditions as well as conditions arising externally such as impacts from external fire events and flooding. Other conditions that may lead to a propagating cell failure event via electrical, control system and prevention system failures are examined in subsequent report sections.

Several active and passive barriers act to prevent a propagating cell failure scenario from developing from these threats. Key preventative barriers in the CEN enclosure product design include, passive module protections, cell thermal abuse tolerance, liquid cooling system, direct injection clean agent system, BMS control system, passive circuit protection, enclosure monitoring system and the enclosure insulation. Other key preventative barriers that may be present or in varying strengths depending upon the final site installation include, system shut down capability, facility design and siting, emergency planning and fire service response.

Once a propagating failure event has occurred, the smoke detection, gas detection and BMS data availability mitigation barriers act to provide situational awareness to facility operators and emergency responders. The strength of these barriers will be dependent upon site installation conditions. The enclosure, fire separation and module thermal isolation barriers act to limit the propagation of the escalating event. The deflagration protection barrier mitigates the possible effects of explosions. The facility siting, emergency response/planning and fire service response barriers are anticipated to provide additional barriers to mitigate an incident depending upon final site conditions.

During a thermal runaway event, several of the provided safety barriers would be expected to slow the growth of a failure event (i.e. thermal isolation, direct injection clean agent system, etc.). The slower rate of propagation with these barriers in effect acts to increase the effectiveness of the smoke and gas detection systems by providing an increased amount of time for event detection prior to the development of untenable conditions adjacent to the enclosure. With the situational awareness provided by activation of the occupant notification appliances located on the exterior of the enclosure, sufficient time is

anticipated to be provided to allow for evacuation of facility occupants to a safe location. The final site installation and operation conditions may act to further multiply the effectiveness of this barrier, such as occupant evacuation training and a site wide fire/emergency notification system.

The accumulation of cell off-gas from a thermal runaway event presents an explosion hazard. This hazard is specifically evaluated in the bow tie model as a possible consequence. The provided deflagration venting system provides a strong barrier to mitigate the effects of deflagration events resulting from a thermal runaway event of up to three cells. Given the previously mentioned safety barriers which act to reduce the rate of propagation of an escalating event, the proposed deflagration system is deemed to be adequate. The gas detection system has the capability to provide situational awareness of internal conditions to emergency and fire service responders.

5.3.2 Failure Mode 2: Failure of a Required Protection System not Covered by Product Listing FMEA

This failure mode considers the failure of an energy storage management system or protection system that is not covered by the product listing failure modes and effects analysis (FMEA). The analysis for Failure Mode 2 uses the control and prevention system failure threat pathway bow tie diagram (see Figure 8).

Specific threats analyzed for this failure mode included cooling system failure, sensor failure, BMS failure, site control / PLC failure and shutdown isolation failure. While none of these threats lead directly to the failure of a cell, they can serve as precursor events to cell failure.

The safety barriers preventing the threats considered in this failure mode from escalating to a propagating cell failure event primarily include cell electrical and thermal abuse tolerance, passive circuit protection and design, and system shutdown / disconnect capability. The effectiveness of the system shutdown / disconnect capability may be subject to site conditions.

The mitigative barriers available once a propagating event has begun are typical to those discussed in the Failure Mode 1 section above.

The assessment of the identified safety barriers to limit the possible consequences to what is specified in the analysis acceptance criteria is typical to the discussion found in the Failure Mode 1 section above.

5.3.3 Failure Mode 3: Failure of a Required Protection System

Failure Mode 3 considers the failure of a required protection system. The analysis for this failure mode primarily uses the thermal runaway & mechanical failure (see Figure 6), and the external impact threat pathway (see Figure 7) bow tie diagrams.

For this failure mode, the consequences are evaluated with required protection systems assumed to have failed and be out of service. The model was separately evaluated assuming failures of the enclosure smoke detection system, enclosure gas detection system, deflagration protection system and direct injection clean agent system. Simultaneous multiple system failures are not considered. Failure of any of the above listed system is not anticipated to immediately create a hazardous condition, rather, failure of a required protection system will reduce the ability to prevent or mitigate hazardous conditions developing from a fire or thermal runaway event.

A failure of the smoke detection system would be expected to lead to a failure of the direct injection clean agent system and in a possible reduction in the overall situational awareness during an emergency. In this case, the gas detection system and BMS data safety barriers act to provide a degree of continued situational awareness. Activation of the gas detection system is expected to occur during a fire or thermal runaway incident and provide activation of the occupant notification system even if a failure occurs in the

smoke detection system. The direct injection clean agent system may be released using the manual pull station on the outside of the enclosure if the smoke detection system is not functioning. The strength of the gas detection and direct injection clean agent system barrier is conditional based on the quality and use of the emergency plan, and the quality of communication between the ROCC and on-site personnel. Other safety barriers such as thermal abuse tolerance and thermal isolation are expected to continue at their previous performance level.

Failure of the gas detection system is not anticipated to result in a significant reduction in safety as this system primarily provides situational awareness. The deflagration prevention system, which uses a passive deflagration vent design, is expected to continue providing a strong safety barrier against explosion type hazard when gas detection system failure occurs.

The deflagration prevention system uses a NFPA 68 compliant passive vent design that does not rely upon electrical or mechanical systems to maintain safety. The passive design is expected to have greater availability as compared to active system designs which use ventilation or other methodologies to maintain safety. If the deflagration prevention system fails, the gas detection system would be expected to provide a degree of situational awareness regarding an escalating flammable gas event within the enclosure.

The direct injection clean agent system is treated as a preventative barrier within this analysis. All threat pathways considered in this failure mode feature multiple additional preventative and mitigative barriers.

The CEN enclosure is evaluated to include a sufficient quantity of safety barriers, such that the failure of any one of the required protection systems is not expected to result in a situation where the rate of event propagation will prevent the evacuation of facility occupants to a safe location.

This can also include the failure of site-wide fire alarm monitoring and reporting, however a system installed in accordance with NFPA 72 helps to mitigate the potential for a failure in which the fire department is not made aware.

5.3.4 Failure Mode 4: Primary Electric Supply Voltage Surges

The analysis for Failure Mode 4 uses the Hazardous Voltage Condition pathway on the electrical system failure threat bow tie diagram (see Figure 9).

The primary safety barriers expected to prevent a propagating cell failure are voltage monitoring and BMS control. The system shutdown and passive circuit protection barriers are expected to also provide preventative barriers. The effectiveness of the system shutdown / disconnect capability may be subject to site conditions.

The mitigative barriers available once a propagating event has begun are typical to those discussed in the Failure Mode 1 section above.

The assessment of the identified safety barriers to limit the possible consequences to what is specified in the analysis acceptance criteria is typical to the discussion found in the Failure Mode 1 section above.

5.3.5 Failure Mode 5: Load Side Short Circuits

The analysis for Failure Mode 5 uses the Ground Fault / Isolation Fault pathway on the electrical system failure threat bow tie diagram (see Figure 9).

The primary safety barriers expected to prevent a propagating cell failure are BMS control and passive circuit protection barriers. Insulation monitoring can also serve to prevent this type of failure.

The mitigative barriers available once a propagating event has begun are typical to those discussed in the Failure Mode 1 section above.

The assessment of the identified safety barriers to limit the possible consequences to what is specified in the analysis acceptance criteria is typical to the discussion found in the Failure Mode 1 section above.

6.0 ANALYSIS APPROVAL

The acceptance criteria applied in this analysis aligns to the HMA approval criteria listed in the 2023 edition of NFPA 855 and the 2021 edition of the IFC. Conformance with the specified acceptance criteria is demonstrated in Table 9 below.

Table 9: Compliance with Analysis Acceptance Criteria

Acceptance Criteria	Acceptance Criteria and Demonstration of Compliance
1	Requirement: Fires and products of combustion will not prevent occupants from evacuating to a safe location
	Conformance: The CEN enclosure features a sufficient quantity of safety barriers to limit the rate of propagation of an escalating fire or thermal runaway event and provide adequate situational awareness to facility occupants to permit evacuation to a safe location.
2	Requirement: Deflagration hazards will be addressed by an explosion control or other system
	Conformance: This analysis has identified that a propagating cell failure event poses a deflagration hazard. The CEN enclosure will be equipped with a NFPA 68 compliant deflagration venting system to release the combustion gases and pressure resulting from a deflagration within the enclosure so that structural and mechanical damage is minimized.

