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| **TN #:** | 254406 |
| **Document Title:** | Apx M Biological Resources Management Plans, Apx N Cultural Technical Report, Apx O Geotechnical Report |
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| **Filer:** | Emily Capello |
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# Appendix M Biological Management Plans

# Appendix M.1 Bird and Bat Conservation Strategy

# Bird and Bat Conservation Strategy

## Perkins Renewable Energy Project

*Prepared for*

Intersect Power

**IP Perkins, LLC**
**and IP Perkins**
**BAAH, LLC**
**subsidiaries of Intersect Power, LLC**

**December 2023**

| **Agency Review Status** |
|---|
| Bureau of Land Management |
| U.S. Fish and Wildlife Service |
| California Department of Fish and Wildlife |

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## TABLES



## ATTACHMENTS

# LIST OF ACRONYMS

| | |
|---|---|
| APLIC | Avian Power Line Interaction Committee |
| BCC | Birds of Conservation Concern |
| BBCS | Bird and Bat Conservation Strategy |
| BLM | Bureau of Land Management |
| BOR | Bureau of Reclamation |
| CEQA | California Environmental Quality Act |
| ESA | Federal Endangered Species Act |
| Gen-tie | Generation tie line |
| MW | Megawatt |
| MBTA | Migratory Bird Treaty Act |
| NBMP | Nesting Bird Management Plan |
| NEPA | National Environmental Policy Act |
| O&M | Operation and maintenance |
| PV | Photovoltaic |
| ROD | Record of Decision |
| ROW | Right-of-way |
| TAG | Technical Advisory Group |
| USFWS | U.S. Fish and Wildlife Service |

# 1. INTRODUCTION

## 1.1. Project Summary

IP Perkins, LLC, and IP Perkins BAAH, LLC (Applicants or Proponents), subsidiaries of Intersect Power, LLC, propose to construct, operate and decommission the Perkins Renewable Energy Project (Project), a utility-scale solar photovoltaic (PV) electrical generating and storage facility, and associated infrastructure to generate and deliver renewable electricity to the statewide electricity transmission grid. The approximately 7,400-acre Project site is located in Imperial County east of El Centro, California (see POD [Plan of Development] Appendix A, Figure 1).

The proposed Project area includes on a combination of Bureau of Land Management (BLM)-managed lands, Bureau of Reclamation (BOR)-managed lands, and private lands. The Project 500kV loop-in transmission lines will traverse Bureau of Reclamation (BOR) lands. (see POD Appendix A, Figure 2). BLM public lands within the Project area are designated as Development Focus Area (DFA) by the Desert Renewable Energy Conservation Plan (DRECP) and associated Record of Decision (ROD), and thus, have been targeted for renewable energy development. Because the proposed Project is partially located on federal land under management of the BLM, the BLM is the lead agency under the National Environmental Policy Act (NEPA), 42 U.S.C. section 4321 et seq. California Energy Commission (CEC) will serve as the lead agency under the California Environmental Quality Act (CEQA).

The Project would generate and store approximately 500 to 1,150 megawatts (MW) of renewable electricity via arrays of solar photovoltaic (PV) panels, battery energy storage system (BESS), and appurtenant facilities. The Project would construct a new gen-tie line that would connect the project substation(s) to a new high-voltage breaker and a half (BAAH) switchyard. From the BAAH switchyard, two new 500 kV loop-in transmission lines would be constructed to interconnect to the existing SDG&E 500 kV transmission line that travels east-west just south of the Project site, crossing BOR lands and terminating at the Imperial Valley Substation (Substation), southwest of El Centro. The transmission lines would span the All-American Canal prior to terminating at the SDG&E transmission line. No construction would occur within the reduced utility corridor along the Project site's southern and western boundaries. For a complete Project description and summary of the Project location, refer to the POD main text.

Clean, renewable energy generation will have an overall benefit to plant and wildlife species on a local, regional, and global scale by replacing fossil fuel energy sources, reducing toxic emissions, and mitigating the effects of climate change on ecosystems.

## 1.2. Purpose

IP Perkins, LLC and IP Perkins BAAH, LLC, is voluntarily proposing this Bird and Bat Conservation Strategy (BBCS) to set forth the measures it will implement to avoid, minimize, or mitigate for potential adverse effects of the Project to birds and bats. Accordingly, IP Perkins, LLC and IP Perkins BAAH, LLC, will collect and evaluate data during the construction, operations and maintenance (O&M), and decommissioning phases of the Project and will implement adaptive management measures as necessary and appropriate to minimize or mitigate impacts to birds and bats. IP Perkins, LLC, does not anticipate that construction, operations, or decommissioning of the Project will cause unauthorized take or prohibited disturbance of bird or bat species; however, some level of injury and/or mortality to species covered under the Migratory Bird Treaty Act (MBTA) may occur.

This BBCS was prepared according to guidelines recommended by the U.S. Fish and Wildlife Service (USFWS, 2010a and 2010b). The BBCS describes the proposed Project components;

summarizes baseline data regarding birds and bats in the Project vicinity; assesses potential risks to those species that could result from Project construction, operation, and decommissioning; and describes conservation measures to be implemented to minimize those risks.

For the purposes of this plan, the Project site refers to the area surveyed in Spring 2023 (Ironwood, 2023); the Project development area refers to the area inside the Project site that will be developed (including access roads and the gen-tie route), which excludes the designated utility corridors noted above. The Project area refers to all land immediately surrounding the Project site, and the Project vicinity refers to the Imperial Valley region, including multiple land uses on public and private lands.

## 1.3. Regulatory Setting

This BBCS was prepared to ensure Project compliance with state and federal statutes protecting native birds, as well as NEPA and California Environmental Quality Act (CEQA) requirements to disclose environmental effects of the Project and provide public opportunity for comment. These applicable statutes are summarized below:

### 1.3.1. Federal Regulations

**Endangered Species Act of 1973.** The Endangered Species Act (ESA) (16 USC 1531 et seq.) and subsequent amendments protect endangered and threatened species and the ecosystems upon which they depend. Section 9 prohibits the take of any fish or wildlife species listed as endangered and most species listed as threatened, and defines *take* to mean “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” *Harm* is defined to mean “any act that kills or injures the species, including significant habitat modification.” *Harass* is further defined as actions that create the likelihood of injury to listed species to an extent as to significantly disrupt normal behavior patterns which include breeding, feeding, and sheltering.

The ESA also includes mechanisms for allowing exceptions to the Section 9 take prohibitions. Section 7 requires federal agencies, in consultation with the U.S. Fish and Wildlife Service to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of threatened or endangered wildlife species or result in the destruction or adverse modification of critical habitat for these species. Under Section 7, USFWS may authorize limited, incidental take (i.e., incidental to an otherwise lawful activity) of listed species in a Biological Opinion.

The Project is not expected to affect federally listed threatened or endangered bird or bat species, though it is possible that such federally listed migratory species may be found in the Project vicinity during seasonal migrations.

**Migratory Bird Treaty Act.** The Migratory Bird Treaty Act (16 U.S.C. §§ 703, et seq.; MBTA) established a prohibition to “pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird,” except where specifically authorized by the USFWS (e.g., hunting waterfowl and upland game species). Under the MBTA, *migratory bird* is broadly defined as “any species or family of birds that live, reproduce or migrate within or across international borders at some point during their annual life cycle” and thus applies to most native bird species. Except where specifically permitted, most actions that cause bird mortality or result in the permanent or temporary possession of migratory birds or any associated body parts, feathers, eggs, or nests, constitute violations of the MBTA.

The USFWS recommends that electric utilities and utility-scale renewable energy project developers prepare and implement Bird and Bat Conservation Strategies to minimize the incidental take of resident and migratory birds.

**Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds.** Directs federal agencies to review the effects of actions and agency plans on migratory birds according to NEPA or other established environmental review processes, with emphasis on species of concern (Section 6 of the order) and identify unintentional take reasonably attributable to agency actions, focusing first on species of concern, priority habitats, and key risk factors and to develop and use principles, standards, and practices to lessen the amount of unintentional take (Section 9).

**Desert Renewable Energy Conservation Plan (DRECP), Land Use Plan Amendment to the California Desert Conservation Area Plan.** The purpose of the DRECP is to conserve and manage plant and wildlife communities in the desert regions of California while facilitating the timely permitting of compatible renewable energy projects (BLM, 2015). The DRECP covers over 10 million acres of BLM land. The BLM Proposed Land Use Plan Amendment (LUPA) and Final Environmental Impact Statement for the DRECP was released in November 2015 and the BLM Record of Decision (ROD) for the DRECP was issued in September 2016 (BLM, 2016). The Project site is within the Colorado Desert ecoregion subsection of the DRECP area. The DRECP LUPA identifies this area as a Development Focus Area (DFA). The DRECP LUPA identifies a series of Conservation Management Actions (CMAs) to be implemented on BLM lands including CMA LUPA BIO-17, which requires renewable energy projects to develop and implement a Project specific BBCS.

### 1.3.2. State Regulations

**California Endangered Species Act.** The California Endangered Species Act (CESA) prohibits take of wildlife listed as threatened or endangered and defines "*take*" as any action or attempt to "hunt, pursue, catch, capture, or kill." CESA also allows exceptions for take that occurs incidental to otherwise lawful activities. Approval requires minimization and full mitigation of projected impacts. For projects that affect a species listed under both CESA and the federal ESA, compliance with the federal ESA will satisfy CESA if CDFW determines that the federal incidental take authorization is consistent with CESA under Fish and Game Code § 2080.1. For projects that will result in take of a species listed under CESA but not under the federal ESA, the applicants must apply for a take permit under § 2081(b). No CESA listed bird species are expected to be taken by the Project.

**Native Birds (California Fish and Game Code, §§ 3503, 3503.5 and 3513).** California Fish and Game Code § 3503 prohibits take, possession, or needless destruction of bird nests or eggs except as otherwise provided by the Code; § 3503.5 prohibits take or possession of birds of prey or their eggs except as otherwise provided by the Code; and § 3513 provides for the adoption of the MBTA's provisions (above). Except for a few non-native species (e.g., European starling (*Sturnus vulgaris*)), the take of any bird or loss of active bird nests or young is regulated by these statutes. As with the MBTA, these statutes offer no statutory or regulatory mechanism for obtaining an incidental take permit for the loss of non-game migratory birds.

**California Fully Protected Species.** Prior to enactment of CESA and the federal ESA, California enacted laws to "fully protect" designated wildlife species from take, including hunting, harvesting, and other activities (Fish and Game Code § 3511). Unlike the subsequent CESA and ESA, there was no provision for authorized take of designated fully protected species. Currently, 36 fish and wildlife species are designated as fully protected, including golden eagle and several other desert species. No California fully protected bird or bat species are expected to be taken by this Project.

# 2. AGENCY COORDINATION

IP Perkins, LLC, will initiate coordination with state and federal resource agencies (BLM, BOR, USFWS, and California Department of Fish and Wildlife (CDFW)) to discuss environmental review of the Project, including review of potential impacts to native birds and bats, and minimization or mitigation of those impacts through the CEQA and NEPA processes. The results of coordination will be incorporated into the CEQA and NEPA documents, as drafted.

# 3. SITING

## 3.1. Project Site Vegetation and Habitat

Sonoran creosote bush scrub is the dominant natural vegetation community. Desert dry wash woodland/microphyll woodland and alkali goldenbush desert scrub are found in thin strips near the central portion of the western Project site and in the southern portion of the transmission corridor. Arrow weed thickets and common reed marsh are located within the southern portion of the transmission corridor, along the edges of the All-American Canal. Desert dry wash woodland is a sensitive vegetation community recognized with a rarity rank of S3 (CDFW 2022a). Vegetation communities on the Project site are described in further detail and mapped in the Project's Biological Resources Technical Report (BRTR) (Ironwood, 2023) (see POD Appendix S).

**Sonoran Creosote Bush Scrub.** Sonoran creosote bush scrub is dominant vegetation community throughout most of the Project site and transmission lines. Creosote bush scrub and white bursage are co-dominants in the shrub canopy with only a few shrubs sparsely distributed that include Emory's indigo (*Psorothmanus emoryi*) and white bursage (*Ambrosia dumosa*), cheesebush (*Ambrosia salsola*), and ephedra (*Ephedra spp*) in some areas with primarily an understory of annual plants. Special-status bird species that were observed in Sonoran creosote bush scrub include burrowing owl (*Athene cunicularia hypugaea*), loggerhead shrike (*Lanius ludovicianus*), Swainson's hawk (*Buteo swainsoni*), and black-tailed gnatcatcher (*Polioptila melanura*). Other special-status bird and bat species with potential to occur are listed in Table 1 and common native bird species that were observed are listed in Table 2.

**Desert Dry Wash Woodland/Microphyll Woodland.** Desert dry wash woodland (also called microphyll woodland) is a sensitive vegetation community recognized with a rarity rank of S3 (CDFW 2022a). It is as an open to relatively densely covered, drought-deciduous, microphyllous (small, compound leaves) riparian scrub woodland, often sup-ported by dry braided wash channels that convey water and sediment to the vegetation. This vegetation community on the Project site is characterized by mesquite thickets that is synonymous to mesquite (*Prosopis glandulosa*) woodland alliance (Sawyer et al. 2009) and Sonoran - Coloradan Semi Desert Wash Woodland / Scrub (NVCS). This vegetation community has mesquite trees that cover at least 2-3 percent of the absolute cover for trees and shrubs and was mapped as a patch within the western parcel.

**Alkali Goldenbush Desert Scrub.** Alkali goldenbush desert scrub has a state rarity rank of S3 (CDFW 2023). Within the Project site, alkali goldenbush forms an open shrub layer and on moist or seasonally dry flats, and margins of intermittently saturated vegetated swales. The tree layer, consisting of mesquite, is mostly sparse if present. Stands generally have low cover of vegetation and may be sparse (<10% total vegetation).

**Arrow Weed Thickets.** Arrow weed thickets have a state rarity rank of S3 (CDFW 2023). This vegetation community is characterized by arrow weed that is more than or equal to 2% of absolute cover with a sparse herbaceous layer of seasonal annuals. This vegetation is usually found near seasonally flooded washes and stream borders. Within the Project site, this vegetation community occurs only within a small portion of the transmission corridor bordering the southern edge of the All-American Canal.

**Common Reed Marsh.** This vegetation community is characterized by more than 2% absolute cover and more than 50% relative cover in the herbaceous layer. This vegetation community is sometimes considered invasive along waterways and wetlands (USDA 2022) and is only located within the edges of the All-American Canal of the transmission corridor.

# 4. BIRD AND BAT SPECIES OF THE PROJECT VICINITY

## 4.1. Information Complied to Date (Pre-Construction Surveys)

During all wildlife surveys for the Project, biologists recorded all wildlife species observed, regardless of status. The BRTR provides a compilation of special-status wildlife with potential to occur in the Project vicinity, and evaluates probability of occurrence for each species, based on habitat, elevational and geographic ranges, and field survey results. The complete methods and results of the surveys are provided in the BRTR (Ironwood, 2023). Noteworthy avian observations are depicted in Figure 10 of the BRTR (see POD Appendix S).

Most of the birds in the Project vicinity have no special conservation status, but all native birds are protected under the federal MBTA and California Fish and Game Code. In addition to the common birds of the area, a list of special-status bird and bat species with potential to occur in the vicinity of the Project was compiled. Special status criteria include:

- Officially listed, or candidate for listing, by California or the federal government as endangered, threatened, or rare under California Endangered Species Act (CESA) or federal Endangered Species Act (ESA) (CDFW, 2022c, 2022e)
- Birds listed in the USFWS's Birds of Conservation Concern 2021
- Birds or bats which meet the criteria for listing, even if not currently included on any list, as described in Section 15380 of the California Environmental Quality Act (CEQA)
- BLM Sensitive Species (BLM, 2014; CDFW, 2022b, 2022d)
- Birds or bats identified by CDFW as Species of Special Concern (CDFW, 2022b, 2022d)
- Birds or bats included in the CDFW lists of Special Plants or Special Animals (CDFW, 2022b, 2022d)
- Birds or bats protected under other statutes or regulations (e.g., Bald and Golden Eagle Protection Act, etc.)
- Considered special-status species in local or regional plans, polices, or regulations such as the NECO Plan/EIS

All special-status birds or bats identified by this literature review, and others known from the general region, are included in Table 1, which summarizes the natural history, agency status, and occurrence probability on the site for each species. Table 2 includes all avian observations documented during biological surveys in Spring 2023.

**Table 1. Special-status Birds and Bats with Potential to Occur in the Project Area**

| Species | Habitat Requirements | Conservation Status | Potential to Occur on Project Site |
|---|---|---|---|
| **BIRDS** | | | |
| Western | Typically found in open, dry annual or | Federal: | ▪ Present |

| Species | Habitat Requirements | Conservation Status | Potential to Occur on Project Site |
|---|---|---|---|
| burrowing owl *Athene cunicularia hypugaea* | perennial grasslands, deserts and scrublands characterized by low-growing vegetation. Subterranean nesters that are dependent upon burrows made by other animals for nest shelters. | BLM Sensitive, BCC, FOC State: SSC | ▪ Five live individuals and nine active burrows observed on Project site during surveys. |
| Swainson's hawk *Buteo swainsoni* | Require large areas of open landscape for foraging, including grasslands and agricultural lands that provide low-growing vegetation for hunting and high rodent prey populations. Swainson's hawks typically nest in large native trees such as valley oak, cottonwood, walnut, and willow, and occasionally in nonnative trees, such as eucalyptus within riparian woodlands, roadside trees, trees along field borders, isolated trees, small groves, and on the edges of remnant oak woodlands. | Federal: BLM Sensitive (Nesting), FOC State: ST | ▪ Present<br>▪ Nesting – Low<br>▪ Two observations of flyovers were documented during surveys. There are no CNDDB records in Imperial County, but historical observation from 1978 in area (Ebird 2023). |
| Northern harrier *Circus hudsonius* | This species does not commonly breed in desert regions of California, where suitable habitat is limited, but winters broadly throughout California in areas with suitable habitat. Northern harriers forage in open habitats including deserts, pasturelands, grasslands, and old fields. | Federal: BCC (nesting) State: SSC | ▪ Nesting – Low<br>▪ Wintering or migration – Moderate<br>▪ Not observed. Nearest record approximately 30 miles east of Project site (CNDDB 2023) and observed in area 2021 (Ebird 2023). |
| Prairie falcon *Falco mexicanus* | Occurs in annual grasslands to alpine meadows, but associated primarily with perennial grasslands, savannahs, rangeland, some agricultural fields, and desert scrub areas. Typically nests cliffs and bluffs. | Federal: None State: WL (nesting) | ▪ Nesting – Low<br>▪ Foraging – Moderate<br>▪ Not observed. Nearest record approximately 30 miles east of Project site (CNDDB 2023) and observed in area 2021 (Ebird 2023). |
| American peregrine falcon *Falco peregrinus anatum* | Rare in the arid southeast, occur and are suspected to breed in the lower Colorado River Valley. Peregrine falcons require open habitat for foraging and prefer breeding sites near water. Nesting habitat includes cliffs, steep banks, dunes, mounds, and some human-made structures. | Federal: None State: CFP, CDF-S (nesting) | ▪ Nesting – Low<br>▪ Foraging – Moderate<br>▪ Not observed. No CNDDB records in Imperial County but observed recently in 2011 within area (Ebird 2023) |
| Loggerhead shrike (Nesting) *Lanius ludovicianus* | Open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches. Highest density occurs in open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinyon-juniper, juniper, desert riparian, and Joshua tree habitats. | Federal: None State: SSC (nesting) | ▪ Present<br>▪ Eleven observations on Project site during surveys. |
| Black-tailed gnatcatcher *Polioptila melanura* | A year-round resident in southwestern United States and central and northern Mexico, in California the black-tailed gnatcatcher is found in the southeast desert wash habitat from Palm Springs and Joshua Tree National Park south, and along the Colorado River. It is now rare in eastern Mojave Desert north to the | Federal: None State: WL | ▪ Present<br>▪ Nesting – Moderate<br>▪ Eight observations were recorded in during surveys. |

| Species | Habitat Requirements | Conservation Status | Potential to Occur on Project Site |
|---|---|---|---|
| | Amargosa River, Inyo County. This species nests primarily in wooded desert wash habitat, but also occurs in creosote scrub habitat during the non-breeding season. | | |
| California black rail *Laterallus jamaicensis coturniculus* | Small populations occur in the freshwater marshes of the Colorado River. | Federal: BLM Sensitive State: CFP | ▪ Moderate ▪ Nesting – Low ▪ Not observed. Occupied habitat in freshwater marsh east of gen-tie corridor. (CNDDB 2023). They may fly over the Project site but nesting and foraging habitat is marginal within transmission corridor that crosses All-American Canal. |
| Ridgway's [Yuma Ridgway's] rail *Rallus obsoletus yumanensis* | In California, nests in freshwater marshes and wetlands along the lower Colorado River, the Coachella Canal, the Imperial Valley, and the upper end of the Salton Sea at the Whitewater River delta and Salt Creek. | Federal: FE State: ST, CFP | ▪ Moderate ▪ Nesting – Low ▪ Not observed. Occupied habitat in freshwater marsh east of gen-tie corridor (CNDDB 2023). They may fly over the Project site, but nesting and foraging habitat is marginal within transmission corridor that crosses All-American Canal. |
| Bank swallow *Riparia riparia* | A neotropical migrant found primarily in riparian and other lowland habitats in California west of the deserts during the spring-fall period. Uses holes dug in cliffs and riverbanks for cover. Will also roost on logs, shoreline vegetation, and telephone wires. | Federal: BLM Sensitive State: ST | ▪ Nesting – Low ▪ Migration – Moderate ▪ Not observed. No CNDDB records in Imperial County, but observed in the area in 2014 (Ebird 2023).No suitable nesting habitat. |
| **BATS** | | | |
| Western yellow bat *Lasiurus xanthinus* | Recorded below 600 m (2000 ft) in valley foothill riparian, desert riparian, desert wash, and palm oasis habitats. This species occurs year-round in California. | Federal: BLM Sensitive, BCC, FOC State: SSC WBWG: H | ▪ Present ▪ Five live individuals and nine active burrows observed on Project site during surveys. |

**Conservation Status**
*Federal:*
FE = Federally listed endangered: species in danger of extinction throughout a significant portion of its range
BCC = Fish and Wildlife Service: Birds of Conservation Concern
FOC = DRECP Focus and Planning Species

*State:*
SSC = State Species of Special Concern CFP = California Fully Protected
ST = State listed as threatened WL = State watch list
CDF-S = California Department of Forestry & Fire Protection Sensitive

*Western Bat Working Group (WBWG):*
H = imperiled or at high risk of imperilment

## Table 2. Avian Species Observed in the Perkins Renewable Energy Project Area (Spring 2023)

| Common Name | Scientific Name | Number of Individuals Observed |
|---|---|---|
| **Birds** | | |
| American coot | *Fulica americana* | 1 |
| Ash-throated flycatcher | *Myiarchus cinerascens* | 1 |
| Barn swallow | *Hirundo rustica* | 25 |
| Black-tailed gnatcatcher | *Polioptila melanura* | 4 |
| Black-throated sparrow | *Amphispiza bilineata* | 3 |
| Brewer’s blackbird | *Euphagus cyanocephalus* | 3 |
| Brewer’s sparrow | *Spizella breweri* | 2 |
| Cactus wren | *Campylorhynchus brunneicapillus* | 2 |
| Canada goose | *Branta canadensis* | 3 |
| Cliff swallow | *Petrochelidon pyrrhonota* | 123 |
| Common raven | *Corvus corax* | 10 |
| Common yellowthroat | *Geothlypis trichas* | 8 |
| Costa’s hummingbird | *Calypte costae* | 1 |
| Double-crested cormorant | *Phalacrocorax auritus* | 36 |
| European starling | *Sturnus vulgaris* | 5 |
| Great blue heron | *Ardea herodias* | 2 |
| House finch | *Haemorhous mexicanus* | 10 |
| Lesser nighthawk | *Chordeiles acutipennis* | 18 |
| Loggerhead shrike | *Lanius ludovicianus* | 7 |
| Mallard | *Anas platyrhynchos* | 3 |
| Mourning dove | *Zenaida macroura* | 47 |
| Northern flicker | *Colaptes auratus* | 1 |
| Northern rough-winged swallow | *Stelgidopteryx serripennis* | 54 |
| Osprey | *Pandion haliaetus* | 1 |
| Red-tailed hawk | *Buteo jamaicensis* | 4 |
| Red-winged blackbird | *Agelaius phoeniceus* | 10 |
| Ruby crowned kinglet | *Corthylio calendula* | 3 |
| Sagebrush sparrow | *Artemisiospiza nevadensis* | 1 |
| Sage Thrasher | *Oreoscoptes montanus* | 1 |
| Savannah sparrow | *Passerculus sandwichensis* | 1 |
| Song sparrow | *Melospiza melodia* | 1 |
| Swainson’s hawk | *Buteo swainsoni* | 5 |
| Turkey vulture | *Cathartes aura* | 8 |
| Verdin | *Auriparus flaviceps* | 16 |
| Violet green swallow | *Tachycineta thalassina* | 30 |
| Western kingbird | *Tyrannus verticalis* | 4 |
| Whimbrel | *Numenius phaeopus* | 16 |
| White-throated swift | *Aeronautes saxatalis* | 6 |
| Wilson’s warbler | *Cardellina pusilla* | 2 |
| Yellow-rumped warbler | *Setophaga coronata* | 10 |
| Yellow-rumped (Audubon’s) warbler | *Setophaga auduboni* | 3 |

## 4.2. State and Federally Listed Threatened or Endangered Species

### Yuma Ridgway’s Rail: FE, CFP

Yuma Ridgway's rail *(Rallus obsoletus yumanensis),* nests in freshwater marshes with less than one foot of water depth, low stem density, and lack of residual vegetation (Conway et al. 1993, Gould 1975). Preferred habitat is emergent marsh dominated by southern cattail (*Typha domingensis*) or California bulrush (*Schoenoplectus acutus*). Yuma Ridgway's rail is found along the lower Colorado River southward to its terminus at the Sea of Cortez, along the Gila River drainage in Arizona, at Lake Mead (and the Overton Arm) and its local tributaries, along the Virgin River in Nevada and Utah, and at the Salton Sea/Imperial Valley areas of California (BLM and USFWS 2014). No Yuma Ridgway's rails were observed during 2023 surveys or avian counts on the Project site. Although there is occupied habitat within a mile of the Project site, in seepage areas along the All-American Canal, there is only marginally suitable foraging habitat along the All-American Canal within portions of the Project transmission corridor due to the mature stands of common reed that would be prohibitive of easy movement for foraging and nesting for the species.

## 4.3. California Fully Protected Species

### American Peregrine Falcon: CFP, CDF-S (nesting)

The American peregrine falcon (*Falco peregrinus anatum*) was formerly listed under CESA and ESA but has been delisted under both Acts. In California, range is primarily central to northern California, with wintering habitat and (more recently) nesting occurrences located in southern California. Migrants occur along the coast and in the western Sierra Nevada in spring and fall. It breeds mostly in woodland, forest, and coastal habitats, and favors open landscapes with cliffs as nest sites. They are found irregularly in the southern desert region, generally during migratory and winter seasons, but also during breeding season in recent years. They nested historically in desert mountain ranges near the Colorado River (Rosenberg et al. 1991; Patten et al. 2003) and may be re-occupying this historical part of their nesting range as their populations recover. Their diet consists primarily of birds and bats (CDFW 2022a). Waterfowl and shorebirds make up a large proportion of their prey, and nest sites are often within foraging range of large water bodies.

No American peregrine falcons were observed on the Project site during 2023 surveys or avian counts. Suitable migratory or foraging habitat is present throughout the Project site, but no suitable nesting habitat is present.

### California Black Rail: CFP, BLM-S

California black rail (*Laterallus jamaicensis coturniculus*) inhabits the freshwater marshes of the Colorado River. This species occurs most commonly in tidal emergent wetlands dominated by pickleweed, or in brackish marshes supporting bulrushes in association with pickleweed (Manolis 1977). Typically occurs in the high wetland zones near upper limit of tidal flooding, not in low wetland areas with considerable annual and/or daily fluctuations in water levels. Along the Colorado River, dense bulrush stands, shallow water, and gently sloping shorelines. During extreme high tides, may depend on upper wetland zone and adjoining upland or freshwater wetland vegetation for cover (Repking and Ohmart 1977).

No California black rails were observed during 2023 surveys or avian counts. There is suitable foraging only in the portion of the transmission corridor within the All-American Canal, but no suitable nesting habitat.

## 4.4. CDFW Species of Special Concern

### Western Burrowing Owl: SSC, BCC, BLM-S, FOC

The Western burrowing owl (*Athene cunicularia hypugaea*) inhabits arid lands throughout much of the western United States and southern interior of western Canada (Haug et al. 1993). Suitable habitat for western burrowing owl includes open habitat with available burrowing opportunities, including agricultural fields (active and fallow), creosote scrub, desert saltbush, ephemeral washes, and ruderal areas.