7.0 ANALYSIS ASSUMPTIONS AND LIMITATIONS

The analysis presented in this analysis is limited by the following key assumptions:

- **Unknown Failure Modes** – While large-scale fire testing and commitment of considerable resources to the study of energy storage safety issues has drastically improved the industry's understanding of failure modes, threats, consequences and general safety, many failure modes and corresponding responses remain uncharacterized. Unknown failures may also potentially arise not otherwise considered in this analysis. The conclusions of this analysis should be re-evaluated as such failure modes become known to the industry.
- **Outside Event effecting more than one unit** – Several of the identified failure modes may affect multiple enclosures simultaneously, examples include flooding, external fires and voltage surges. The effectiveness of some safety barriers may be degraded when multiple events are occurring simultaneously and thus may not perform at the same strength as compared to when preventing or mitigating a single event. While this analysis does not directly consider events affecting more than a single unit at a time, it can be assumed that the risk of event propagation will be increased as more enclosures are involved.

- **Hazards during Construction, Shipping and Storage** – This analysis does not evaluate the hazards associated with the construction, off-site storage and shipping of the BESS enclosures. Other hazards may exist during these phases that are not present during operation of the enclosure.

- **Continued Maintenance** – All BESS systems are assumed to be inspected, tested and maintained in accordance with the original equipment manufacturer's instructions and as required by regulatory requirements. A lack of inspection, testing and maintenance of BESS subsystems can be expected to have a detrimental effect on the strength of the provided safety barriers.

- **Installed per code** – All life safety, fire protection and explosion systems are assumed to be installed and maintained in accordance with the applicable installation standards as required by the IFC. This report does not specifically evaluate the compliance of any protection systems to applicable installation standards.

8.0 REFERENCED DOCUMENTATION

In addition to the code documents listed in this report, other documents reviewed as part of this report were all provided by the project team. These documents include:

- *AES CEN Project BESS Container General and Internal Arrangement* drawings, CEN Solutions, Revision 0, Dated January 3, 2024
- *McFarland B – BESS Signals Logic Specific Project Procedure*, CEN Solutions, Revision 3, Dated October 16, 2023
- *30% Electrical Documents for Rancho Viejo Solar Utility BESS*, PVInsight Inc., Revision 3, Dated 07/02/2024
- *30% Civil Documents for Rancho Viejo Solar Utility BESS*, PVInsight Inc., Revision 3, Dated 07/02/2024
- *30% Structural Documents for Rancho Viejo Solar Utility BESS*, PVInsight Inc., Revision 2, Dated 03/04/2024
- *UL 9540A Report – Cell Level Report* (Project No. 4790746849), Dated July 7, 2023
- *UL 9540A Report – Module Level Report* (Project No. 4790351859), Dated July 10, 2023
- *UL 9540A Report – Unit Level Report* (Project No. 4790648531), Dated July 6, 2023
- *UL 9540A Report – Installation Level Report* (Project No. 4790648557), Dated July 7, 2023
- *Bespoke Fire Testing Reports to be added*

9.0 QUALIFICATIONS AND LIMITATIONS STATEMENT

The opinions and recommendations made in this report have been rendered using our professional judgment after our visual inspection and an evaluation of the information obtained from the documents provided to Coffman. The information contained within this report is specific to this project and should not be applied to any other facility or operation. We assume no liability for the work, opinions or reports of any other independent consulting firm engaged to do so. The analysis detailed in this report is based upon our engineering judgment using codes, standards, and research publicly available to-date relative to lithium-ion batteries. The recommendations in this report are advisory in nature. It is the sole responsibility of the client to implement the conclusions and recommendations contained herein.

APPENDIX A – NFPA 855 AND IFC HAZARDOUS MITIGATION ANALYSIS REQUIRMENTS

A1. INTRODUCTION

This Appendix compares the HMA failure mode and analysis approval requirements as found in the below listed codes to the failure modes and approval requirements selected for the analysis contained in this Fire Safety Technical Report.

- *International Fire Code* (IFC), 2021 edition
- NFPA 855, *Standard for the Installation of Energy Storage System*, 2023

A1.1. FAILURE MODES

The single mode failure modes considered in this analysis are described in Table 1. Table 2 below, relates the failure mode requirements as found in NFPA 855 and the IFC to the failure mode requirements applied to this analysis.

Table 1: Analysis Failure Modes

Failure Mode	Failure Mode Description
1	A thermal runaway or mechanical failure in a single ESS unit.
2	Failure of an energy storage management system or protection system that is not covered by the product listing failure modes and effects analysis (FMEA).
3	Failure of a required protection system including, but not limited to, ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, fire suppression, or gas detection.
4	Voltage surges on the primary electric supply.
5	Short circuits on the load side of the ESS.

Table 2: NFPA 855 and IFC Failure Mode Requirements

Code or Standard	Failure Mode Description	As Applied in This Analysis
NFPA 855 (2023 edition) Section 4.4.2.1	(1) A thermal runaway or mechanical failure in a single ESS unit.	Addressed in this analysis as Failure Mode #**1** (See Table 1).
	(2) Failure of an energy storage management system or protection system that is not covered by the product listing failure modes and effects analysis (FMEA).	Addressed in this analysis as Failure Mode #**2** (See Table 1).
	(3) Failure of a required protection system including, but not limited to, ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, fire suppression, or gas detection.	Addressed in this analysis as Failure Mode #**3** (See Table 1).
IFC (2021 Edition) Section 1207.1.4.1	(1) A thermal runaway condition in a single ESS rack, module or unit.	Addressed in this analysis as Failure Mode #**1** (See Table 1).
	(2) Failure of any battery (energy) management system	Addressed in this analysis as a component of Failure Mode #**2** (See Table 1).
	(3) Failure of any required ventilation or exhaust system	Addressed in this analysis as a component of Failure Mode #**3** (See Table 1).
	(4) Voltage surges on the primary electric supply	Addressed in this analysis as Failure Mode #**4** (See Table 1).

	(5) Short circuits on the load side of the ESS	Addressed in this analysis as Failure Mode #**5** (See Table 1).
	(6) Failure of the smoke detection, fire detection, fire suppression or gas detection system	Addressed in this analysis as a component of Failure Mode #**3** (See Table 1).
	(7) Required spill neutralization not being provided or failure of a required secondary containment system	Not Applicable – Secondary containment are not required for lithium-ion battery types.

A1.2. ACCEPTANCE CRITERIA

The acceptance criteria considered in this analysis are described in Table 3. Table 4 below, relates the approval criteria requirements as found in NFPA 855 and the IFC to the acceptance criteria applied to this analysis.

Table 3: Analysis Acceptance Criteria

Acceptance Criteria	Acceptance Criteria Description
1	Fires and products of combustion will not prevent occupants from evacuating to a safe location
2	Deflagration hazards will be addressed by an explosion control or other system

Table 4: NFPA 855 and IFC Approval Criteria Requirements

Code or Standard	Approval Criteria Requirements	As Applied in This Analysis
NFPA 855 (2023 edition) Section 4.4.3	(1) Fires will be contained within unoccupied ESS rooms for the minimum duration of the fire resistance rating specified in NFPA 855 Section 9.6.4	Not Applicable – The E5S enclosure does not constitute a room, nor is the E5S enclosure intended to be used indoors.
	(2) Fires and products of combustion will not prevent occupants from evacuating to a safe location	Addressed in this analysis as Acceptance Criteria #**1** (See Table 3).
	(3) Deflagration hazards will be addressed by an explosion control or other system	Addressed in this analysis as Acceptance Criteria #**2** (See Table 3).
IFC (2021 Edition) Section 1207.1.4.2	(1) Fires will be contained within unoccupied ESS rooms or areas for the minimum duration of the fire-resistance-rated separations identified in IFC Section 1207.7.4	Not Applicable – The E5S enclosure does not constitute a room, nor is the E5S enclosure intended to be used indoors.
	(2) Fires in occupied work centers will be detected in time to allow occupants within the room or area to safely evacuate	Not Applicable – The E5S enclosure is not intended to be used indoors.
	(3) Toxic and highly toxic gases released during fires will not reach concentrations in excess of the IDLH level in the building or adjacent means of egress routes during the time deemed necessary to evacuate occupants from any affected area	Addressed in this analysis as Acceptance Criteria #**1** (See Table 3).

	(4) Flammable gases released from ESS during charging, discharging and normal operation will not exceed 25 percent of their LFL	Not Applicable – Lithium-ion cells are hermetically sealed and do not vent under normal charging or discharging operating conditions. Flammable gases are not released during normal operations.
	(5) Flammable gases released from ESS during fire, overcharging and other abnormal conditions will be controlled through the use of ventilation of the gases, preventing accumulation, or by deflagration venting	Addressed in this analysis as Acceptance Criteria #2 (See Table 3).

APPENDIX B – BOW TIE METHODOLOGY

B1. INTRODUCTION

This Appendix provides a general description of the bow tie methodology as a hazard analysis tool.

The bow tie methodology is common is risk and hazard studies to identify the safety barriers that can be implemented to prevent a critical event from happening and/or to mitigate its effects after it has occurred [1]. In bow tie models, a fault tree and event tree are linked to a critical event that is related to an undesirable event. In this way, bow tie models represent the relationship that exists between hazards, threats, safety prevention barriers, safety mitigation barriers and consequences.

The strength of the bowtie approach comes from its visual nature. An example of a bow tie model is given below in

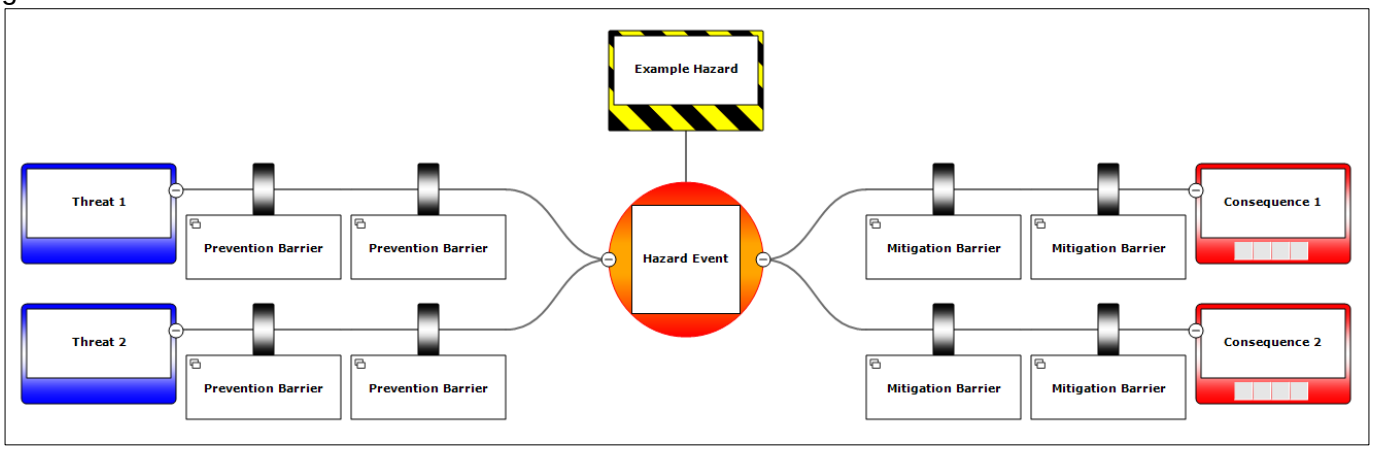


Figure **1**.

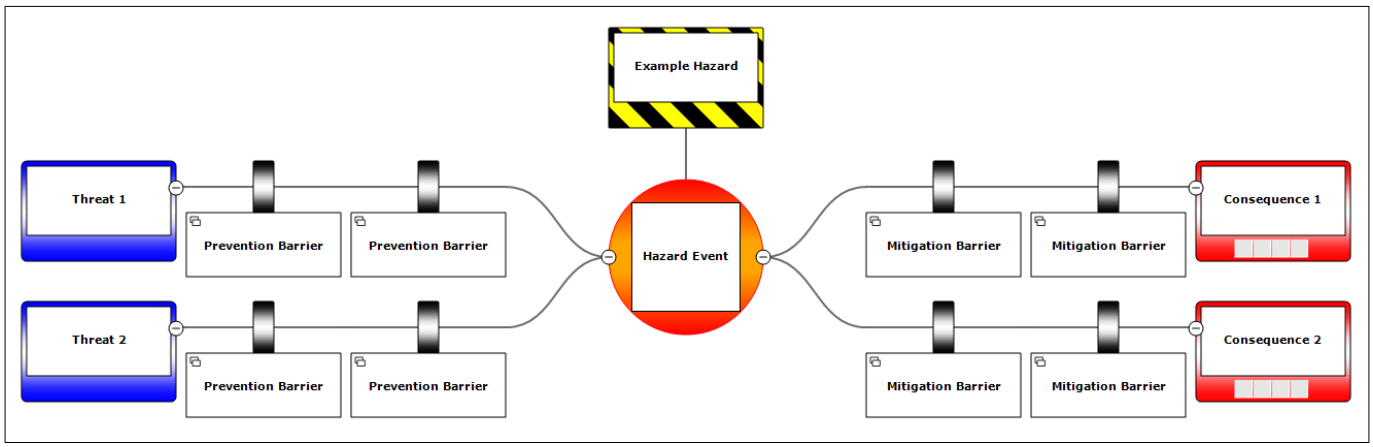


Figure 1 – Bow Tie Model Description

B2. BOW TIE ELEMENTS

Bow tie models contain the elements listed below:

- **Hazard** – The hazard is an operation, activity or material with the potential to cause harm. It is shown on bow tie model diagrams to provide clarity to the reader as to the source of risk. Hazards are part of normal business and are often necessary to run an operation.

- **Top Event** – The top event is the moment when control over the hazard or its containment is lost. While the top event may have occurred, there may still be time for barriers to act to stop or mitigate the consequences.

- **Threats** – Threats are the potential reasons for loss of control of the hazard leading to the top event. For each top event there are normally multiple threats located on the left side of the bow tie model diagram, each representing a single scenario that could directly and independently lead to the event.

- **Consequences** – Consequences are unwanted outcomes that could result from the top event and lead to damage or harm. Generally, these would be major accident events, but lesser consequences can be selected if the aim is to map the full range of important safety and environmental barriers. One top event may have multiple consequences, but normally only important consequences would be developed to show the mitigation of barriers, not trivial ones.

- **Barriers** – Barriers can be physical or non-physical measures to prevent or mitigate unwanted events. Active barriers can differ with respect to 'detect', 'decide' and 'act' components they contain and whether these components are performed by humans or executed by technology.

    - **Prevention Barriers** – A prevention barrier is a barrier that prevents the top event from occurring. A key test for a prevention barrier is that it must be capable of completely stopping the top event on its own. These barriers appear to the left of the top event on the bow tie model diagram.

    - **Mitigation Barriers** – Mitigation barriers are employed after the top event has occurred and act to prevent or reduce losses and regain control once it has been lost. These barriers appear to the right of the top event on the bow tie model diagram.

The bow tie element descriptions provided above, is based on information found in *Bow Ties in Risk Management* as developed by the Center for Chemical Process Safety [2].

B3. ADVANTAGES, DISADVANTAGES AND UNCERTAINTIES

All hazard analysis techniques are subject to certain advantages, disadvantages and uncertainties. These items are summarized below for the bow tie methodology. The summary provided below is based upon information found in *A Guide to Hazard Identification Methods* [3].

B3.1. ADVANTAGES

- **Hazard Communication** – Bow tie model diagrams communicate:
    - a clear picture of the possible consequences and the routes in which they arise
    - the necessary conditions and sequences of events for each to occur
    - the relative importance of each safety barrier and the consequence of failure
    - the points where additional safety barriers are needed
    - the conditions requiring further in-depth analysis

- **Facilitate hazard-event-consequences Understanding** – The analysis and its visual representation can help all concerned with the safety of a facility to recognize the sequence that could lead to catastrophic events and to appreciate maintaining preventative and mitigation barriers.

- **AHJ Communication** – Regulatory authorities can be assured that a full analysis has been carried out and that hazards are understood and satisfactorily controlled.

B3.2. DISADVANTAGES

- **Requires Detailed Process Understanding** – The analyst needs to be skilled in the use of bow ties, particularly in determining the degree of detail to be included and have a detailed understanding of the system under analysis.
- **Poor Data** – The value of a study will be limited if the available data is of poor quality and lacks robustness or relevance. Imprecise data leads to imprecise predictions.
- **Treat with Care** – All results must be treated with care.

B3.3. UNCERTAINTIES

- **Common Mode Failures** – It is essential that full allowance is made for common mode failures and it may be necessary to make an arbitrary allowance for the possibility of these events.

B4. APPENDIX B REFERENCES

[1] S. Mannan, Lees' Loss Prevention in the Process Industries, Waltham, MA: Elservier, 2012.

[2] Center for Chemical Process Safety of the American Institute of Chemical Engineers, Bow Ties in Risk Managment, Hoboken, NJ: John Wiley & Sons, Inc., 2018.

[3] F. Crawley, A Guide to Hazard Identification Methods, Cambridge, MA: Elsevier, Inc., 2020.