Burrowing owls are unique among the North American owls in that they nest and roost in abandoned burrows, especially those created by ground squirrels, kit fox, desert tortoise, and other wildlife. Burrowing owls have a strong affinity for previously occupied nesting and wintering sites and will often return to previously used burrows, particularly if they had successful reproduction in previous years (Gervais et al. 2008). They generally depend on other species to dig suitable burrows for use but may also use anthropogenic surrogate burrows such as rubble piles or drainage pipes. If formerly occupied burrows are badly damaged or collapsed, burrowing owls cannot repair them and must seek alternate sites. The southern California breeding season (defined as the time from pair bonding of adults to fledging of the offspring) generally occurs from February to August, with peak breeding activity from April through July (Haug et al. 1993).

In the Colorado Desert, burrowing owls generally occur at low densities in scattered locations, but they can be found in much higher densities near agricultural lands where rodent and insect prey tend to be more abundant (Gervais et al. 2008). Burrowing owls tend to be opportunistic feeders, and a large portion of their diet consists of beetles, grasshoppers, and other large arthropods. The consumption of insects increases during the breeding season (Haug et al. 1993). Small mammals, especially mice and voles (*Microtus and Peromyscus spp*.) are important food items. Other prey animals include herpetofauna, young cottontail rabbits, bats, and birds such as sparrows and horned larks.

Five live individuals were observed during 2023 surveys. Nine active burrows were observed. Two carcasses were observed.

## Loggerhead Shrike: SSC (nesting)

Loggerhead shrikes (*Lanius ludovicianus*) are small predatory birds that are common year-round residents throughout most of the southern portion of their range, including southern California. In southern California, they are generally much more common in interior desert regions than along the coast (Humple 2008). They can be found within lowland, open habitat types, including creosote scrub and other desert habitats, sage scrub, non-native grasslands, chaparral, riparian, croplands, and areas characterized by open scattered trees and shrubs. Loss of habitat to agriculture, development, and invasive species is a major threat; this species has shown a significant decline in the Sonoran Desert (Humple 2008). Loggerhead shrikes initiate their breeding season in February and may raise a second brood as late as July; they often re-nest if their first nest fails or to raise a second brood (Yosef 1996). In general, loggerhead shrikes prey upon large insects, small birds, amphibians, reptiles, and small rodents over open ground within areas of short vegetation, usually impaling prey on thorns, wire barbs, or sharp twigs to cache for later feeding (Yosef 1996).

Suitable foraging and nesting habitat for loggerhead shrike is found throughout the Project site. Eleven observations of live individuals were documented during all 2023 surveys and avian counts.

## Northern Harrier: SSC, BCC (nesting)

Northern harrier (*Circus cyaneus*) inhabits most of California at various times of the year and is found up to 3000 m elevation. Northern harriers frequent meadows, grasslands, open rangelands, desert sinks, fresh and saltwater emergent wetlands. Nesting occurs on the ground at the edge of marshes, in wetlands or along lakes and rivers, or less commonly in grasslands and sagebrush flats. It is a widespread winter resident and migrant in suitable habitat. They primarily feed on small mammals, birds, frogs, small reptiles, crustaceans, and insects. (CDFW 2022a).

No northern harriers were observed during 2023 surveys or avian counts on the Project site. There is suitable foraging throughout the Project site, but no suitable nesting habitat.

## 4.5. BLM Sensitive Species

### Swainson's Hawk: BLM-S (nesting), FOC

Swainson's hawk (*Buteo swainsoni*) breeds in open habitats throughout much of the western United States and Canada, and in northern Mexico. In California, breeding populations of Swainson's hawks occur in desert, shrub and grasslands, and agricultural habitats with tree rows; however, most of the state's breeding sites are in the Great Basin and Central Valley (Woodbridge 1998). The only desert breeding occurrences are in the Antelope Valley, over 200 miles northwest of the Project site. These birds favor open habitats for foraging, and are near- exclusive insectivores as adults, but may also forage on small mammals and reptiles.

Two live individuals were observed during 2023 surveys or avian counts. The Project site provides potential migratory foraging habitat but is outside the nesting range.

### Bank Swallow: BLM-S (nesting)

Bank swallow (*Riparia riparia*) is a neotropical migrant found primarily in riparian and other lowland habitats in California west of the deserts during the spring-fall period. In summer, restricted to riparian, lacustrine, and coastal areas with vertical banks, bluffs, and cliffs with fine-textured or sandy soils, into which it digs nesting holes. In migration, flocks with other swallows over many open habitats. This species uses holes dug in cliffs and riverbanks for cover. Will also roost on logs, shoreline vegetation, and telephone wires.

No bank swallows were observed during 2023 surveys or avian counts on the Project site. There is suitable foraging habitat throughout the Project site, but no suitable nesting habitat.

## 4.6. CDFW Watch List

### Prairie Falcon: WL (nesting)

The prairie falcon (*Falco mexicanus*) is on the CDFW watch list and is a USFWS Bird of Conservation Concern. It inhabits dry environments in the North American west from southern Canada to central Mexico. It is found in open habitat at all elevations up to 3,350 m, but is associated primarily with perennial grasslands, savannahs, rangeland, some agricultural fields, and desert scrub areas. Prairie falcons require cliffs or bluffs for nesting though will sometimes nest in trees, on power line structures, on buildings, or inside caves or stone quarries. Ground squirrels and horned larks are the primary food source, but prairie falcons will also prey on lizards, other small birds, and small rodents (CDFW 2022a).

Prairie falcon was not observed during 2023 surveys. The entire Project site contains suitable foraging habitat for this species but does not have suitable nesting habitat.

### Black-tailed Gnatcatcher: WL

Black-tailed gnatcatchers (*Polioptila melanura*) are permanent residents from southeastern California and Arizona to southern Texas and northern Mexico. They are found in arid scrublands, desert brush, and dry washes amongst creosote bush, ocotillo, mesquite, paloverdes, and cactus. They live in pairs all year-round, defend their territory, and forage for small insects amongst low shrubs and trees. Their nests are cup shaped and typically placed in shrubs 2-3ft above ground.

Eight live individuals were observed during 2023 surveys and avian counts. The Project site contains suitable foraging and potential nesting habitat for this species throughout the Project site.

## 4.7. Special Status Bat Species

### Western Yellow Bat: SSC, H

The western yellow bat (*Lasiurus xanthinus*) is a CDFW Species of Special Concern. It is found in Arizona, New Mexico, Mexico, and year-round in California. It is found in arid regions, in riparian, desert riparian, desert wash and palm oasis habitat. The western yellow bat is insectivorous, and roosts and feeds in palm oases and riparian habitats (CDFW 2022a). This species feeds on flying insects and forages over water and among trees. Roost sites are primarily trees in riparian habitats.

No western yellow bats or roosts were observed during 2023 wildlife surveys on the Project site. Targeted surveys for bats were not conducted. Suitable foraging habitat and roosting habitat is found on the Project site within desert dry wash woodland.

# 5. RISK ASSESSMENT

## 5.1. Collision

During the construction, O&M, and decommissioning Project phases, the Project component of greatest potential concern that would pose lethal collision risk to birds or bats are the 500 kV loop-in transmission and gen-tie lines. Smaller risks would be posed by other components during any of the three phases. These include any above-ground distribution lines, meteorological station(s), guy wires that may support meteorological instruments, and large equipment such as cranes that would be in use during the construction and decommissioning phases. As a solar PV facility, the Project would not include a power tower.

Bird collisions with structures typically occur when the structures are not visible (e.g., bare power lines or guy wires at night), deceptive (e.g., glazing and reflective glare), or confusing (e.g., light refraction or reflection from mist). Transmission lines, including the proposed gen-tie and loop-in lines, present collision hazards to birds.

While bird fatalities may be expected to occur due to collisions with Project facilities and equipment, the risk of significant impact to avian populations is minimal. A collection of 13 fatality monitoring studies at PV solar facilities in three bird conservation regions (BCRs) in California and Nevada have shown the highest percentage of fatalities across all studies were common species including mourning dove, horned lark, house finch, and western meadowlark. Passerines (55.0%) and doves/pigeons (17.0%), on average, are the most common detections (Kosciuch et al., 2020). Carcasses of water-associated birds (e.g., herons and egrets) and water obligate birds (e.g., loons and grebes) have been found at PV solar facilities in the Sonoran and Mojave Deserts, primarily at sites within 60 miles of the Salton Sea (The Perkins Renewable Energy Project is approximately 38 miles from the Salton Sea). Water associated (6.3%) and water obligate species (7.8%) each compose less than 10% of the detections. Raptors are very uncommon detections (less than 1.0%) (Kosciuch et al., 2020).

Therefore, it is not presently possible to determine if the conditions present at the Project site may cause impacts and/or what level of impacts may occur. The Project components would include an anti-reflective coating designed to reduce glare. While the causes of avian injuries and the fatality monitoring studies at commercial-scale solar projects are being evaluated, uncertainty remains because: (1) mortality data has been collected over a relatively short period and still is being evaluated; (2) in many cases, the cause of death is not clear; and (3) mortality information from one Project location is not necessarily indicative of the mortality information that might be found at another Project location.

The Perkins Renewable Energy Project will construct all transmission lines and above ground collection and distribution lines according to Avian Power Line Interaction Committee (APLIC) guidelines to minimize the risk of avian and bat collision. Note that as proposed, the majority of collection and distribution lines will be installed underground.

Consistent with LUPA-BIO 16, the Project will design the gen-tie lines between the Project substation and the BAAH without the use of guy wires to the greatest extent feasible, and where guy wires are unavoidable, it will demarcate them using the best available methods to minimize hazards to birds and bats.

## 5.2. Electrocution Potential

Large birds can be electrocuted by transmission lines if a bird's wings simultaneously contact conductors, or a conductor and a ground wire or grounded hardware. This happens most frequently when a bird attempts to perch or take off from a structure with insufficient clearance between these elements. Distribution lines that are less than 69 kilovolts (kV) but greater than 1 kV generally have less spacing than transmission lines, thus posing an electrocution hazard for perching raptors. Configurations less than 1 kV or greater than 69 kV typically do not present an electrocution potential, based on conductor placement and orientation (APLIC 2006). The 500 kV transmission loop-in and gen-tie lines would have minimal electrocution potential and the majority of the Project's 34.5-kV level collection lines would be installed underground.

IP Perkins, LLC and IP Perkins BAAH, LLC will design and construct the 500 kV transmission loop-in lines, the gen-tie, collector, and distribution lines to avoid potential for electrocution and minimize potential for roosting on the structures or colliding with them. These measures would effectively minimize or mitigate adverse effects of electrocution to the extent feasible.

## 5.3. Territory Abandonment

Since the majority of the dominant vegetation community, creosote bush scrub, would be restored post-construction and desert dry wash woodland would be avoided during construction (including a 200-foot buffer in accordance with DRECP CMA LUPA-BIO-13); therefore, large swaths of native habitat will be available for use by wildlife post construction. However, construction activities would cause most mobile avian species to temporarily leave the site. Avian species dispersing from the site would be subject to further adverse effects, including potential mortality. They would be at increased risk of predation as they flush from cover during site clearing. After leaving their home territories, displaced avian species may be unable to find suitable food or cover in new, unfamiliar areas. They may attempt to return to their home ranges, possibly resulting in increased predation risk or other effects. If they find food and other resources at new locations off site, these may be within the occupied territory of another individual of the same or similar species, resulting in competition for resources. Impacted desert habitat may not recover quickly, displacing avian species until habitat has reestablished to a suitable condition. These displacement effects would apply to common avian species and to special-status species.

## 5.4. Nest and Roost Site Disturbances

As proposed, for purposes of construction, vegetated PV panel areas will be mowed and grubbed, and subsequently restored post construction (see Project Restoration and IWMP, POD Appendix Y). Substation, BAAH, BESS, roadway and O&M facility areas will be permanent cleared. Many adult birds would flee from equipment during initial vegetation clearance for Project PV construction. However, nestlings and eggs would be vulnerable to impacts during Project construction. If initial site grading or brush removal were to occur during nesting season, then it likely would destroy bird nests, including eggs or nestling birds. One special-status species, the burrowing owl, is unlikely to flee the site during construction, due to its characteristic behavior of taking cover in burrows. Potential Project impacts and avoidance for burrowing owl are summarized below.

Some birds will likely nest in the Project area during construction and O&M phases, even after initial site preparation. Depending on the species, birds may nest on the ground close to equipment; within the open metal framework of the panel support structures; on buildings, foundations, structures, or construction trailers; or on idle vehicles or construction equipment left overnight or during a long weekend. In areas where construction is phased (e.g., footings, or tower structures) birds may quickly use these features as nest sites between active construction phases. The species most likely to nest in the Project area during construction are common raven, house finch, and mourning dove, all of which are protected by the MBTA and Fish and Game Code Sections 3503 and 3513 but have no other special conservation status.

IP Perkins, LLC and IP Perkins BAAH, LLC will conduct pre-construction surveys for active nests throughout the entire Project site and adjacent off-site habitat areas, beginning January 1 for raptors and hummingbirds and February 1 for other species, and continue through August 15. Pre-construction nest surveys will occur no more than seven days prior to scheduled activities at any given site and will be repeated as needed if activities are delayed. At each active nest, the qualified biologist will delineate and mark buffer areas of various sizes depending upon the species. The qualified biologist will also document baseline environmental conditions and construction activity levels. If a nest would be removed for any reason during the nesting season (while following all regulations in F&G code 3503 and 3503.5), IP Perkins, LLC, will notify BLM, BOR, USFWS, and CDFW and retain written documentation of the correspondence. Nests would only be removed if they are inactive, or if an active nest presents a hazard (i.e., being built where it could be harmed). Due to the high probability that birds may nest on site during construction, IP Perkins, LLC and IP Perkins BAAH, LLC, will conduct monitoring of the work area throughout the breeding season, so that all active work sites and equipment are monitored at least weekly. During bird breeding season, surveys for active nests will occur no more than 7 days prior to ground disturbance at any work site. Please refer to the Project Nesting Bird Management Plan (POD Appendix V) for additional information.

Impacts to burrowing owl are discussed in detail below in Section 6 due to the species-specific impacts and avoidance requirements resulting from the sensitivity of nesting to human activity and their continued presence in burrows during both nesting and non-nesting seasons.

## 5.5. Habitat Loss and Fragmentation

**Habitat Loss.** Disturbance in the Project site would result in loss of habitat over a large area and displacement of resident shrubland species, including loggerhead shrike and burrowing owl. The facility would be designed and constructed as a low-impact facility where the majority of the site would be mowed, instead of cleared of vegetation. Mass grading would not be required. Project construction would result in a small acreage of permanent and long-term impacts to habitat types from permanent facilities constructed on-site, including the substation, switchyard, BESS, roads, and the O&M facility, as shown in Table 3. Temporary impact areas, including the solar facility, would be restored in accordance with the Restoration and Integrated Weed Management Plan (POD Appendix Y).