DRAFT

APPENDIX C – THREAT AND PREVENTATIVE BARRIER DESCRIPTIONS

Table 1: Detailed Threat Descriptions		
Threat	**Threat Description**	**Threat Category**
Single-Cell Thermal Runaway	*A single cell has entered thermal runaway resulting in flames and combustion or production of flammable gases.* This scenario may occur as a result of an internal cell defect or other cause. Single cell thermal runaway events may not be readily detectable if the event scenario does not propagate beyond the initial event. If no ignition source is present, the failure may result in the generation of hazardous and flammable gases that could lead to other hazards. If an ignition source is present, the byproducts may combust and result in fire. The UL 9540A module, unit and installation level test for the E5S ESS enclosure utilizes a single cell thermal runaway event as an initiating event.	Thermal Runaway & Mechanical Failure
Multi-Cell Thermal Runaway	*Multiple cells have entered thermal runaway.* Multicell thermal runaway is a credible failure mode that may result from the overcharge of a parallel cell group or the early results of a propagating cell failure. Multicell thermal runaway may prove manageable and containable in some cases.	Thermal Runaway & Mechanical Failure
Internal Defect / Failure (No Thermal Runaway)	*A cell has failed as a result of an internal defect, creating a short circuit, open circuit, or other electrical condition or off-gas but not entering thermal runaway.* In this instance an internal cell defect does not result in thermal runaway but results in the electrical failure of the cell. This may be by reducing the capacity of the cell relative to its neighbors, creating a dead short or creating an open circuit event.	Thermal Runaway & Mechanical Failure
Hazardous Temperature Condition (Cell)	*High temperature at the cell level during normal operations without thermal runaway.* This hazardous temperature threat is a condition in which cells within a module are exposed to high temperatures just short of thermal runaway. This may be the result of hotspots, an HVAC failure, heavy operation, excessive degradation or increased impedance. Regardless of cause, high cell temperatures pose an increased likelihood of thermal runaway or increasing cell degradation.	Thermal Runaway & Mechanical Failure
Hazardous Temperature Condition (Module)	*High temperature in the module during normal operation without failure / thermal runaway.* At the module level, poor performance of cooling systems may result in cases where a module, sets of modules, or entire racks operate at elevated or uneven temperatures relative to other modules or racks within a system. Cells with manufacturing defects or other environmental considerations may also result in elevated cell and module temperatures.	Thermal Runaway & Mechanical Failure
Hazardous Temperature Condition (Enclosure)	*High temperature in the enclosure during normal operations.* The largest scale of hazardous temperature condition, dangerously elevated container temperatures pose serious risk to system safety. High temperatures throughout the entire enclosure will equate to high temperatures throughout all modules and thus cells, further increasing	Thermal Runaway & Mechanical Failure

Table 1: Detailed Threat Descriptions		
Threat	**Threat Description**	**Threat Category**
	the risk of thermal runaway. Non-uniform thermal management means hot spots may be even hotter than usual. These events may be caused by HVAC failures but may also be the result of poor thermal management of co-located power electronics, intense duty cycles, or environmental conditions such as record high ambient temperatures or fire impingement.	
Electrical Hotspot / Loose Connection	*Loose connections in the system may increase resistance and cause hotspots. Hotspots may form in other ways for unknown reasons. These hotspots will then conduct via bus bars or mechanical contact into cells.* Electrical hotspots within a device may propagate through thermally conductive busbars and materials, resulting in the direct heating of cells. Management of this threat pathway involves proper engineering practices for thermal design, proper commissioning, and maintenance practices to insure proper electrical connections, adequate active or passive thermal monitoring, alarms to stop operation if such conditions are reached and an ability to properly shutdown the system.	Thermal Runaway & Mechanical Failure
Impact	*Something has struck the battery system, sharply or as blunt force, causing mechanical damage or deformation.* This is defined as something striking a system (e.g., inadvertent forklift strike or a vehicle hitting the system as part of a deliberate attack). As physical damage to the batteries can result in either immediate or delayed cell failure and fire, such an event may pose grave risk if unmanaged. The risk of this threat is likely to be greater during maintenance activities when other protection systems are not in service. Maintenance activity-related scenarios fall beyond the scope of this analysis.	External Impact Failures
Water Damage (Flooding)	*The system is flooded with water as a result of liquid cooling system failure.* A failure of the cooling system may lead to flooding of the enclosure. This damage poses two risks, one from the risk of short circuit, and the other from degradation to components and corrosion from exposure to water.	External Impact Failures
Water Damage (Condensation)	*The system is subject to uncontrolled condensation of water via dehumidifier failure, internal condensation of moisture, or from natural reasons.* Whether this is condensate building on cool surfaces which falls onto the system, or the formation of condensate on sensitive parts, the presence of water and moisture within electrical systems is not best practice in these systems (outside of intentional liquid cooling systems or those rated for damp environments). The E5S enclosure includes two separate dehumidifiers which act to reduce the probability of a complete failure of the dehumidifier system.	External Impact Failures
External Fire Impingement	*An external fire that is impinging on the system from outside the containment.* Systems built near combustible materials or equipment are at risk of being exposed to fire should these flammable structures become	External Impact Failures

Table 1: Detailed Threat Descriptions		
Threat	**Threat Description**	**Threat Category**
	involved in fire (examples include power transformers and wildfire threats). The site plan shows that the PCS units are located 8 ft from each pair of enclosures and could pose a potential fire hazard risk to the enclosures. There is also a standby generator located 21 ft from one of the enclosures.	
Dust / Dirt / Particulate Accumulation	*Accumulation of dust, dirt, or particulate that results in an adverse condition inside the system.* Dependent on location and maintenance, the accumulation of dust, dirt, or other particles may result in eventual failure. Examples include reducing the effectiveness of thermal management, causing failure of moving parts or switches, or creating electrical shorts.	External Impact Failures
Human Factors	*An adverse condition caused by the result of human interaction, error, or imperfection.* This broad reaching category is intended to cover any accident directly attributable to human intervention. Human factors include any and all variables that humans induce in the systems they interact with. Examples include a visitor bumping into a button, switch, or wire; a technician dropping a wrench on terminals; and an operator missing a warning signal.	External Impact Failures
Module Cooling or HVAC System Failure	*Mechanical or electrical failure of the module cooling or enclosure HVAC system resulting in high temperatures throughout system.* HVAC system failures are a common occurrence in ESS installations. A failure of the module cooling system or the HVAC system may create clear temperature gradients across the system. The systems provide degree of redundancy to each other.	Control & Prevention System Failure
Sensor Failure	*A sensor inside the system fails, resulting in incorrect reporting of system properties.* As a control system is only as effective as its ability to measure and provide feedback – the failure of a sensor may result in adverse conditions in a system unable to properly measure its own state.	Control & Prevention System Failure
BMS Failure	*Cell / module level monitoring and control fails, resulting in inability to shut down, report adverse conditions, properly monitor, balance, or protect the system resulting in an adverse condition.* Failures may be software related (e.g., hang up in operation), hardware related (e.g., failure of a balancing circuit or loss of a sensor), or a combination of both where the entire system fails.	Control & Prevention System Failure
Enclosure PLC Failure	*Failure of the enclosure PLC controller resulting in adverse condition to the system or inability to detect or protect against adverse conditions under its purview.* The E5S enclosure utilizes a PLC to communicate supervision and control signals between the battery system BMS, HVAC controller, FACP and to the master site controller. While failure of this controller itself is unlikely to result in immediate risk to the system, failure of this controller will likely compromise the ability of the system to communicate its status to the ROCC and control interactions between systems.	Control & Prevention System Failure

Table 1: Detailed Threat Descriptions		
Threat	**Threat Description**	**Threat Category**
Site Control / Balance of Plant / PLC Failure	*Failure of the master site controller or other balance of system controller resulting in adverse condition to the system or inability to detect or protect against adverse conditions under their purview.* While failure of this controller itself is unlikely to result in immediate risk to the system, failure of this controller will likely compromise the ability of the system to adequately shutdown and isolate itself as well as monitor and control interactions between systems. In some cases, if this controller is needed for intervention, failure has likely already occurred or the system is experiencing massive, system wide issues, thus the master site controller may be necessary for adequate isolation from the grid or other AC or DC sources among other actuations. The relative risk of this threat may vary on a site-by-site basis and therefore not fully addressed within the scope of this report.	Control & Prevention System Failure
Shutdown / Isolation Failure	*Failure of the system to shut down or isolate itself when an adverse condition is detected.* This may be the result of a failure of electrical or mechanical protections designed to open power circuits within the system. For the E5S enclosure this may include failure of the battery rack level contactors or other automated disconnects upstream of the enclosure. Failure of this type may require manual human intervention to accomplish system isolation. Each PCS block has a motor operated switch that is capable of disconnecting power upstream and downstream of the block. Additional information related to the relative risk of this threat will be expanded upon in the final HMA.	Control & Prevention System Failure
Hazardous Voltage Condition	*This could include high line voltages, floating ground issues, or other high voltage issues at the cell, module, or rack level.* In this case, the voltage on the batteries is increased or decreased to unsafe levels beyond the voltage limits. A number of issues could cause either scenario. Such scenarios have been directly attributed to historic large scale ESS fires.	Electrical Failure
Ground Fault / Isolation Fault	*This could include localized shorting of cells, shorting between modules, shorting of entire racks or systems and ground fault shorting.* Unintended ground faults and insulation faults resulting in shorts that produce adverse, high current events. Similar to short circuiting, these events have been directly attributed to historic large scale ESS fires.	Electrical Failure

Table 2: Detailed Preventative Barrier Descriptions	
Barrier	**Preventative Description**
Passive Module Protections	*Module fuse which may open the circuit in the case of failure as well as general resilience of design to withstand adverse electrical conditions.*

Table 2: Detailed Preventative Barrier Descriptions	
Barrier	**Preventative Description**
	In cases where the circuit is unable to adequately isolate itself, the final barrier to avoiding catastrophic failure is passive circuit elements. Passive protection is provided by the module fuse which may open individual modules prior to failure. Depending on the nature of the failure, these elements may have mixed success in achieving these goals. The final passive protection barrier resides in the module itself.
Liquid Cooling System	*The liquid cooling system is an active cell protection which may prevent thermal runaway propagation.* Active cell protections include any type of actively monitored or controlled mechanism intended to protect against the effects of thermal runaway, whether it be actively preventing the cell from entering thermal runaway or actively mitigating thermal runaway once it occurs. For the E5S enclosure, this includes the liquid cooling system.
Enclosure Dehumidification System	*The enclosure's dehumidification system acts to prevent the buildup of condensation that may pose a short circuit hazard.* The E5S enclosure is provided with two dehumidifiers, one located on each side of the fire separation. The operation of the dehumidifiers are initiated by a humidity sensor located on each side of the fire separation. Humidifiers are powered from a separate auxiliary feed and will remain powered regardless if the enclosure is disconnected from DC power.
Direct Injection Clean Agent System	*The direct injection clean agent system is an active cell protection which may prevent thermal runaway propagation.* Active cell protections include any type of actively monitored or controlled mechanism intended to protect against the effects of thermal runaway, whether it be actively preventing the cell from entering thermal runaway or actively mitigating thermal runaway once it occurs. For the E5S enclosure, this includes the direct injection clean agent systems. This system is activated by activation of two smoke detectors or by the manual release located on the outside of the E5S enclosure. The system will continue to operate, discharging agent to all cells, until the agent is exhausted. The potential effectiveness of this barrier is demonstrated in the UL 9540A installation level testing.
Cell Thermal Abuse Tolerance	*Ability of the cells to withstand thermal abuse without going into failure themselves.* Thermal abuse tolerance applies to the ability of the chemistry in question to fail when exposed to high temperatures. It is typically not considered a strong barrier without sufficient testing to demonstrate. Both the cell and module proposed for the E5S enclosure are UL 1973 listed which includes testing for thermal abuse tolerance.
Cell Quality Control	*Overall quality of the cell such that internal defects are minimized, and cells maintain rigidity and shape during operations. Also includes tight tolerances with respect to degradation.* This barrier is intended as a catch all for considerations related to cell quality. This is likely to be outside the control of the end user of the system but covers the overall reliability of the cells with respect to internal failures and faults that may result in adverse conditions.

Table 2: Detailed Preventative Barrier Descriptions	
Barrier	**Preventative Description**
BMS Control	*Includes monitoring and shutdown/isolation capabilities of the affected BMS / module or system.* BMS Control includes aspects of BMS Shutdown / Disconnect but also includes overall effectiveness of monitoring such that proactive measures may be taken, or warnings given, indicating imminent failure or adverse conditions. Utilized as a barrier on multiple threats, this barrier is evaluated differently in each case based on the algorithmic response to the threat or failure in question.
Temperature Monitoring and Alarms	*Thermal monitoring within the container.* This barrier is the ability of the battery system or BMS to detect adverse thermal conditions within itself and alarm those issues outward. Four temperature sensors are provided within each module. The BMS will initiate an automatic shutdown when a hazardous temperature condition is detected.
System Shutdown / Disconnect	*Ability of system to actively shut itself down or disconnect itself. This is the aggregate of the BMS ability as well as physical disconnects and the Balance of System controller's ability to shut down.* This barrier may be approached from two perspectives, with the first the ability of the system to truly shut off only the affected and responsible operations when such conditions are detected. This shutdown will stop ohmic and electrochemical heating thus stopping heat generation and may also increase the temperature at which thermal runaway would occur (by stopping internal heat generation). The second approach involves shutting down the entire system. The BMS system is capable of automatically disconnecting individual battery racks. Remote emergency manual system shutdown of the enclosure from the ROCC can only be accomplished using disconnects located beyond the E5S enclosure. A manual DC disconnect is also available within the enclosure. The strength of this barrier will be expanded upon in the final HMA.
Preventative Maintenance and Commissioning	*Proper maintenance and monitoring of the system in conjunction with adequate commission and site acceptance testing to reduce likelihood of loose connections or other transportation or construction defects.* Preventative Maintenance consists of the normally scheduled preplanned maintenance required for operation such as periodic inspections for function and operating limits and the necessary upkeep required for continued operation as well as the prompt repair of failures and failing components. Commissioning refers to the process of bringing the system online, performing inspections of the built system to ensure proper compliance with operating parameters, and the shakedown of “bugs” and issues from construction to normal operation. Through these processes, the system is brought to and maintained in good working order.
Passive Circuit Protection and Design	*Breakers and fuses which may open the circuit in the case of failure and general resilience of design to withstand adverse electrical conditions.* The E5S enclosure includes a passive fuse for each battery rack and at the main DC disconnect.
Cell Electrical Abuse Tolerance	*Ability of the cell to withstand electrical abuse such as overcharge, over discharge, high currents, or other adverse electrical abuse.*

Table 2: Detailed Preventative Barrier Descriptions	
Barrier	**Preventative Description**
	The ability of the individual cells to withstand electrical abuse such as short circuit, overcharge, and overcurrent events without resulting in adverse conditions. As no testing standard yet exists to quantify the ability of the cell to withstand electrical abuse, this barrier is evaluated as weak
Redundant Failure Detection / System Intelligence	*Ability of system to determine a sensor has failed, to operate safely without that sensor to shut down, or operate safely indefinitely without sensor. This may include Checksums, additional sensors, or the ability to pull data from other sensors.* This barrier is highly dependent on the sensor in question as well as the design, architecture, and operation of the system as a whole and the evaluation of the data collected within the confines of the system.
Human Factors / Process Control	*Quality control or other processes put in place to prevent mishandling of systems that may result in adverse or hazardous conditions or mishandling.* A catchall barrier that includes all possible failures and adverse conditions brought about by human interaction with the system. It also includes failures related to process and flow separate from the control system of ESS itself. This could be as simple as a technician dropping a wrench across the terminals or as complex as sophisticated maintenance procedure which fails to adequately address an otherwise trivial detail, such as failure to check the tightness of unreachable bolts or clean unexposed terminals. The relative strength of this barrier is assumed to be in alignment with industry norms.
Container / Structural Resiliency	*Resiliency of the system and container of the system to withstand impacts or strikes.* The enclosure envelope is assumed to be effective to protect against basic vandalism or low speed, accidental vehicle impacts such as construction equipment as well as high winds, hail, seismic vibrations, and other environmental forces.
Module Resiliency	*Resiliency of the individual modules to withstand impacts, shocks, or other mechanical abuse.* Similar to cell abuse tolerance, this barrier covers the overall strength and rigidity of a battery module as it relates to the ability of the module to withstand both impacts and shocks as well as the noise, vibration, and harshness.
Cell Physical Abuse Tolerance	*Ability of the cell to withstand thermal, physical, or mechanical abuse.* This barrier considers the ability of a cell to withstand physical, thermal, or mechanical damage without resulting in an adverse condition. As all lithium ion battery chemistries have shown susceptibility to physical damage such as penetration and crush, this barrier is likely to be considered weak, depending on the threat faced. The proposed cell and module have been certified to UL 1973 which includes physical abuse testing. These include vibration, shock, crush, static force, impact, and drop impact testing. The strength of this barrier is assessed as strong when the degree of abuse is within the bounds of UL testing but may be weaker when these bounds are exceeded.
Humidity Monitoring	*Monitoring within the container which may detect high humidity, water condensation or water leakage.*
System Maintenance	*Proper preventative maintenance to minimize the impact of adverse, long term or slow acting environmental effects resulting in degradation.* Includes normally scheduled maintenance required for operation including periodic inspections for function and operating limits, replacement of expendable parts, and