**Table 3. Native Habitat Impact Acres**

| | Permanent Impact (acres) | | Temporary Impact (acres) | |
|---|---|---|---|---|
| Habitat Type | Solar facility | Gen-tie | Solar facility | Gen-tie |

| | Permanent Impact (acres) | Temporary Impact (acres) |
|---|---|---|
| Sonoran creosote bush scrub | | |
| Desert dry wash woodland | | |
| Alkali goldenbush desert scrub | | |
| Arrow weed thickets | | |
| Common reed marsh | | |

The site would not be restored to pre-disturbance habitat values. The temporary disturbance areas will be revegetated to stabilize soils; maximize the likelihood of vegetation recovery over time; and minimize soil erosion, dust generation, and weed invasions. Vegetation and habitat conditions following construction would likely remain suitable for common species such as common raven, house finch, and mourning dove. Native vegetation will re-establish beneath the arrays and conditions may become suitable for birds.

**Habitat Fragmentation.** Wildlife, including birds and bats, are often restricted to specific habitat types or elevations. Their habitats may be contiguous over extensive areas, or they may be scattered in patches in a landscape. For species with patchy distributions, dispersal between habitat patches may be important in colonizing (or recolonizing) areas or in supplementing demography or genetic makeup in isolated populations.

Desert scrub is present in the Project site and in the surrounding area to the south, east, and north, serving as stopover and foraging habitat for migratory and wide-ranging non-migrant bird species. The water in the All-American Canal, which spans 82 miles from the Colorado River to the Imperial Valley and borders the Project site to the south, is also an attractant and stopover location for migratory birds. Disturbance in the Project site would fragment desert scrub habitat; however, bird and bat species could continue to use surrounding open space areas and the canal. Native vegetation in the solar facility will reestablish per the Restoration and Integrated Weed Management Plan (POD Appendix Y) and loss of habitat would not permanently prohibit use of the site by birds and bats.

## 5.6. Disturbance Due to Ongoing Human Presence at the Facility

In general, the Project site is void of infrastructure requiring human presence to operate. The site is authorized for offroad vehicle use and is used during the evenings for border related activities. Construction noise would be a substantial increase over existing background noise levels at the Project site. If construction activities were to occur at night, lighting would be required. Noise and lighting during construction could affect wildlife in adjacent habitats by disrupting foraging, breeding, sheltering, and other activities; it could also cause animals to avoid otherwise suitable habitat surrounding the site. The effects of construction noise include annoyance, which could lead to nest or den abandonment; interference with sleep and other activities; and interference with acoustic communication by masking important sounds or sound components, such as territorial calls, contact calls, or alarm calls (Dooling and Popper, 2007). Lighting can affect behavior and physiology and may also increase the risk of predation of wildlife because they may be more detectable to nocturnal predators. Lighting could attract nocturnal insects and, in turn, bats; possibly including special-status bats. IP Perkins, LLC and IP Perkins BAAH, LLC, will minimize the impacts of noise and lighting by ensuring that lighting is focused only on work areas, and by adhering to noise restrictions to be identified in the Project's EIR and EA. Lighting would be directed downward and focused to minimize impacts.

During operation, some birds would re-occupy the solar field site once construction activities are completed, where ongoing O&M noise and lighting may affect them. Noise and lighting may also affect avian species in the nearby off-site habitat. These effects would be qualitatively similar to the description of construction phase effects of noise and lighting but would be of lesser magnitude. IP Perkins, LLC and IP Perkins, BAAH, LLC, will minimize these impacts as described above. In addition, per CMA LUPA-BIO-13, night lighting used for security and emergency night work would be directed and shielded downward, and motion sensor lighting will be used at the substation, BAAH, BESS and O&M facilities to avoid interference with the navigation of night-migrating birds and to minimize the attraction of insects as well as insectivorous birds and bats to project infrastructure.

## 5.7. Additional Risk Factors

**Predator subsidies.** Project construction, operation, and decommissioning activities could provide subsidies in the form of trash, litter, or water, which attract unnaturally high numbers of predators such as common ravens. This influx of predators could cause unnaturally high predation pressure on wildlife in the vicinity. Ravens are opportunistic omnivores, and they prey on the eggs and nestlings of native birds, among many other food sources (Zeiner et al., 1990. Ravens habituate to human activities and are subsidized by food (trash, road killed animals) and water (irrigation or dust control overspray). For ravens, new perching, roosting, and nesting sites, such as transmission line and other structures, would be introduced or augmented by human encroachment. IP Perkins, LLC and IP Perkins BAAH, LLC, will require management of all potential predator subsidies (i.e., food trash, pooled water, roosting/nesting sites, shelter), monitoring of raven presence and abundance, and predator control measures as needed.

- **All-American Canal.** The 500 kV transmission loop-in corridor is located south of the Project solar site and crosses the All-American Canal (see POD Appendix A, Figure 2). The Canal holds water yearlong, providing a subsidy for birds. A hydroelectric dam and associated infrastructure are operated in the canal nearby, which provides perching opportunities for common raven.

# 6. CONSERVATION MEASURES

IP Perkins, LLC and IP Perkins BAAH, LLC will adopt conservation measures to avoid and minimize impacts to avian species. The measures that relate to bird and bat conservation are listed and briefly summarized below.

**Biological Monitoring.** IP Perkins, LLC and IP Perkins BAAH, LLC will assign biological monitors to the Project. Duties of the biological monitors will include, but are not limited to, nesting season bird monitoring and reporting, conducting clearance surveys, and removing inactive nests (except for special status species nests).

**Avian Species Protection.** IP Perkins, LLC and IP Perkins BAAH, LLC, will avoid or minimize impacts to avian species specifically by containing all food-related trash in containers inaccessible to ravens or other birds; regularly inspecting and maintaining bird deterrent netting; securing Project excavations and covering or capping all pipes to prevent avian entrapment; and reporting all dead or injured special-status bird species to CDFW.

**Burrowing Owl Avoidance and Relocation:** Burrowing owl protection and relocation will be implemented per the Wildlife Protection and Translocation Plan (see POD Appendix U). Pre-construction surveys for burrowing owls, possible burrows, and sign of owls (e.g., pellets, feathers, whitewash) will be conducted throughout each work area no more than 30 days prior to construction. If burrowing owl or active burrows are found within the solar facility, avoidance and set-back distances will be implemented within the solar facility. Disturbance of owls or occupied burrows during the breeding season from February 1 through August 31 will be avoided.

Unoccupied burrows will be excavated and filled in under the supervision of the Lead Biologist prior to site preparation. Passive relocation will occur only during the non-breeding season, generally September 1 to February 1, but will be adjusted during the late summer months (August and September) if breeding activities are not observed at any occupied burrows and as detailed in the Wildlife Protection and Translocation Plan.

**500 kV Transmission Loop-In and Gen-tie lines.** IP Perkins, LLC and IP Perkins BAAH, LLC, will design the 500 kV transmission loop-in and gen-tie support structures and other facility structures in compliance with APLIC guidelines and current standards and practices to discourage their use by raptors for perching or nesting (e.g., by use of anti-perching devices). Mechanisms to visually warn birds, such as permanent markers or bird flight diverters, will be placed on the transmission loop-in and gen-tie lines at regular intervals to prevent birds from colliding with the lines (APLIC, 2006). To the extent practicable, the use of guy wires shall be avoided because they pose a collision hazard for birds and bats. Necessary guy wires will be clearly marked with bird flight diverters to reduce the probability of collision. Shield wires will also be marked. Transmission loop-in and gen-tie lines will maintain sufficient distance between all conductors and grounded components to prevent potential for electrocution of the largest birds that may occur in the area (e.g., red-tailed hawk and Swainson’s hawk). They will utilize non-specular conductors and non-reflective coatings on insulators.

# 7. MONITORING AND REPORTING

This section summarizes the contents of a Nesting Bird Management Plan (NBMP) (POD Appendix V) and a standardized approach to document and report all bird and bat injuries and mortalities that occur during the construction and O&M phases of the Project. The NBMP will estimate post-construction fatality rates associated with Project features, and institute sampling methodologies to estimate searcher efficiency and carcass persistence to incorporate into the post-construction fatality rate assessment. The post-construction monitoring methods and sampling protocol is based on the standards, guidelines, and proposed methods developed for renewable energy industries to quantify fatality estimates for birds and bats due to interactions with energy-related infrastructure development and maintenance (Anderson et al., 1999; APLIC, 2005, 2006 and 2012; CDFG and CEC, 2007; USFWS, 2010a and 2012; Kosciuch et al., 2020; Desert Harvest Solar Project, 2013). Details on the methodology for monitoring during construction and O&M phases (post-construction), procedures for handling and reporting injured or deceased wildlife, sampling protocol and efficiency testing, agency reporting, and adaptive management are provided below.

## 7.1. Bird and Bat Monitoring Requirements

Several of the conservation measures summarized above specify monitoring and reporting requirements. The Lead Biologist will be responsible for monitoring and reporting on biological resources for Project activities, beginning with pre-construction surveys and continuing through the construction and O&M Project phases. Specific monitoring requirements related to bird and bat conservation are listed below.

### Construction Phase Only:

- Biologists will conduct pre-construction surveys of work areas prior to the start of construction (time varies for different species).
- Worker Environmental Awareness Training would be given to all personnel working at the Project.

- Biologists will ensure biologically sensitive resources are clearly marked for avoidance.
- Biologists will conduct monitoring of construction activities for compliance with agency permits and other Project requirements.

**Construction and O&M Phases:**

- Lead Biologist who is the primary point of contact regarding all biological resources and compliance will be responsible for all agency reporting, communication, and submittals.
- Biologists and on-site qualified staff will conduct required ongoing monitoring and reporting during O&M activities.
- Within nesting bird season, the Lead Biologist will survey for nesting birds prior to vegetation clearance or construction activity that may affect active nests.
- Active nests will be monitored to ensure that measures are being employed to minimize disturbance to nesting birds. The Lead Biologist must keep updated records of all active nests, buffers, buffer reductions, and nest outcomes (Attachments B, C: Avian Nest Reporting Form).

The O&M bird and bat mortality monitoring program methods and sampling protocol is based on the standards, guidelines, and proposed methods developed for renewable energy industries to quantify fatality estimates for birds and bats due to interactions with energy-related infrastructure development and maintenance (Anderson et al., 1999; APLIC, 2005, 2006 and 2012; USFWS, 2010a and 2012; Kosciuch et al., 2020). Details on the methodology for monitoring during construction and O&M phases (post-construction), procedures for handling and reporting injured or deceased wildlife, sampling protocol and efficiency testing, agency reporting, and adaptive management are provided below.

IP Perkins, LLC and IP Perkins BAAH, LLC, will implement a wildlife reporting system to identify and document incidentally found bird and bat fatalities by an on-call qualified avian biologist. The site manager will lead the program. Site personnel will be trained to follow the wildlife reporting system procedures and complete the wildlife reporting form. O&M monitoring will be conducted by facility operators and field engineers during normally scheduled activities with support from a qualified biologist as needed (e.g., to identify dead or injured bird species).

Employees and subcontractors of the Project are required to comply with all environmental laws and regulations. Birds and bats occurring in the vicinity are afforded varying levels of protection under state and federal law and agency policy (see Section 1.1). MBTA and other regulations prohibit collection or possession of birds or other special-status species, including handling and disposition of injured or dead birds, unless otherwise permitted by the respective jurisdictional agencies.

## 7.2. Post-Construction Bird and Bat Monitoring Approach

Incidental bird and bat injuries and mortalities that occur during the construction and O&M phases of the Project would be documented and reported. Incidental injury and mortality monitoring and reporting will continue for a 2-year period beginning at the onset of Project O&M, per the Avian/Bat Incident Reporting Form (Attachment A). After the 2-year period, avian surveys and counts would be performed to compare with pre-construction surveys. Monitoring data will provide a measure of plan efficacy and inform adaptive management decisions. Results of the monitoring will guide adaptive management decisions regarding any additional practical impact reduction measures to further avoid, minimize, and/or mitigate impacts to bird and species during the Project O&M period. Adjustments to the observation and reporting requirements may be made during the monitoring period, as described in Section 8.0 Adaptive Management, if observed bird and bat injuries and mortality do not meet the goals of the Project.

## 7.3. Injury and Mortality Reporting Procedures

This section details procedures to be employed in the event of any reportable incident of bat or bird mortality, as defined above. As part of this process, a Special Utility Permit (SPUT) will be obtained from the United States Fish and Wildlife Service, which authorizes the collection, transport and temporary possession of migratory birds. No birds, bats, or carcasses will be handled except as allowed under the SPUT. A “bird kit” with handling supplies such as bags and gloves will be onsite at all times. The kit will include:

- Copies of Avian/Bat Incident Reporting Forms
- Avian/Bat Injury and Mortality Log binder for retaining forms
- Project personnel and agency contact information
- Camera
- Zip-top bags (to be used if carcasses or parts must be retained at agency direction)
- Garbage bags or similarly sized bags with zip fasteners (for larger carcasses)
- Latex or protective disposable gloves
- Large forceps
- Leather gloves
- Pin flags and flagging
- Permanent markers, pencils, and pens
- 3x5 index cards

All bird and bat injuries and fatalities discovered during, or incidental to, the standard carcass surveys will be documented according to the requirements and standards reflected in the USFWS Avian/Bat Incident Reporting Form (Attachment C).

If a dead or injured bird or bat is found, the following procedures will be followed:

1. Project personnel will immediately report observations of injured birds or bats to the site manager responsible for implementing the BBCS. When an injured bird or bat is found, Project personnel will maintain a large enough distance so as not to further disturb or distress the animal. Personnel will follow the procedures for reporting and care of injured wildlife found in step 2 below. If a bat is hanging, head down, in a concealed or semi-concealed location, personnel will not disturb it, but will re-check later. If a bird or bat is certainly dead, Project personnel will continue on to step 3 below.

2. Project personnel will in, turn, report to the applicable agency contact for further instructions. No live animal will be handled or harassed in any way by unauthorized personnel. Only qualified personnel who are trained to implement BBCS injury procedures and appropriately permitted as applicable will be authorized to handle dead or injured animals.

   - The Project site manager will contact CDFW for further instructions and to determine whether a rehabilitator should come and pick up the injured animal. If the injured animal is found after normal business hours, the site manager will leave a message (if possible) and report it again the next available working day.

   - If Project personnel cannot reach the appropriate agency contact with the initial phone call, they will phone the USFWS Division of Law Enforcement and request further instruction.

   - Project personnel will fill out an Avian/Bat Incident Reporting Form and place the form in the Project Avian/Bat Injury and Mortality Log maintained for the facility.

3. For dead bats or birds, Project personnel will flag the location of the carcass while data is being taken. Carcasses present a potential human health hazard and may attract scavengers

(bird and mammal) to Project facilities and work areas, further increasing the risk of wildlife mortality on the Project site. Carcasses of eagles or other raptors, state or federally listed species, and sensitive species require special consideration described under step 8. Unless otherwise directed (see step 8), other carcasses will be covered with an open crate or similar container to prevent scavenging. Scavenged or scattered carcasses (e.g., bones, feathers), will be left in place or removed based on agency feedback (Number 7 below), and the location documented so that they are not reported again during subsequent facility inspections.