Table 2: Detailed Preventative Barrier Descriptions	
Barrier	**Preventative Description**
	any necessary upkeep required for continued operation. Also includes prompt repair of failures and failing components.
SME Training	*Proper training procedures, availability of subject matter expertise and system competence, and clear jurisdictional hierarchy for managing situations.* Though required by fire codes such as NFPA 855, subject matter expert (SME) remains an undefined term and the quality and title of SMEs across the industry varies wildly. In addition to the undefined term, there is no nationally recognized standard or methodology for training or credentialing subject matter experts. In some cases, the SME may be more critical to the response of an ESS emergency than the first service, because the safety of the first responders and fire fighters also depends on the SME. This role should be evaluated carefully by all stakeholders when selecting an SME.
Voltage Monitoring	*Overall effectiveness of the voltage monitoring scheme of the system. Includes resilience to errors, error checking, and other measurement intelligence.* This includes adequate measurement of voltage throughout the system coupled with checks or redundant measurements such that a sensor failure cannot drive the system to an adverse condition. This includes monitoring of module, rack, and bus levels DC voltages and any intermediary voltages.
Insulation Monitoring	*Continual, or active, monitoring of insulation integrity, ground versus float voltage, and other practices to prevent insulation or isolation degradation.* Insulation monitoring is a common electrical maintenance best practice. Degradation of insulation for any reason runs the risk of current related failures anywhere in the system. This includes not just wire insulation but isolation on components and effectiveness of ground isolation during normal operation.

APPENDIX D – CONSEQUENCE AND MITIGATIVE BARRIER DESCRIPTIONS

Table 1: Detailed Consequences Descriptions	
Consequence	**Consequence Description**
Cell / Module Combustion	*A battery cell or module has failed and is now producing flame or combusting.* A single cell failure resulting in combustion and flame is likely the result of thermal runaway. While several mitigating barriers exist to prevent this scenario from reaching its natural conclusion, should those barriers fail, it is possible this consequence will continue, evolving into any of the consequences included in this analysis. Spread to other nearby cells or modules may continue the propagation of failure throughout the system
Multi-Module / Rack Fire	*Multiple modules have begun producing flame or combusting.* Fire within multiple modules or racks. Fire at this scale may be the result of propagation from a smaller event. Fire at this scale will be more dependent on the fire department response. Defensive postures may be needed to protect external exposures. A fire of this magnitude is expected to continue burning for several hours. This fire scenario is beyond the fire events experienced in UL 9540A testing for the E5S enclosure.
Fire Spread Beyond Enclosure Fire Partition	*A fire within the system has spread from one side of the enclosure fire rated partition to the modules/rack and equipment on the opposite side within the same enclosure.* In this scenario, the fire event has spread beyond the fire partition that subdivides the E5S enclosure, subsequently involving the modules/racks and other equipment on the opposite side of the enclosure. This fire scenario is beyond the fire events experienced in UL 9540A testing for the E5S enclosure.
Fire Spread Beyond Enclosure	*A fire within the system has spread beyond the enclosure to adjacent ESS enclosures or other structures.* In this case, fire has likely compromised the entire or a large portion of the interior space of the enclosure and has now breached the container, posing immediate risk to adjacent equipment or facilities. This scenario may occur even if the fire does not compromise the enclosure fire partition. Defensive firefighting is likely required to mitigate this incident. A fire of this scale may burn for several hours or days. ASHREA data for the nearest airport at Albuquerque International shows 1% extreme wind speed shows a wind speed of 28.2 mph and high temperatures of 95.2º F. The overall site is relatively flat and a defensible space is recommended to be maintained around enclosures to reduce wildfire risk. Based on the project site plan, the E5S enclosures are grouped in side-by-side pairs with 3.5 feet of space between each enclosure. Each pair is then spaced 21.75 ft from the next pair in groups totaling 5 pairs (10 E5S enclosures). The site consists of 4 total groups of enclosures separated by a minimum of 40’ of space between them. If a fire spreads beyond an enclosure, it is highly likely the pair will become involved. It is recommended that defensive firefighting be provided to mitigate further spread to adjacent pairs of enclosures. Fire modeling is being conducted to determine the likelihood of a fire spreading beyond that. The Final HMA report will be updated to include the results of the analysis.
Cell Off-Gassing / Explosions	*A cell or multiple cells have failed or entered thermal runaway and is now producing off-gas.* UL 9540A testing indicates that the cell off gasses include hydrogen, carbon monoxide, methane and other flammable hydrocarbons. When mixed with oxygen from the air, a flammable mixture may be formed. As such, this event may pose even greater risk than a single cell combustion, as the ability of batteries to maintain high temperatures in excess of autoignition temperatures for hours is well documented and the electrical nature of the systems adds additional ignitions sources. The cells utilized for the E5S enclosure may

	possess enough electrolyte, and ultimately gas generation potential, to create a flammable environment from only a single cell.
Accumulation of Off-Gasses / Delayed Explosions	*A cell or multiple cell failure which may or may not have propagated has resulted in the accumulation of potentially explosive off-gas within the enclosure.* Even with a single cell, long after the risk of propagating failure has passed, off-gas may continue to linger in the area, especially within the enclosure. This gas may continue to pose deflagration risk. Even cooled or extinguished batteries may emit gas several hours following an event. The lack of ventilation within the enclosure means the ability to exhaust this gas without putting personnel into harm's way is practically nonexistent.
Balance of System Fire	*A fire that either is initiated in or results in the involvement of a balance of system fire such as wire insulation, electrical components, or plastic inside the system.* In this instance, a small fire results in damage to the balance of system, including wiring insulation, bus bars, plastic containment or other component or material. Such damage may pose significant risk as compromised wiring or components may result in arcing, shorting, or other high energy event or act as ignition source causing delayed fire or explosion.
Environmental / HAZMAT Issues	*A large-scale system fire has resulted in an environmental or hazardous material incident which requires hazardous material response.* Examples include toxic smoke / gas plumage, contamination of firefighting runoff water in a sensitive area, or leftover energetic hazardous materials which may require special handling. These issues may be an active concern throughout the initial fire / thermal runaway incident or may be addressed post initial incident.

Table 2: Detailed Mitigative Barrier Descriptions	
Barrier	**Mitigative Barrier Description**
Enclosure Smoke Detection	*Activation of the enclosure's smoke detection system and communication via the Fire Alarm Control Panel (FACP). System activation provides both situational awareness to facility operators, personnel in the vicinity of the enclosure and first responders, as well as activation of the enclosure's direct injection clean agent system.* This barrier provides situational awareness of an emerging situation to facility operators and first responders. The effectiveness is based on the ability of the system and site to provide information and clarity of the failure. Poor situational awareness may weaken subsequent barriers. Effective use of the information provided by this system is dependent on proper annunciation of this data on site or the availability of this data to first responders and operations personnel. Activation of the smoke detection system will initiate the enclosure fire alarm notification device to facilitate personnel evacuation from the immediate vicinity of the enclosure. Communication of the fire alarm signal from the enclosure's FACP to the site's FACP may be used to initiate site wide notification of the fire event. Detection of smoke within the enclosure by two or more detectors will result in activation of the direct injection clean agent system. Depending upon the nature of the failure scenario, this system may act to reduce or limit the likelihood of continued propagation of a thermal event.

Enclosure Gas Detection System	*Activation of the enclosure's gas detection system and communication of alarm signal to the SCADA system. System activation provides situational awareness to facility operators, personnel in the vicinity of the enclosure and first responders.* This barrier provides situational awareness of an emerging situation to facility operators and first responders. When activated the gas detection system raises an alarm in the ROCC and will activate the enclosure fire alarm notification device to facilitate personnel evacuation from the immediate vicinity of the enclosure. Communication of gas detector data to emergency and first responders will require interface with the ROCC. The strength of this barrier may vary on a site-by-site basis and requires coordination with the team.
Occupant Notification	*Activation of the alarm notification device on the exterior of the enclosure and activation of the facility's site wide alarm system if provided.* This barrier provides situational awareness of an emerging fire or gas related situation to occupants in the area adjacent to the enclosure and in the wider facility (if a site wide occupant notification system is provided). Occupants are expected to evacuate the immediate area upon alarm system activation. The strength of this barrier may vary depending upon the quality of employee and site visitor training. The strength of this barrier may vary on a site-by-site basis and therefore not fully addressed within the scope of this report.
BMS Data Availability	*Includes BMS measurements available to first responders, ROCC, or other SMEs. Effectiveness based on what is detected and how accurate, how this information is being conveyed, and robustness of sensors in case of failure.* In the event of a failure event, BMS data may be available via the ROCC or otherwise communicated to first responders. This information may provide insight into the current conditions of the system (e.g., temperature of cells / modules, SOC, voltage trends, etc.) – provided the system is still online – or the state of the system prior to loss of measurements. This barrier provides situational awareness of an emerging situation to facility operators and first responders. The effectiveness is based on the ability of the system and site to provide information and clarity of the failure. Poor situational awareness may weaken subsequent barriers. Effective use of the information provided by this system is dependent on proper annunciation of this data on site or the availability of this data to first responders and operations personnel.
Direct Injection Clean Agent System	*Activation of the direct injection clean agent system may limit or reduce the rate of a propagating thermal runaway event.* This system is activated by smoke detector operation (two or more detectors). The direct injection clean agent may limit or reduce the rate of a previously occurring propagating thermal runaway event.
Deflagration Protection	*Activation of the enclosure's deflagration venting system.* Deflagration or explosion as a result of combustion, expansion, or detonation, poses severe risks to life and property near an ESS. UL 9540A testing indicates that the cell off gasses include hydrogen, carbon monoxide, methane and other flammable hydrocarbons. When mixed with oxygen from the air, a flammable mixture may be formed. The E5S enclosure has been provided with a deflagration vent design in accordance with the requirements of NFPA 68. The system has been subject to both UL 9540A installation level testing and bespoke deflagration testing. The system has been primarily designed to protect from an off-gassing event involving three cells.

Thermal Isolation (Enclosure Insulation)	*Passive thermal propagation protection provided by insulation installed on the boundaries of the enclosure.* The insulating panels provided on the enclosure walls is anticipated to reduce conduction to the exterior surface of the enclosure thusly retarding fire spread to adjoining enclosures. The assessed strength of this barrier for the E5S enclosure is informed by both UL 9540A and bespoke fire testing. These will be analyzed and included in the final HMA report.
Thermal Isolation (Enclosure Fire Separation)	*Passive thermal propagation protection provided the enclosure's fire separation.* The enclosure's fire separation subdivides the enclosure into two separate fire compartments. This separation provides a strong barrier to limiting a flaming fire event to half of the enclosure. The assessed strength of this barrier for the E5S enclosure is informed by bespoke fire testing. These will be analyzed and included in the final HMA report.
Thermal Isolation (Module / Rack Separation)	*Passive thermal propagation protection provided by physical separation between modules within a rack and physical separation between racks within the enclosure.* The degree of separation provided between modules within rack and between racks acts to retard the rate of thermal runaway / fire propagation. This barrier is assessed to be relatively weak for most flaming fire scenarios but stronger for non-flaming thermal runaway scenarios. The assessed strength of this barrier for the E5S enclosure is informed by both UL 9540A and bespoke fire testing. These will be analyzed and included in the final HMA report.
Facility Design and Siting	*Placement of the facility such that adverse environmental effects such as flooding, vehicle impact, and fire impingement are mitigated or avoided. The strength of this barrier is dependent upon the site-specific aspects of the facility layout.* This barrier is intended to include analysis of the system in its location with respect to localized environmental hazards, adjacent structures, fire loads, and personnel exposures, and other generic environmental threats either to the system as posed by the environment or to the environment as posed by the system. While a specific spacing may be suitable for most ESS, it may not be sufficient spacing from a large fuel storage depot or an ambulatory care facility. Further, proper siting should include the type of environment the system is built in such as a flood plain, a high traffic area, a wetland, or an area prone to fire. The E5S enclosures are grouped in side-by-side pairs with 3.5 feet of space between each enclosure. Each pair is then spaced 21.75 ft from the next pair in groups totaling 5 pairs (10 E5S enclosures). The site consists of 4 total groups of enclosures separated by a minimum of 40' of space between them. If a fire evolves to the point it spreads beyond an enclosure, it is highly likely the pair will become involved. It is recommended that defensive firefighting be provided to mitigate further spread to adjacent pairs of enclosures. The additional separation between the pairs and the groups of enclosures helps to mitigate the potential for fire to spread throughout the site. The site is considered remote and not anticipated to have public traffic that could pose physical damage risk to the enclosures.
Emergency Response Plan / First Responders	*System operator plan to handle any and all emergency events. A site-specific emergency response plan should be developed. Effectiveness based on level of the subject matter expert (SME) / first responder training, knowledge of the specific ESS undergoing failure, coordination with fire department, etc.* First responders refer to site personnel, corporate employees, local technicians, and SMEs who may be the first to detect or respond to failure or fault in the system and alert fire services. The term first responders in this case does not refer to fire fighters or other fire service personnel, but to those who will be reporting the event or directing the fire

	service in regard to the risks posed by the system. The guidance from these individuals, as well as the information contained in the emergency response plan, will serve as the initial human response to the incident and have the greatest chance of containing the incident, if it is containable, to a reduced state. Depending on time to detection, along with time to first response and fire service response, the incident may have progressed through multiple consequence pathways, as single cell failure can propagate to adjacent modules and beyond in a matter of minutes. The ERP will be reviewed and the strength of this barrier will be expanded upon in the final HMA.
Fire Service Response	*Fire department response including active firefighting suppression. Effectiveness based on level of department knowledge and training to effectively respond both offensively and defensively during an ESS incident.* This barrier includes all aspects of the fire service response including the personnel, resources, knowledge, and overall comfort level brought to bear on the scene. Current industry training and emergency response planning point toward automatic dispatch of multiple trucks or departments/stations for ESS emergencies or multiple alarms in some jurisdictions. Response time, access, fire water supply and situational awareness (e.g., Detection Systems) will act as a multipliers, resulting in decisions which may save the currently impacted or adjacent systems or result in the loss of the entire facility. SFCFD does not have a HAZMAT team but utilizes the City of Sante Fe Fire Department with a response time of 24 minutes.