4. Project personnel will complete an Avian/Bat Incident Reporting Form (Attachment D). All reportable incidences discovered be recorded using the reporting form that identifies the type of animal (bird or bat), the species (if known), its condition (e.g., predated, injured) with evidence of collision or other injury, surrounding vegetation type or Project component, and the date, time, and location of the incident. Personnel will then determine whether the death appears to be related to Project construction or O&M activities. If the mortality apparently occurred through contact with equipment, the observer would also list the type of equipment and damage sustained by the equipment (if any).

5. Project personnel will record the date and time of the discovery and the observer's name on a 3x5 index card using a permanent marker. This card will be photographed with the bird or bat remains to ensure that photos and datasheets are correctly correlated to the incident.

6. Project personnel will photograph the bird or bat carcass as it was found. The carcass will be photographed from at least four angles: two close-up shots with the 3x5 index card next to the animal, and two more expansive views that include the area surrounding the animal.

7. After completing the Avian/Bat Incident Reporting Form and photographs, Project personnel will immediately contact the site manager responsible for implementing the BBCS. The site manager will take the appropriate steps listed below to report the mortality to the resource agencies. Based on feedback from the agencies, personnel will be instructed to take appropriate action (e.g., remove the carcass). These actions will be recorded on the Mortality Reporting Form and maintained in the Project Avian/Bat Injury and Mortality Log, copies of which will be provided to agency representatives on a quarterly basis. The site manager will be responsible for making sure the incident data is entered into the USFWS Bird Fatality/Injury Reporting Program (https://birdreport.fws.gov/). A record of all dead or injured bird or bat species will be maintained in the Project Avian/Bat Injury and Mortality Log, copies of which will be provided to agency representatives on request and as part of the quarterly report.

8. Carcasses will not be handled by Project personnel except under authorization of the Project SPUT permit. Carcasses will be temporarily stored on-site at the specific direction of USFWS, until they can be shipped to a specified laboratory or institute. If directed, Project personnel will place a large, open crate upside-down over the carcass, and secure the crate to the ground with stakes or other devices to reduce scavengers' access to the carcass until it can be appropriately handled under permit.

Annual reports will be provided to BLM, BOR, USFWS, and CDFW, thoroughly summarizing each year's findings. The quarterly reports will be brief and include a list of species found with associated spatial and temporal information. A full statistical analysis will not be completed for the quarterly report. The goal of the quarterly report will be to provide a detailed summary of monitoring results to date and to identify any major concerns with the monitoring program. The annual report will provide a robust statistical analysis of the results of seasonal monitoring results. If a significant fatality event is discovered (e.g., listed bird species), more than three raptors in a single event, more than ten birds or bats in a single event) or if nesting attempts reach a nuisance level, the site manager will contact the USFWS and CDFW as soon as possible for coordination.

## 7.4. Injured Bird Rescue

Any injured or rescued birds located during surveys or monitoring will be recorded. A qualified biologist will determine if the injured bird should be transported to the nearest CDFW-permitted rehabilitation facility, or if the individual should be released. Injured raptors will be handled only by experienced, trained personnel and/or biologists and will be taken only to rehabilitation facilities that are permitted to handle raptors. The closest rehabilitation facilities to the Project area that are capable of handling injured birds are outlined in Table 4.[1] Rehabilitation facilities will be compensated by the Project ROW holder for costs associated with each bird put into their care.

**Table 4. Wildlife Rehabilitation Facilities Near the Project Area**

| Wildlife Facility Name | Address | Contact | Specialty |
|---|---|---|---|
| Project Wildlife | 5433 Gaines St.<br>San Diego, CA 92110<br>(located in the San Diego Humane Society) | Phone: 619-299-7012<br>Hours: 9:00am-5:00pm | Wildlife Rescue Service |
| San Diego Humane Society's Ramona Wildlife Center | 18740 Highland Valley Road, Ramona, CA 92065 | Phone: 619-299-7012<br>Hours: 10:00am-5:00pm | Wildlife Rescue Service |
| Feathers 'n Fur Wildlife Rehab Team | 3930 Lori Lane<br>Twentynine Palms, CA 92277 | Phone: 760-831-2544<br>Hours: 8:00am-8:00pm | Wildlife Rescue Service |
| Orange County Bird of Prey Center | 25422 Trabuco Road #105-541<br>Lake Forest, CA 92630 | Phone: 949-837-0786 | Animal Rescue Service |
| Sunshine Haven Wildlife Rehabilitation | 5370 Riverview Drive<br>Jurupa Valley, CA 92509 | Phone: 951-588-8811<br>Hours: 11:00am-3:00pm | Wildlife Rescue Center |
| International Bird Rescue | Los Angeles Center<br>San Pedro, CA 90731 | Phone: 310-514-2573<br>Hours: 8:00am-5:00pm | Waterbird Rescue, Mass Stranding Events |

If a qualified biologist if not available, all stranded birds (injured or uninjured) will be taken to the nearest rehabilitation center that can care for water-associated birds (Table 4). Injured or exhausted water-associated birds should be taken to the International Bird Rescue.

If a mass-stranding event involving many water-associated birds occurs within the Project area, it will be determined if they are injured and if so, transferred to the nearest rehabilitation facility (Table 4). International Bird Rescue can also assist with these mass stranding events.

If a Project personnel identifies a dead bird or bat that is a special-status or listed species, for which handling is not specifically authorized under the SPUT permit, data will be collected, and photos taken as described for other fatalities. In addition, the personnel will flag the carcass, cover it with a protective surface such as a bucket, and leave it in place. If it is confirmed to be a special-status or listed species under the ESA or is a golden eagle, the Project personnel will need to immediately notify a USFWS Office of Law Enforcement special agent with 24 hours to determine appropriate next-step actions. CDFW will also be notified to prompt coordination between USFWS and CDFW.

# 8. ADAPTIVE MANAGEMENT

[1] A list of CDFW-permitted wildlife rehabilitation facilities can also be found at https://wildlife.ca.gov/Conservation/Laboratories/Wildlife-Investigations/Rehab/Facilities

## 8.1. Adaptive Management Process

Adaptive management is an iterative process in which impact minimization and mitigation measures are continuously reevaluated to improve upon them to meet management objectives. As action is taken, the results are monitored, and future actions are modified accordingly if necessary. This is an especially useful strategy for managing resources where uncertainty surrounds appropriate management actions and their consequences. Because utility-scale solar energy development is a relatively new and rapidly expanding industry, its effect on bird and bat populations is uncertain. There is also uncertainty surrounding current fatality estimates as well as which measures are most effective at reducing fatalities and mitigating impacts to bird and bat populations. Fatality estimates are expressed per unit area (e.g., acres) per MW, per year. As more data are gathered at facilities and new strategies are tested, these uncertainties will be reduced, and agency guidance will be refined.

IP Perkins, LLC and IP Perkins BAAH, LLC is committed to incorporating adaptive management principles into its BBCS. To facilitate the adaptive management process, IP Perkins, LLC and IP Perkins BAAH, LLC will submit seasonal monitoring reports to BLM, BOR, USFWS, and CDFW summarizing results of operational monitoring and the wildlife reporting system, including estimates of fatalities calculated as fatalities/MW/year.

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# Attachment A

## AVIAN/ BAT INCIDENT REPORTING FORM

# Avian/Bat Incident Reporting Form

**Discoverer's Name** ______________________________

**Phone Number** ______________________ **Date of Discovery** __________________

**Date and Time of Incident/Discovery** ______________________________

**Location, include Pole and GPS Coordinates (if available)** ______________________

______________________________

**Species (if known)** ______________________________

**Type of Bird or Bat (circle one if species is unknown)**

| | | |
|---|---|---|
| Diurnal Raptor (hawk, falcon, eagle) | Owl | Crow / Raven |
| Passerine (songbird) | Bat | Unknown / Other |

**Number of Individuals** ______________________

**Age of Bird(s) (circle all that apply)** Adult Juvenile Nestling Eggs Unknown

**Surrounding Habitat (circle all that apply)**

| | | |
|---|---|---|
| Agricultural | Chaparral/Shrubs | Desert Scrub |
| Disturbed/Developed | Grassland | Riparian |

**Type of Incident (circle one)** Injury Mortality

**Description of Incident**. Include condition of bird, circumstances of incident and cause of injury or mortality (if known), and any damage to facilities.______________________________

______________________________

______________________________

______________________________

______________________________

______________________________

______________________________

**Please attach a picture of the bird or bat, if possible.**

**OPERATIONS MORTALITY REPORTING FORM FOR AVIAN AND BAT SPECIES**

DATE: _________ TIME: ________ OBSERVER: ______________________________________

PROXIMAL TO PROJECT COMPONENT: _____________________________________________

**CARCASS POSITION**

GPS COORDINATES (UTM NAD83) 11S East: ________________ North: _________________

BEARING (degrees) to PROJECT COMPONENT: ___________________

DISTANCE (meters) to PROJECT COMPONENT: __________________

**CARCASS DESCRIPTION**

SPECIES: __________________________________

SEX (*circle*): M F U AGE (*circle*): A J U Tag/Band Number: ___________

CONDITION (*circle*): intact scavenged dismembered feather spot injured ESTIMATED TIME SINCE DEATH/INJURY (no. of days): >1 1 2 3 4 5 6 7 7+ CAUSE OF DEATH:

_________________________________________________________________________________

_________________________________________________________________________________

OBSERVABLE INJURIES:

_________________________________________________________________________________

_________________________________________________________________________________

SUBSTRATE/GROUND COVER (*at carcass location)*:____________________________________

DISPOSITION OF CARCASS[1] (*circle*): left in place removed collected for trials collected for other: _______________________________________________________________

SHIPPED TO:

[name of institution] _____________________________________________________________

[physical address] _______________________________________________________________

[phone/email] ___________________________________________________________________

**WEATHER CONDITIONS**

AIR TEMPERATURE (degrees Fahrenheit): _______

PRECIPITATON (last 24 hours, *circle*): none light rain rain heavy rain hail snow

CLOUD COVER (*circle*): clear mostly clear partly cloudy mostly cloudy cloudy

WIND DIRECTION: ______ SPEED (mph, *circle*): 0-10 10-20 20-30 30+ gusty

NOTES (describe noteworthy weather conditions since last search, including high wind, fog, precipitation, and storm events):

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

**PHOTOGRAPHS[2]:**

Close Up: Photo 1 _______ Photo 2 ________

Landscape: Photo 3 _______ Photo 4 ________

PHOTO NOTES:

______________________________________________________________________

______________________________________________________________________

**NOTIFICATION[3]:**

DATE: _______ TIME: _______

NAME: ________________________ AGENCY/ASSOCIATION: ______________________

**NOTES:**

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

[1] Permit required to handle bird carcasses.

[2] At least four photographs should be taken. Two should be close-in shots of the carcass and should be taken from at least two different angles. Two should be shots taken farther away showing the landscape (project components, surrounding habitat, etc.) and should be taken from at least two different angles).

[3] Indicate who was notified of the event, date, time, etc.

# Attachment B

## O&M Avian Nest Reporting Form

## Operational Phase – Solar Facility Avian Nest Reporting Form

**Discoverer's Name** ______________________________

**Phone Number** ______________________ **Date of Nest Discovery** ______________

**Nest Location (circle one)** Facility Equipment or Structure  Tree  Shrub  Ground

**Nest Coordinates** ______________________________

**Other Location Information** ______________________________

**Surrounding Habitat outside of Solar Array Fence (circle all that apply)**

| | | |
|---|---|---|
| Agricultural | Desert Scrub | Riparian |
| Grassland | Disturbed/Developed | Bare |

**Nest Condition (circle one)**  Inactive  Under Construction  Active

**Describe any Bird Signs around the Nest (feathers, whitewash, scat, prey remains)**

______________________________

______________________________

**Are Birds Present? (circle one)**  Yes  No

**Number of Birds Visible** ______________

**Age of Bird(s) (circle all that apply)**  Adult  Juvenile  Nestling  Eggs  Unknown

**Bird Species (if known)** ______________________________

**Type of Bird (circle one if species is unknown)**

| | | |
|---|---|---|
| Diurnal Raptor (hawk, falcon, eagle) | Owl | Crow/Raven |
| Passerine (songbird) | Unknown | |

**Risk to Solar Array and Equipment (circle one)**

No Risk  Potential Risk – Not Imminent  Potential Risk – Imminent

**Additional Comments** ______________________________

______________________________

______________________________

## Operation Phase – Transmission Line Avian Nest Reporting Form

**Discoverer's Name** ______________________________

**Phone Number** ____________ **Date of Nest Discovery** ____________

**Pole Number of Nest Location** ______________________________

**Other Location Information**
______________________________

**Surrounding Habitat (circle all that apply)**

| | | |
|---|---|---|
| Agricultural | Desert Scrub | Riparian |
| Grassland | Disturbed/Developed | Bare |

**Nest Condition (circle one)** Inactive Under Construction Active

**Describe any Bird Signs Around the Nest (feathers, scat, prey remains)** ____________

______________________________

**Are Birds Present? (circle one)** Yes No

**Number of Birds Visible** ____________

**Age of Bird(s) (circle all that apply)** Adult Juvenile Nestling Eggs Unknown

**Bird Species (if known)** ______________________________

**Type of Bird (circle one if species is unknown)**

| | | |
|---|---|---|
| Diurnal Raptor (hawk, falcon, eagle) | Owl | Crow/Raven |
| Passerine (songbird) | Unknown | |

**Risk to Electrical Equipment (circle one)**

Potential Risk – Not Imminent Potential Risk – Imminent

**Additional Comments** ______________________________

______________________________

______________________________

# Attachment C

## Construction Phase Avian Nest Reporting Form

# Project Construction Phase – Solar Facility Avian Nest Reporting Form

**Discoverer's Name** ______________________________

**Phone Number** ____________________ **Date of Nest Discovery** ______________

**Nest Location (circle one)** Tree Shrub Structure Ground

**Nest Coordinates** ______________________________

**Other Location Information** ______________________________

**Surrounding Habitat (circle all that apply)**

Agricultural Desert Scrub Riparian

Grassland Disturbed/Developed Bare

**Nest Condition (circle one)** Active Inactive, Intact
Inactive, Partial Deterioration Inactive, Heavy Deterioration

**Describe any Bird Signs around the Nest (feathers, scat, prey remains)** ______________

______________________________

**Are Birds Present? (circle one)** Yes No

**Number of Birds Visible** ____________________

**Age of Bird(s) (circle all that apply)** Adult Juvenile Nestling Eggs Unknown

**Bird Species (if known)** ______________________________

**Type of Bird (circle one if species is unknown)**

Diurnal Raptor (hawk, falcon, eagle) Owl Crow/Raven

Passerine (songbird) Unknown

**Risk to Birds/Construction (circle one)**

No Risk Potential Risk – Not Imminent Potential Risk – Imminent

**Additional Comments** ______________________________

______________________________

______________________________

## Project Construction Phase –
## Transmission Line Avian Nest Reporting Form

**Discoverer's Name** ______________________________

**Phone Number** ______________________ **Date of Nest Discovery** ______________

**Nest Location (circle one)** Tree Shrub Structure Ground

**Nest Coordinates or Closest Pole Location** ______________________________

**Other Location Information** ______________________________

**Surrounding Habitat (circle all that apply)**

| | | |
|---|---|---|
| Agricultural | Desert Scrub | Riparian |
| Grassland | Disturbed/Developed | Bare |

---

**Nest Condition (circle one)** Active Inactive, Intact
Inactive, Partial Deterioration Inactive, Heavy Deterioration

**Describe any Bird Signs Around the Nest (feathers, scat, prey remains)**

______________________________

______________________________

**Are Birds Present? (circle one)** Yes No

**Number of Birds Visible** ______________________

**Age of Bird(s) (circle all that apply)** Adult Juvenile Nestling Eggs Unknown

**Bird Species (if known)** ______________________________

**Type of Bird (circle one if species is unknown)**

| | | |
|---|---|---|
| Diurnal Raptor (hawk, falcon, eagle) | Owl | Crow/Raven |
| Passerine (songbird) | Unknown | |

**Risk to Birds/Construction (circle one)**

No Risk Potential Risk – Not Imminent Potential Risk – Imminent

**Additional Comments** ______________________________

______________________________

______________________________

# Appendix M.2 Nesting Bird Management Plan

www.intersectpower.com

# NESTING BIRD MANAGEMENT PLAN

## Perkins Renewable Energy Project

*Prepared for*

**IP Perkins, LLC and IP Perkins BAAH, LLC**

**subsidiaries of Intersect Power, LLC**

**December 2023**

| **Agency Review Status** |
| --- |
| Bureau of Land Management |
| U.S. Fish and Wildlife Service |
| California Department of Fish and Wildlife |

## CONTENTS



## TABLES



## ATTACHMENTS

# LIST OF ACRONYMS

| | |
|---|---|
| BBCS | Bird and Bat Conservation Strategy |
| BLM | Bureau of Land Management |
| CDFW | California Department of Fish and Wildlife |
| CPUC | California Public Utilities Commission |
| EA | Environmental Assessment |
| EIR | Environmental Impact Report |
| FGC | California Fish and Game Code |
| MBTA | Migratory Bird Treaty Act |
| MM | Mitigation Measure |
| MW | Megawatt |
| NBMP | Nesting Bird Management Plan |
| USFWS | United States Fish and Wildlife Service |

# 1. INTRODUCTION

## 1.1. Project Summary

IP Perkins, LLC and IP Perkins BAAH, LLC (Applicants or Proponents), subsidiaries of Intersect Power, LLC, propose to construct, operate, and decommission the Perkins Renewable Energy Project (Project), a utility-scale solar photovoltaic (PV) electrical generating and storage facility, and associated infrastructure to generate and deliver renewable electricity to the statewide electricity transmission grid. The proposed Project site is located on a combination of Bureau of Land Management (BLM)-managed lands, Bureau of Reclamation (BOR)-managed lands, and private lands in Imperial County east of El Centro, California. The Project 500kV loop-in transmission lines will traverse Bureau of Reclamation (BOR) lands (see POD [Plan of Development] Appendix A, Figure 1).

BLM public lands within the Project area are designated as Development Focus Area (DFA) by the Desert Renewable Energy Conservation Plan (DRECP) and associated Record of Decision (ROD), and thus, have been targeted for renewable energy development. Because the proposed Project is partially located on federal land under management of the BLM, the BLM is the lead agency under the National Environmental Policy Act (NEPA), 42 U.S.C. section 4321 et seq. California Energy Commission (CEC) will serve as the lead agency under the California Environmental Quality Act (CEQA).

The Project would generate and store approximately 500 to 1,150 megawatts (MW) of renewable electricity via arrays of solar photovoltaic (PV) panels, battery energy storage system (BESS), and appurtenant facilities. The Project would construct a new gen-tie line that would connect the project substation(s) to a new high-voltage breaker and a half (BAAH) switchyard. From the BAAH switchyard, two new 500 kV loop-in transmission lines would be constructed to interconnect to the existing SDG&E 500 kV transmission line that travels east-west just south of the Project site, crossing BOR lands and terminating in the Imperial Valley Substation (Substation), southwest of El Centro. No construction would occur within the reduced utility corridor along the Project site's southern and western boundaries. For a complete Project description and summary of the Project location, refer to the POD main text.

Clean, renewable energy generation will have an overall benefit to plant and wildlife species on a local, regional, and global scale by replacing fossil fuel energy sources, reducing toxic emissions, and mitigating the effects of climate change on ecosystems.

## 1.2. Purpose

The primary purpose of the Nesting Bird Management Plan (NBMP) is to provide a framework for management and monitoring of bird nesting activities during the construction phase of development. Implementation will ensure that impacts to avian species protected by the California Fish and Game Code (FGC) and the federal Migratory Bird Treaty Act (MBTA) are avoided and minimized during construction. The State of California regulations include FGC Sections 3503, 3503.5, and 3513 which protect all birds, birds of prey, and all nongame birds, as well as their eggs and nests. The MBTA makes it unlawful in most circumstances to take (hunt, pursue, take capture, or kill) migratory birds.

In 2023, wildlife surveys were conducted at 20-meter belt transects, consistent with 2012 CDFW burrowing owl protocol surveys (CDFW 2012). Survey crews in the spring season 2023 consisted of experienced desert wildlife and avian biologists. During wildlife surveys, biologists recorded all wildlife species observed, regardless of conservation status. Common species were tallied at the end of each transect and recorded throughout each day. There were four sensitive species found during surveys including Western burrowing owl *(Athene cunicularia hypugaea)*, loggerhead shrikes *(Lanius ludovicianus)*, Black-tailed gnatcatchers *(Polioptila melanura)*, and Swainson's hawk *(Buteo swainsoni)*. Although there were no Yuma Rideway's rail (*Rallus obsoletus yumanensis*) observed during surveys or avian counts, there is occupied habitat within a mile of the Project site, in seepage areas along the All-American Canal (Blackhawk Environmental 2020) and marginally suitable foraging habitat in mature stands of common reed within the transmission corridor along the All-American canal. The complete Avian Count during Spring 2023 surveys is included in the Biological Resources Technical Report ([BRTR, Appendix C, Table 5], POD Appendix S)

This NBMP was prepared in conjunction with the Bird and Bat Conservation Plan (BBCS) (see POD Appendix X) to conform to DRECP Conservation and Management Action (CMA) LUPA-BIO-17 (BBCS)[1]. Nesting birds are further protected through implementation of CMAs for monitoring, pre-construction/activity nesting bird surveys, and setbacks from active nests, as directed in the following CMAs. Full text of CMAs can be found in POD Appendix D, Applicability of DRECP CMAs.

- **LUPA-BIO-16,** Activity-Specific Bird and Bat CMAs,
- **DFA-BIO-IFS-1**, Individual Focus Species (IFS) (pre-construction/activity breeding season surveys for individual species – Bendire's thrasher, burrowing owl, golden eagle),
- **DFA-BIO-IFS-2**, Setbacks for individual species – Bendire's thrasher, burrowing owl, golden eagle),
- **LUPA-BIO-3**, Resource Setback Standards,
- **LUPA-BIO-RIPWET-3**, BLM Special Status Riparian Bird Species (pre-construction/activity nesting bird surveys), and
- **LUPA-BIO-IFS-12**, Burrowing Owl (setbacks and monitoring for burrows).

This NBMP may be revised to conform to requirements of: (1) relevant provisions of the Project's Final Environmental Impact Report or Environmental Assessment, (2) any USFWS Biological Opinion (BO) or CDFW Consistency Determination or Incidental Take Permit (ITP) issued for the Project, (3) any revisions to relevant Mitigation Measures (MMs) that may be adopted in the BLM Record of Decision and/or by California Energy Commission, or (4) any further direction from the resource agencies.

## 1.3. Biologist Designations

The Lead Avian Biologist(s) and Avian Biologist/Monitors will be responsible for implementation of this NBMP including monitoring and reporting. All biologists' qualifications will be subject to review and approval by BLM, California Department of Fish and Wildlife (CDFW), and the United States Fish and Wildlife Service (USFWS) (or its designated representative). The following specifies the roles and minimum qualifications for the Lead Avian and Avian Biologist/Monitors.

**Lead Avian Biologist:** Searches for and identifies active bird nests; makes recommendations for

[1] LUPA-BIO-17: For activities that may result in mortality to Focus and BLM Special–Status bird and bat species, a Bird and Bat Conservation Strategy (BBCS) will be prepared with the goal of assessing operational impacts to bird and bat species and incorporating methods to reduce documented mortality. The strategy shall be approved by BLM in coordination with USFWS, and CDFW as appropriate.

establishing appropriate nest buffers and any subsequent adjustments to those buffers; communicates buffer information to CDFW, USFWS, BLM and BOR, who may also recommend indirect impact reductions, such as establishing no parking/stopping/loitering zones; involved in determining when a nest is no longer active based on personal observations or those of the biologist/biological monitor; maintains documentation. May establish Environmentally Sensitive Area (ESA) buffers for active nests and halt construction to protect nesting birds.

To be approved as a Lead Avian Biologist by the agencies, an individual is expected to have the following average qualifications:

- A bachelor's degree in biological sciences, zoology, botany, ecology, or a closely related field.
- Two or more years of focused experience performing nesting bird surveys or monitoring nests for a range of bird species in Southern California.
- Worked on 10 or more substantial multi-season bird projects, or the equivalent, performing surveys, habitat assessments, etc. in the field. Of these, at least 8 must be in the Southwest, preferably in California.

**Avian Biologist/Monitor:** Conducts pre-construction nest sweeps and identifies nest locations; establishes appropriate buffers around active nests following guidance provided by the Lead Avian Biologist; actively monitors nests and adjacent construction activities; conducts regular sweeps to search for and identify additional nests; communicates regularly with the Lead Avian Biologist about any nesting bird behaviors observed; enters nesting and bird monitoring data; creates new documentation; and updates existing documentation. The Avian Biologist/Monitor may halt construction at any time to protect nesting birds.

To be approved as an Avian Biologist/Monitor, an individual is expected to have the following qualifications:

- Worked on 3 or more substantial multi-season bird projects or the equivalent, performing surveys, habitat assessments, etc. in the field. Of these, at least 2 must be in the Southwest, preferably in California.

## 1.4. Definitions

**Active Nest.** An active nest for the purposes of this plan is a nest that contains an egg or a bird, or a nest being actively used (i.e., incubation, eggs, nestlings, fledglings) by any bird species. For raptors or special-status species actively building a nest, that nest is considered active.

Birds and their nests are protected in the state of California by both state and federal law. At the federal level, the MBTA states:

> *It shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird, any part, nest, or eggs of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof.*

At the state level, California FGC Section 3503 states:[2]

> *It is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto.*

California FGC Section 3503.5 states:

> *It is unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds-of-prey) or to take, possess or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto.*

While MBTA does not clearly define what an active (or inactive) nest is, the USFWS (USFWS, 2003) has clarified that the federal regulations do not pertain to the destruction of nests alone (without birds or eggs), provided that possession of the nests does not occur, and the activities do not otherwise result in take of migratory birds covered by the MBTA. CDFW has not provided clarification on the regulations pertaining to nesting birds. Therefore, for purposes of this Plan, non-raptor, non-special-status species nests without eggs or chicks are considered inactive. For raptors, a nest is considered active when raptors exhibit nest construction or nest decorating behavior. The Lead Avian Biologist will determine when a nest is active based upon field observations at each nest. For special-status species, a nest is considered active upon initiation of construction of the nest.

Because a moderate number of avian species never “build” nests, special attention will be provided to potential nests, known old nests, and the behavior of adults of any member of the orders Strigiformes (owls), Caprimulgiformes (nightjars), Cathartidae (new world vultures) or families in the order Falconiformes (diurnal birds of prey) including Falconidae (falcons), and Accipitridae (eagles, hawks, and kites), and some ground-nesting species (e.g., killdeer). The determination of an active nest will be made by the Lead Avian Biologist with a minimum observation time as described below.

**Inactive Nest.** For the purposes of this plan, non-raptor and non-special-status species nests that are under construction will be considered inactive until eggs are present within the nest. Special-status species nests will be considered active during the nest building phase.

Based on the Lead Avian Biologist’s best judgement, a previously active nest becomes inactive when it no longer contains viable eggs and/or living young and is not being used by a bird as part of the reproductive cycle (eggs, young, fledging young still dependent upon nest). Egg inviability will be inferred if eggs are present or believed present, but the adult birds have stopped brooding the eggs or abandoned the nest, based upon repeated observations of inactivity at the nest location. In some cases, a nest can be abandoned by the bird constructing it and become inactive prior to egg laying. In such cases, determination that the nest is inactive is made on a case-by-case basis based on consistent observations and the determination of a Lead Avian Biologist.

**Special-Status Species.** Special-status species are defined as species listed under the Federal Endangered Species Act, under the California Endangered Species Act, species with other state-level protections, and species that are on lists maintained by BLM. A list of special-status species with potential to occur in the Project area is included in Table 1 of the BBCS (see POD Appendix X).

[2] See footnote 2 for information regarding proposed amendments to the CFGC.

# 2. CONDITIONS FOR NESTING BIRDS

The entire Perkins Renewable Energy Project site and surrounding area provides suitable nesting habitat for numerous resident and migratory bird species (see BRTR, POD Appendix S [Ironwood, 2023], Figure 6: Vegetation Communities). Nesting bird breeding seasons are dependent upon the species but is typically between January 1 through August 31 and is distributed among species as follows.

- Raptors and hummingbirds beginning January 1 through August 31.
- Other species, beginning February 1 continuing through August 15.

Special-status bird species known to or with high-moderate potential to nest on or near the Project site include Western burrowing owl (*Athene cunicularia hypugaea*), Loggerhead shrike (*Lanius ludovicianus*), and Black-tailed gnatcatchers (*Polioptila melanura*) (see POD Appendix S: BRTR).

Many adult birds would flee from equipment during Project construction; however, nestlings and eggs would be vulnerable. If initial fencing, site grading, or brush removal were to take place during nesting season, it could destroy bird nests, including eggs or nestling birds. Impacts to birds can be avoided by scheduling initial clearing and grading outside the nesting season. Or, if initial clearing and grading are undertaken during nesting season, work will be limited only to areas where no nesting birds are present, as documented by pre-construction nest surveys (Section 3.1).