APPENDIX E – BOW TIE MODEL DIAGRAMS

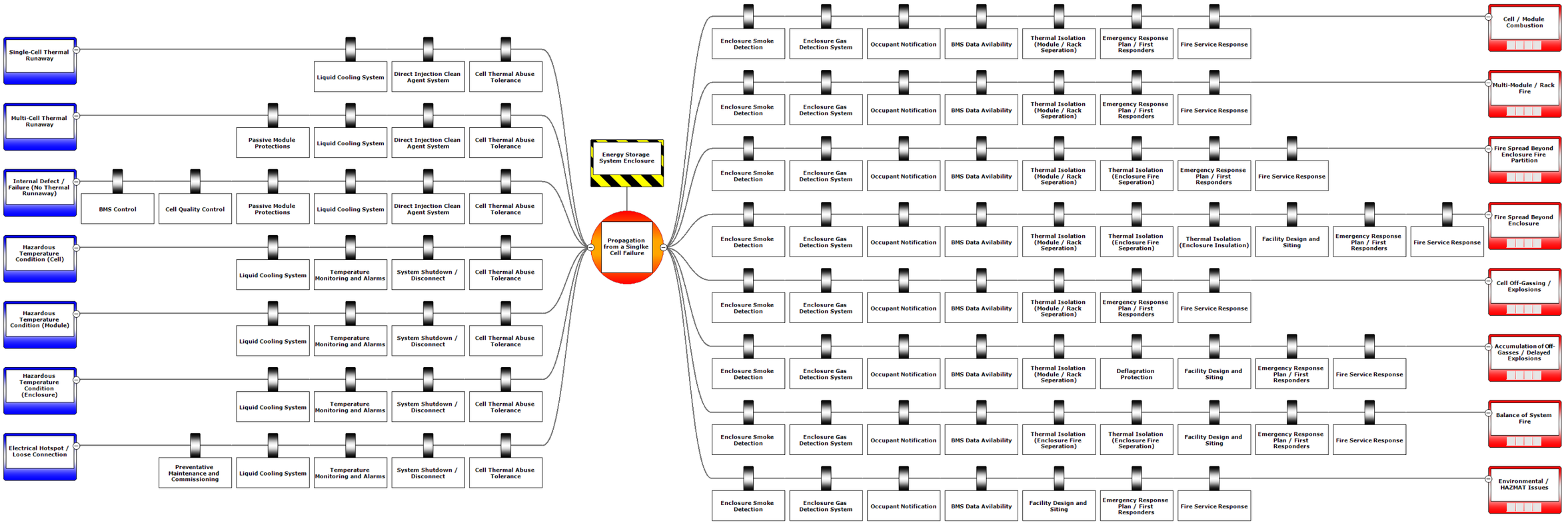


Figure E-1 – Thermal Runaway and Mechanical Failure Threat Pathways

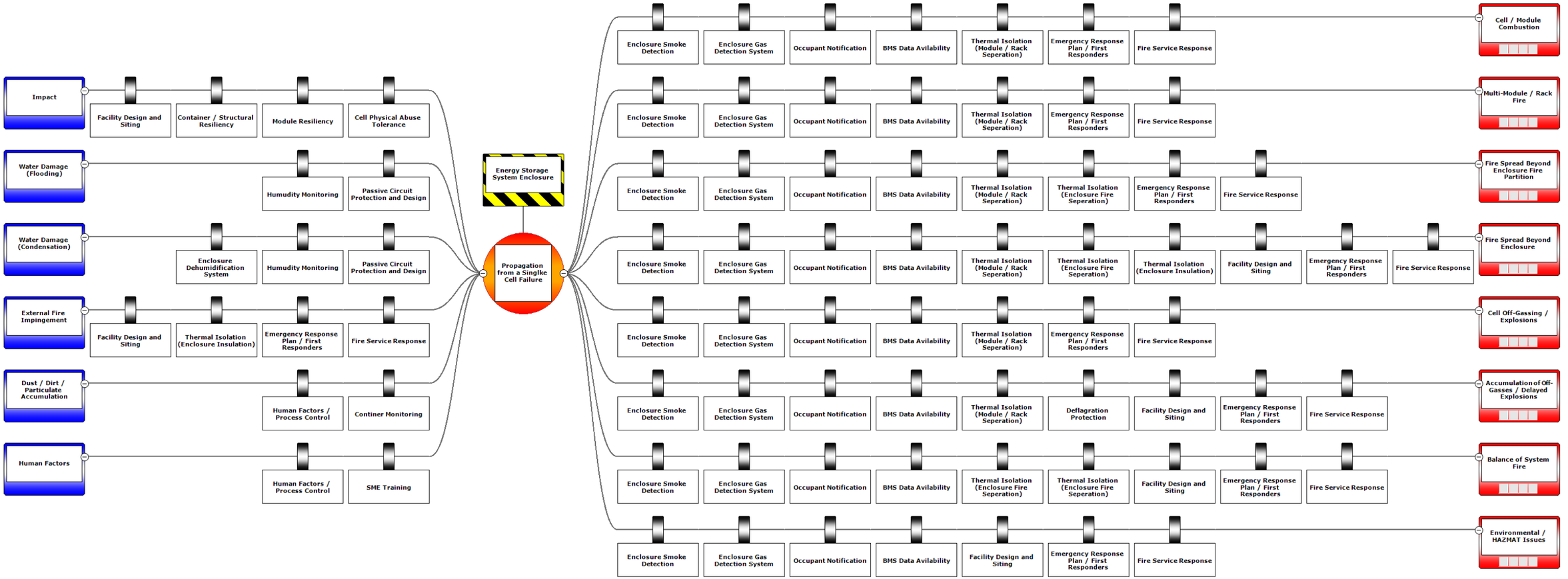


Figure E-2 – External Impact Failures Threat Pathways

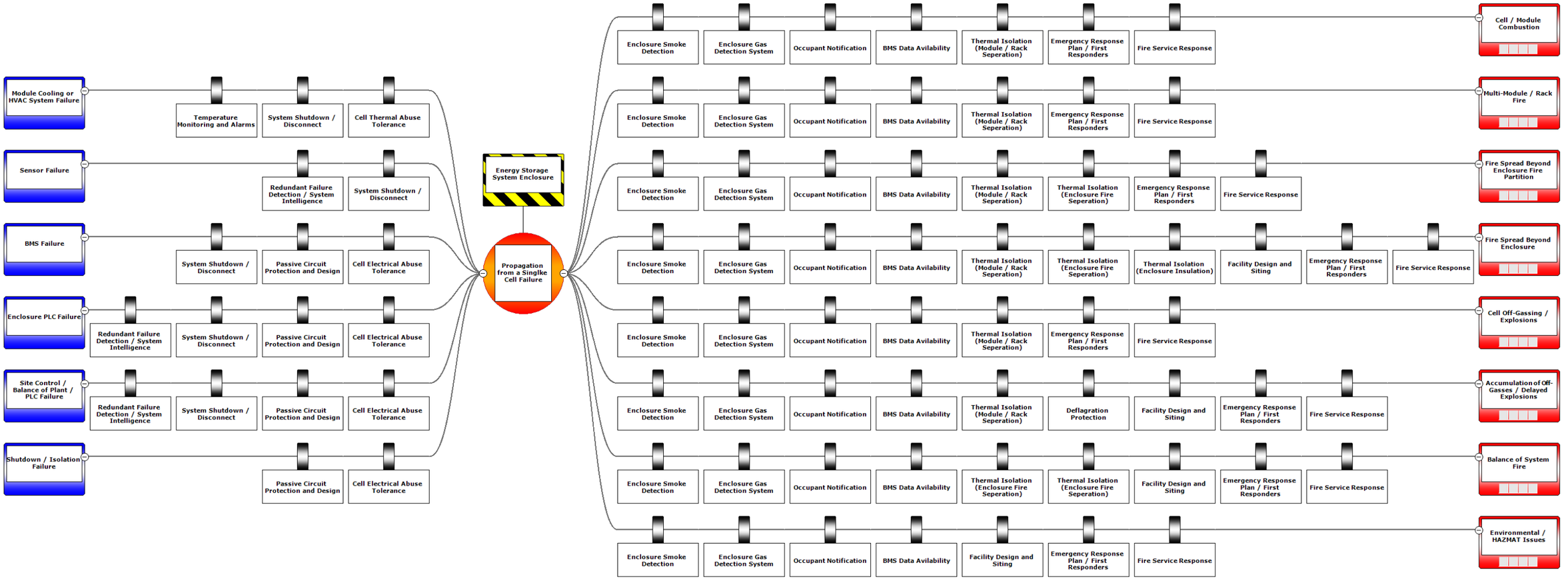


Figure E-3 – Control and Prevention System Failure Threat Pathways

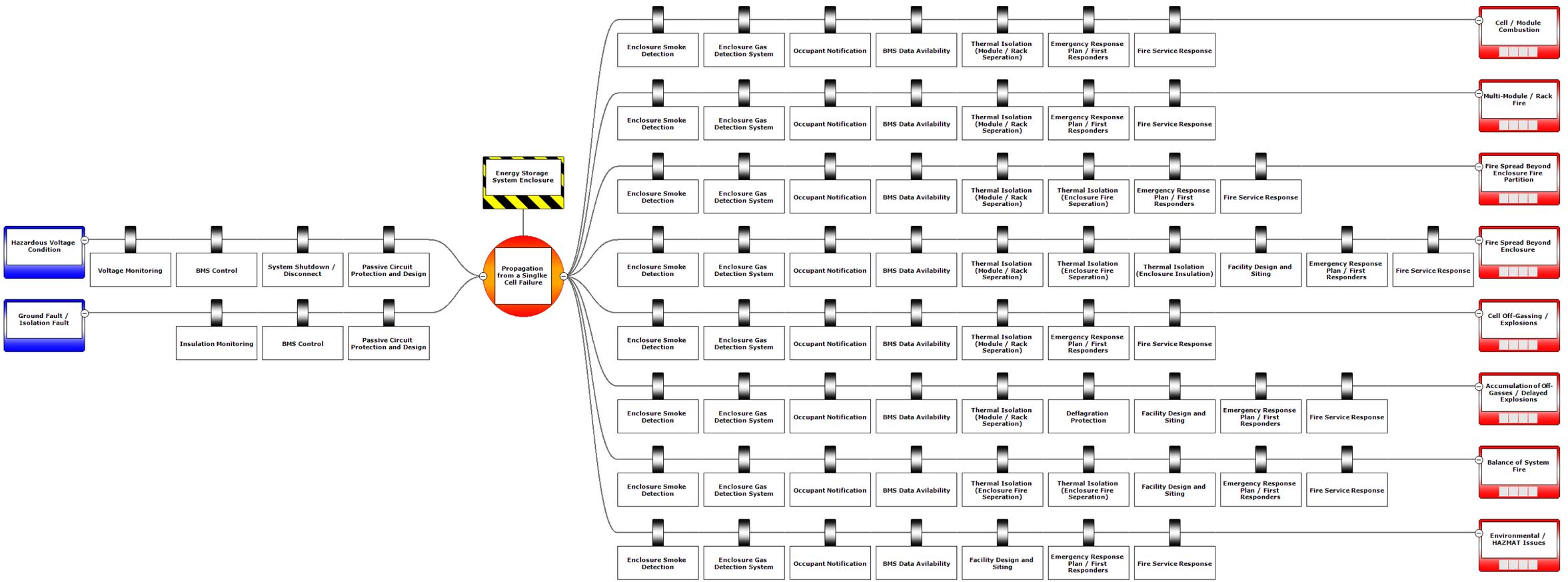


Figure E-4 – Electrical Failure Threat Pathways

APPENDIX F – UL 9540A FIRE TEST RESULTS

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