One special-status species, the burrowing owl, is unlikely to flee the site during construction, even outside the nesting season, due to its characteristic behavior of taking cover in burrows. The Wildlife Protection and Relocation Plan (see POD Appendix U) includes a framework for management approach, monitoring, and relocation of special-status species that may occur within the Project area, including burrowing owl. Refer to the Wildlife Protection and Relocation Plan for guidance on burrowing owl monitoring and management. Any direct handling of burrowing owl would require the Lead Avian Biologist or Avian Biologist/Monitor to be permitted for burrowing owl.

Some birds will likely nest in the Project disturbance area during construction, even after initial grading and clearing. Depending on the species, birds may nest on the ground close to equipment; on foundations, structures, or construction trailers; or on idle vehicles or construction equipment left overnight or during a long weekend. The species most likely to nest in the Project disturbance area during construction are common ravens, house finches, and mourning doves, all of which are protected by the MBTA and California FGC. Due to the high probability that birds may nest on site during construction, regular monitoring and nest site management, including monitoring and buffering of active nests, may be necessary throughout the breeding season.

# 3. NESTING SEASON MONITORING METHODOLOGY

The following section outlines monitoring methodology for the active avian nest season. As discussed above in Section 2, the nesting season begins January 1 for raptors and hummingbirds and February 1 for other species and continues through August. Active nests may occur at any time of year, and it is unlawful to kill or take a migratory bird, nest, or egg, except as permitted under regulations.

The Applicant will identify a qualified Lead Avian Biologist who will direct the nest detection surveys and nest monitoring described in this section. The Lead Avian Biologist may conduct the surveys and monitoring or may oversee Avian Biologist/Monitors in conducting all or part of the work. As presented in Section 1.4, the Lead Avian Biologist and Avian Biologist/Monitors will be approved by the agencies prior to their implementation of NBMP activities.

Surveys will consist of a pedestrian search by an Avian Biologist for both direct and indirect evidence of bird nesting. Direct evidence will include the visual search of an actual nest location. Indirect evidence will include observing birds for nesting behavior, such as copulation, carrying food or nesting materials, nest building, adult agitation or feigning injury, feeding chicks, removal of fecal sacks, and other characteristic behaviors that indicate the presence of an active nest. Surveys will be conducted in accordance with the guidance in Martin and Guepel (1993).

The size of the survey area physically surveyed will vary according to site specific conditions. The amount of acreage covered by surveyors will be determined based upon the nesting bird activity encountered and the opinion of the qualified personnel conducting the surveys. The density and complexity of habitat type will be considered during survey planning to determine the field methods, number of qualified personnel, and the time needed to locate nests. Surveys located in more dense habitats may require observations from multiple vantage points to locate all potential nests prior to construction. Surveys located in desert scrub habitats may be completed in less time due to lower vegetation density that would allow surveyors to spot nests and nesting activity.

## 3.1. Preconstruction Surveys & Daily Sweeps

Preconstruction surveys will consist of a pedestrian search by the Lead Avian Biologist or Avian Biologist/Monitor for evidence of nesting birds in potential nesting habitat that would be impacted by Project construction. During construction in the nesting season, the Lead Avian Biologist or Avian Biologist/Monitor will also conduct regular sweeps of the area to detect nesting activity. The survey methods will follow standard nest-locating techniques such as those described in Martin and Guepel (1993) and may vary based on site specific conditions, such as the complexity of habitat, the number of vantage points, birds observed in the area, and their territory size. Surveys may be systematic transects (e.g., 10 m intervals), meandering transects (e.g., where specific topography, substrates, or vegetation are targeted) or other methods which are determined by the Lead Avian Biologist based on site-specific characteristics. Evidence of nesting birds includes the visual search of an active nest location or observing nesting behaviors such as repeat visits to specific location, carrying food or nesting materials, nest building, feeding chicks, or distraction displays. If the presence of a potentially active nest is suspected but cannot be confirmed, additional surveys will be conducted.

Within nesting bird season, the Lead Avian Biologist or Avian Biologist/Monitor will survey for nesting birds prior to vegetation clearance or construction activity that may affect active nests. Any nesting surveys involving passerines should be conducted within 4 days of the initiation of any vegetation clearance or grading, whereas surveys involving raptors will be 7 days prior. An additional preconstruction survey will be conducted immediately prior to initial Project related, ground disturbing activities to confirm no new nests are found. The preconstruction surveys will cover all areas within the Project site and along linear features where work may occur. Surveys will include a 1,200-foot buffer for raptors and a 300-foot buffer for other species surrounding each work area, if habitat occurs in the buffer. An example Avian Nest Reporting Form is included as Attachment A. Surveys will be repeated regularly during nesting season in nesting habitat. If a work site remains inactive for a period of ten days or more, the surveys will be repeated.

The Lead Avian Biologist or Avian Biologist/Monitor shall conduct daily pre-construction “sweeps” of each work site, immediately prior to beginning construction or disturbance work, to identify any vulnerable wildlife that may have entered the site.

If survey requirements are inconsistent between this NBMP and other permit conditions, the most conservative approach will be selected, or the Lead Avian Biologist will request clarification from the BLM, CDFW, and or USFWS, as specified by final project mitigation.

## 3.2. Exclusion Buffers for Active, Occupied Nests

If active nests are found, an exclusion buffer will be established and marked in the field around each nest. Construction shall not occur within the designated nest exclusion buffer until the nest is no longer active (i.e., the young fledge from the nest, or the nest is abandoned). At all times, nest exclusion buffers must be effective in avoiding the potential for Project-related nest abandonment, failure of fledging, and disturbance of the nesting behavior. If Project activities cause or contribute to a bird being flushed from a nest, the buffer size must be increased, and the nest monitored to ensure the bird has returned and nesting has not failed.

The default buffer distance established around a particular nest will be species-specific, according to the buffer distances in Table 1. The default buffer distances have been used on multiple other infrastructure projects in the immediate area and were included in a NBMP for similar habitat and region. These buffers were developed in coordination with BLM, CDFW, USFWS, and CPUC (California Public Utilities Commission Nesting Bird Working Group, 2015). Default buffers consider species tolerances for disturbance, if known. Larger default buffers are used for raptors and for species that are not tolerant of disturbance. Smaller default buffers are generally used for smaller birds and species that have a high tolerance for disturbance, such as those that are commonly found nesting close to development. Several species that nest in lattice steel towers or build nests in or on equipment that is stored at construction sites are identified in Table 1 as common. These include red-tailed hawks, common ravens, western kingbirds, and house finches.

In Table 1, some species fall into more than one category and may therefore have more than one species-specific buffer. For example, a blue-gray gnatcatcher nesting in a thicket or understory is less likely to be disturbed by Project activities than one nesting in a more exposed location in a shrub or small tree, even though both nests are the same distance from the construction activity. The category for each nest will be determined by the Lead Avian Biologist based upon location of the nest relative to surrounding activities, as well as the bird's observed tolerance to human activity. For specific construction activities, sound monitoring information may be used during analysis of potential impacts from construction-related activity.

**Table 1. Default Buffers for Nests During Construction**

| Avian Group (nest type/location) | Species Potentially Nesting Within Project Site | Minimum Buffers for Ground Construction per Disturbance Level (feet)* |
|---|---|---|
| Waterfowl and rails | Canada goose, mallard, cinnamon teal, ruddy duck, Yuma Ridgway's rail*, Virginia rail, American coot, pied-billed grebe | 150 (500 for species marked with an *) |
| Quail | Gambel's quail | 150 |
| Herons | Great blue heron | 250 |
| Cormorants | Double-crested cormorant | 250 |
| Birds of prey (Category 1) | American kestrel, barn owl, western screech-owl | 300 |
| Birds of prey[2] (Category 2) | red-tailed hawk (2), great horned owl, osprey | 300 |
| Birds of prey (Category 3) | Turkey vulture, red-tailed hawk (2), | 500 |
| Shorebirds | Killdeer, Whimbrel | 200 |

| Avian Group (nest type/location) | Species Potentially Nesting Within Project Site | Minimum Buffers for Ground Construction per Disturbance Level (feet)* |
|---|---|---|
| Doves | Mourning dove, white-winged dove, common ground-dove, Inca dove | 150 |
| Roadrunners | Greater roadrunner | 300 |
| Nightjars | Lesser nighthawk | 150 |
| Swifts | White-throated swift | 200 |
| Hummingbirds | Anna's hummingbird, Costa's hummingbird | 100 |
| Woodpeckers | ladder-backed woodpecker | 150 |
| Paaserines (cavity and crevice nesters) | Say's Phoebe (2), ash-throated flycatcher (2), violet-green swallow, rock wren (2) | 100 |
| Passerines (bridge, culvert, and building nesters) | Black phoebe, Say's phoebe (2), Ash-throated flycatcher (2), northern rough-winged swallow, cliff swallow, barn swallow, house finch (3) | 100 |
| Passerines (ground nesters, open habitats) | Horned lark, rock wren (2), western meadowlark, common yellowthroat (2) | 150 |
| Passerines (understory and thicket nesters) | yellow-breasted chat, song sparrow, blue grosbeak | 150 |
| Passerines (shrub and tree nesters) | western kingbird (2), loggerhead shrike (2)*, common raven, verdin, ruby-crowned kinglet, black-tailed gnatcatcher, cactus wren (2)*, northern mockingbird, Le Conte's thrasher, phainopepla, yellow warbler, yellow-rumped warbler, Wilson's warbler, yellow-breasted chat, Abert's towhee, black-throated sparrow, song sparrow, summer tanager, great-tailed grackle (2), hooded oriole, Bullock's oriole, house finch (3), lesser goldfinch (2), Brewer's sparrow, white-crowned sparrow | 150 (300 for species marked with *) |
| Passerines (open scrub nesters) | Loggerhead shrike (2)*, verdin, cactus wren (2)*, black-tailed gnatcatcher, northern mockingbird, Le Conte's thrasher, Phainopepla, orange-crowned warbler, southern rufous-crowned sparrow, Abert's towhee, black-throated sparrow, Brewer's blackbird, lesser goldfinch (2) | 150 (300 for species marked with *) |
| Passerines (tower nesters) | Western kingbird (2), common raven, house finch (3) | 150 |
| Passerines (marsh nesters) | Common yellowthroat (2), red-winged blackbird, great-tailed grackle (2) | 150 |
| Species not covered under MBTA | Domestic waterfowl, including domesticated mallards, feral (rock) pigeon, ring-necked pheasant, chukar, Eurasian collared dove, spotted dove, parrots, parakeets, European starling, house sparrow | NA |

For species listed under two or more categories, the number of categories is indicated in parentheses, e.g., "Loggerhead shrike (2)."[3]
*Default buffers provided by USFWS.

## 3.3. Minimal Disturbance Activities

[3] Lead Avian Biologist should contact the wildlife agencies for buffers of Prairie Falcon, Peregrine Falcon, or Golden Eagle if a nest if found.

Minimal disturbance level activities generally produce little to no noise, use no machinery, create minimal fugitive dust, are short in duration, and cause minimal to no ground or vegetation disturbance. Some examples of low disturbance activities are vegetation clearing (hand tools) and bird deterrent installation. Some low disturbance level activities such as surveys, staking and flagging, and best management practice (BMP) installation and repairs generate very minimal levels of disturbance compared to other construction activities; however, would still be overseen by an Avian Biologist. Minimal disturbance activities do not require the typical buffers that other construction activities necessitate. Minimal disturbance level activities may include the following.

- Hand clearing of vegetation
- Installation of bird deterrent (see Section 3.6)
- BMP (straw waddle) installation or repair
- Environmental surveys
- Staking/Flagging installation or removal

## 3.4. Buffer Reduction Process

For Project activities of any disturbance level that are inconsistent with established buffer distances, the Lead Avian Biologist will evaluate the proposed activity on a case-by-case basis. A reduced buffer distance may be implemented if recommended by the Lead Avian Biologist.

For each proposed buffer reduction, an Avian Biologist will be consulted and will determine whether the species-specific buffers may be reduced for the specific activity and duration associated with the active nest. Buffer reductions will take place only after resource agencies notification and consideration of site-specific conditions.

Buffers may be reduced based on the nest cycle status. For some species, nesting is most susceptible to failure earlier in the nest cycle when fewer resources have been invested towards the nest, thus requiring a larger buffer early on.

If buffer distances are temporarily reduced for a specific activity, the buffers will be returned to the original distance after completion of the activity.

Once vegetation removal activities are complete and construction is underway, birds may become acclimated to regular construction activities and will nest near work activities. Buffers may be further reduced by the Lead Avian Biologist based on the level of habituation and acclimation, following required notification to BLM, BOR, CDFW, and USFWS. However, because of fluctuating conditions in an active construction site, these factors will be continually reassessed, and management adjusted by the Lead Avian Biologist, to avoid disturbance of active nests.

### 3.4.1. Common Species Buffer Reduction Process

For common species, buffers may be reduced through the following notification process.

1. The Construction Contractor will file a buffer reduction request to the Lead Avian Biologist, describing the proposed work activity within the buffer area, reason the activity must be completed while the nest remains active, and total period of proposed buffer reduction.
2. The Lead Avian Biologist will review the nest status and the need for the reductions with the contractor or construction manager. Opportunities for potential avoidance of the buffer reduction will be evaluated (e.g., by staging equipment in a different location or altering project construction sequencing). Wherever feasible, proposed work activities and locations will be adjusted to avoid or minimize incursion into the buffer area.

3. The Lead Avian Biologist will evaluate the request and determine whether a reduced buffer can be applied. The decision will be based on the documented nest information and site-specific conditions. Site-specific conditions include nesting species, behavior of the pair, reproductive stage, geographic location, distance to construction, type and extent of disturbance activity, anticipated duration and timing of the disturbance, microhabitat at the location of the nest that may provide visual and acoustic barriers, the species' natural history, species' known tolerances to human presence and activities, proposed buffer reduction distance, and start and end dates.
4. If determined to be acceptable by the Lead Avian Biologist, a buffer reduction notification will be submitted to, BLM, BOR, CDFW, and USFWS. The following information will be included in the notification.
   - Complete description of activities proposed within the reduced buffer, including types of equipment, duration, and start date
   - Description of Project activity in the vicinity of the nest within the last 30 days
   - Identification of the current and reduced buffers
   - Map showing current and reduced buffers
   - Nest activity, location, topography or other features that may shield the nest from the work area, the pair's response to the biologist, and photos
   - Assessment made by the Avian Biologist
   - Description of monitoring if different from the monitoring protocol described within the Plan
   - Statement regarding returning to the established default buffer after work has been completed in the reduced buffer area.
5. The Lead Avian Biologist will modify the buffer distance, upload the notification information, and document the notification date and, if applicable, the concurrence date. The Avian Biologist/Monitor will modify the ESA markers to the new buffer distance.
6. As the work activity is initiated, the Avian Biologist/Monitor will monitor the nest long enough to determine how the nesting pair is responding to the disturbance activity. If necessary, the Avian Biologist/Monitor will adjust the buffer accordingly to minimize disturbance at the nest.
7. If the activities described in the notification do not begin within seven calendar days or if Project activities change to a higher level of disturbance, the nest will be reevaluated, and an updated buffer reduction notification will be submitted for the proposed activities.

Once the Project activity is complete, the buffer will revert to the original established buffer. The Avian Biologist/Monitor will adjust the ESA markers. Note that as described in Section 1.4 above, the tasks noted above could be implemented by the Avian Biologist/Monitor under the direction of the Lead Avian Biologist.

### 3.4.2. Special-Status Species Buffer Reductions

Buffers for special-status species may be reduced to smaller buffers through coordination with the appropriate resource agencies. This NBMP does not address buffers or buffer reductions for listed threatened or endangered species. Any threatened or endangered listed species would require agency approval prior to any buffer reduction.

If a buffer for a special-status species nest impedes Project activities, a reduced buffer may be implemented according to the following process:

1. The Construction Contractor will file a buffer reduction request to the Lead Avian Biologist, describing the proposed work activity within the default buffer area, reason the activity must be completed while the nest remains active, and total period of proposed buffer reduction.
2. The Lead Avian Biologist will review the nest status and the need for the reduction with the contractor or construction manager. Opportunities for potential avoidance of the buffer reduction will be evaluated (e.g., by staging equipment in a different location or altering project construction sequencing). Wherever feasible, proposed work activities and locations will be adjusted to avoid or minimize incursion into the buffer area.
3. The Lead Avian Biologist will evaluate the request and determine whether a reduced buffer can be applied. The decision will be based on the documented nest information and site-specific conditions. Site-specific conditions include nesting species, behavior of the pair, reproductive stage, geographic location, distance to construction, type and extent of disturbance activity, anticipated duration and timing of the disturbance, microhabitat at the location of the nest that may provide visual and acoustic barriers, the species' natural history, species' known tolerances to human presence and activities, proposed buffer reduction distance and start and end dates.
4. If determined to be acceptable, the Lead Avian Biologist will submit a buffer reduction notification to BLM, BOR, CDFW, and USFWS. The following information will be included in the notification.
    - Complete description of activities proposed within the reduced buffer, including types of equipment, duration, and start date
    - Description of Project activity in the vicinity of the nest within the last 30 days
    - Identification of the current and reduced buffers
    - Map showing current and reduced buffers
    - Nest activity, location, topography or other features that may shield the nest from the work area, the pair's response to the biologist, and photos
    - Assessment made by the Avian Biologist
    - Description of monitoring if different from the monitoring protocol described within the Plan
    - Statement regarding returning to the established default buffer after work has been completed in the reduced buffer area.
5. If no objections are received within 24 hours, the buffer reduction may be implemented at the discretion of the Lead Avian Biologist. The Avian Biologist/ Monitor will then modify the ESA markers to the new buffer distance. The Avian Biologist/Monitor will modify the buffer distance, upload the approval information, and document the request and approval dates. If objections are communicated, the Lead Avian Biologist will cooperate with the concerned agency(s) to resolve the issue.
6. As the work activity is initiated, the Avian Biologist/Monitor will monitor the nest long enough to determine how the nesting pair is responding to the disturbance activity. If necessary, the Avian Biologist/Monitor will adjust the buffer accordingly to minimize disturbance at the nest.
7. If the activities described in the request do not begin within seven calendar days or if Project activities change to a higher level of disturbance, the nest will be reevaluated, and an updated buffer reduction request shall be submitted for the proposed activities.

Once the Project activity is complete, the buffer will revert back to the original established buffer. The Avian Biologist/Monitor will adjust the ESA markers. Note that as described in Section 1.4

above, the tasks noted above could be implemented by the Avian Biologist/Monitor under the direction of the Lead Avian Biologist.

## 3.5. Active Nest Monitoring Standards

Active nests will be monitored to ensure that measures are being employed to minimize disturbance to nesting birds. Regular monitoring of active nests will also inform when and if a buffer can be reduced or removed, or if adaptive management measures, such as increasing the buffer, need to be employed. The frequency of nest monitoring will be determined by site-specific conditions but will occur at a minimum one to three times per week. For example, active nests near ongoing construction may require daily monitoring, while active nests that are not near active construction activities may be monitored in a 4-day monitoring interval.

The frequency of monitoring for each nest will be determined by the Lead Avian Biologist. The following standards will be adhered to for nest monitoring:

- Nests shall be monitored via binoculars from outside of their buffer zones, except as identified below, to ensure their viability while construction is ongoing.
- Nests will be mapped from a distance, as appropriate, because close encroachment may cause nest abandonment.
- Surveys will identify the species and, to the degree feasible, nesting stage (e.g., incubation of young, feeding of young, near fledging).
- Only the Lead Avian Biologist or Avian Biologist/Monitor may enter the established buffer zone of a nest. If it is necessary for other personnel to enter the buffer zone, it must be done so with the permission and under the supervision of the Lead Avian Biologist.
- Nearby nest predators will be identified before approaching the nest.
- The Lead Avian Biologist must keep updated records of all active nests, buffers, buffer reductions, and nest outcomes.

## 3.6. Nesting Bird Deterrent Methods

Implementing nesting bird deterrent methods may reduce the potential for nest building near construction activities, and will be implemented, as warranted. Bird deterrent methods may include removal of vegetation within the Project area prior to nesting season; creating a disturbance by removing or moving equipment within an active construction area; covering straw wattle and other potential nesting materials in active construction areas; using pipe covers, tarps, and visual deterrents; and managing trash to reduce food subsidies.

## 3.7. Nest Removals

If for any reason a bird nest must be removed during nesting season, the Applicant or its agent will first notify BLM, BOR, CDFW, and USFWS. Nests would be removed only if they are inactive or if an active nest presents a hazard to people or other wildlife. If a hazardous situation involves a nest, the bird species, condition of the nest, and the hazard present will be documented. All wildlife agencies would be notified, and a consultation will occur. Removal of an active nest requires a permit from USFWS, which would be acquired, as needed.

Depending upon the hazard, the agencies will provide guidance to a viable approach for resolution. The Lead Avian Biologist will ensure that no needless nest removal occurs in accordance with California FGC 3503. Partially constructed nests from special-status species or raptors are considered active. Nests of non-special-status species or raptors determined to be inactive (no eggs or young) can be dismantled onsite by the Avian Biologist/Monitor after notification to CDFW and USFWS. All nest removals will be documented, and the data will be included in Annual Reports submitted to BLM, BOR, CDFW, and USFWS.

# 4. ADAPTIVE MANAGEMENT

Adaptive management measures will be implemented as needed. Generally, adaptive management measures will be implemented if there is evidence of Project-related disturbance to nesting birds where initial protection methods (e.g., standard exclusion buffer distance) have been deemed ineffective. Triggers for adaptive management may include agitation behavior (displacement, avoidance, and defense), increased vigilance behavior at nest sites, changes in foraging and feeding behavior, or nest site abandonment. Adaptive management measures may include the following:

- Increased buffer width
- Additional worker education
- Modifying work intervals, or allowing specific work types that may be implemented on a case-by-case basis
- Cessation by the Lead Avian Biologist of construction activities that are deemed to be the source of disturbance to the nesting bird
- Installation of visual or sound barriers
- Specific measures related to Project facilities or subsidies

If a nest fails, or a dead or injured bird is found, the Lead Avian Biologist will collect data including condition, species, location, and weather data. The nearest Project component or work activity will be documented, and the potential cause of death or injury will be assessed. For any fatalities or injuries to special status species, the findings will be reported to BLM, CDFW and/or the USFWS, as appropriate, within 24 hours of positive identification or as otherwise required. Data of all nest failures and dead or injured birds will be presented in the Annual Reports submitted to BLM, CDFW, and the USFWS. Procedures for reporting mortality or injury are included in the BBCS (POD Appendix X).

# 5. RECORD KEEPING AND REPORTING

A nest survey and monitoring log shall document all new and monitored nests and include the following information:

- Date
- Species of bird
- Nest status (e.g., nest building, incubating, fledglings present, or inactive)
- Unique identification number of each nest monitored and coordinates (easting and northing)
- Estimated date of nest establishment
- Estimated fledge date
- Description of nearby construction activities, including distance from nest and relative noise level
- Description of any nearby non-Project activities (e.g., publicly accessible roads or trails)

- Exclusion buffer size
- Description of additional measures taken to protect nests

Logs and corresponding maps showing the disturbance limits, Project features, and current nest buffer data shall be updated weekly and made available to survey crews, construction personnel, and resource agencies.

If a nest of a threatened or endangered species, a California species of special concern, or fully protected species is detected, BLM, BOR, CDFW, and/or the USFWS, as appropriate, will be notified within 24 hours.

The Applicant will provide an Annual Report during construction which details a summary of nesting activities on the Project site and survey buffers. The Applicant will provide the annual reports to BLM, CDFW, and the USFWS during the last quarter following each of season of construction that occurs during the nesting season.

# 6. REFERENCES

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Martin, T.E., and G.R. Guepel. 1993. Nest-monitoring plots: Methods for locating nests and monitoring success. J. Field Ornithol., 64(4): 507 519.

United States Fish and Wildlife Service (USFWS). 2003. Migratory Bird Permit Memorandum, MBPM-2. April 15.

# Attachment A

## Avian Nest Reporting Form

## Project Construction Phase – Solar Facility Avian Nest Reporting Form

**Discoverer's Name** ______________________________________________

**Phone Number** ______________________ **Date of Nest Discovery** ________________

**Nest Location (circle one)** Tree Shrub Structure Ground

**Nest Coordinates** ________________________________________

**Other Location Information** ______________________________________________

**Surrounding Habitat (circle all that apply)**

Agricultural Desert Scrub Riparian

Grassland Disturbed/Developed Bare

**Nest Condition (circle one)** Active Inactive, Intact Inactive, Partial Deterioration Inactive, Heavy Deterioration

**Describe any Bird Signs around the Nest (feathers, scat, prey remains)** ____________________

______________________________________________________________________

**Are Birds Present? (circle one)** Yes No

**Number of Birds Visible** __________________________

**Age of Bird(s) (circle all that apply)** Adult Juvenile Nestling Eggs Unknown

**Bird Species (if known)** ______________________________________________

**Type of Bird (circle one if species is unknown)**

Diurnal Raptor (hawk, falcon, eagle) Owl Crow/Raven

Passerine (songbird) Unknown

**Risk to Birds/Construction (circle one)**

No Risk Potential Risk – Not Imminent Potential Risk – Imminent

**Additional Comments** ______________________________________________

______________________________________________________________________

______________________________________________________________________

## Project Construction Phase –
## Transmission Line Avian Nest Reporting Form

**Discoverer's Name** ______________________________

**Phone Number** ______________________ **Date of Nest Discovery** ______________

**Nest Location (circle one)** Tree Shrub Structure Ground

**Nest Coordinates or Closest Pole Location** ______________________________

**Other Location Information** ______________________________

**Surrounding Habitat (circle all that apply)**

Agricultural Desert Scrub Riparian

Grassland Disturbed/Developed Bare

**Nest Condition (circle one)** Active Inactive, Intact
Inactive, Partial Deterioration Inactive, Heavy Deterioration

**Describe any Bird Signs Around the Nest (feathers, scat, prey remains)**

______________________________

______________________________

**Are Birds Present? (circle one)** Yes No

**Number of Birds Visible** ______________________

**Age of Bird(s) (circle all that apply)** Adult Juvenile Nestling Eggs Unknown

**Bird Species (if known)** ______________________________

**Type of Bird (circle one if species is unknown)**

Diurnal Raptor (hawk, falcon, eagle) Owl Crow/Raven

Passerine (songbird) Unknown

**Risk to Birds/Construction (circle one)**

No Risk Potential Risk – Not Imminent Potential Risk – Imminent

**Additional Comments** ______________________________

______________________________

______________________________

# Appendix M.3 Raven Management Plan

www.intersectpower.com

# RAVEN MANAGEMENT PLAN

## Perkins Renewable Energy Project

*Prepared for*

Intersect Power

**IP Perkins, LLC**
**and IP Perkins**
**BAAH, LLC**
**subsidiaries of Intersect Power, LLC**

**December 2023**

| **Agency Review Status** |
|---|
| Bureau of Land Management |
| U.S. Fish and Wildlife Service |
| California Department of Fish and Wildlife |

# Contents



## Tables



## Attachments

# LIST OF ACRONYMS

| | |
|---|---|
| BESS | Battery Energy Storage System |
| BLM | Bureau of Land Management |
| BO | Biological Opinion |
| BOR | Bureau of Reclamation |
| CDFW | California Department of Fish and Wildlife |
| CEQA | California Environmental Quality Act |
| DFA | Development Focus Area |
| DRECP | Desert Renewable Energy Conservation Plan |
| I-8 | Interstate 8 |
| ITP | Incidental Take Permit |
| kV | kilovolt |
| LUPA | Land Use Plan Amendment |
| LTVA | Tamarisk Long Term Visitor Area |
| MW | megawatt |
| NBMP | Nesting Bird Management Plan |
| NEPA | National Environmental Policy Act |
| O&M | Operations and Maintenance |
| PV | solar photovoltaic |
| ROD | Record of Decision |
| USFWS | United States Fish and Wildlife Service |
| WEAP | Worker Environmental Awareness Program |

# 1. INTRODUCTION

## 1.1. Project Summary

IP Perkins, LLC and IP Perkins BAAH, LLC (Applicants or Proponents), subsidiaries of Intersect Power, LLC, proposes to construct, operate and decommission the Perkins Renewable Energy Project (Project), a utility-scale solar photovoltaic (PV) electrical generating and storage facility, and associated infrastructure to generate and deliver renewable electricity to the statewide electricity transmission grid. ). The proposed Project site is located on a combination of Bureau of Land Management (BLM)-managed lands, Bureau of Reclamation (BOR)-managed lands, and private lands. The Project 500kV loop-in transmission lines will traverse Bureau of Reclamation (BOR) lands in Imperial County east of El Centro, California (see POD [Plan of Development] Appendix A, Figure 1).

BLM public lands within the Project area are designated as Development Focus Area (DFA) by the Desert Renewable Energy Conservation Plan (DRECP) and associated Record of Decision (ROD), and thus, have been targeted for renewable energy development. Because the proposed Project is partially located on federal land under management of the BLM, the BLM is the lead agency under the National Environmental Policy Act (NEPA), 42 U.S.C. section 4321 et seq. California Energy Commission (CEC) will serve as the lead agency under the California Environmental Quality Act (CEQA).

The Project would generate and store approximately 500 to 1,150 megawatts (MW) of renewable electricity via arrays of solar photovoltaic (PV) panels, battery energy storage system (BESS), and appurtenant facilities. The Project would construct a new gen-tie line that would connect the project substation(s) to a new high-voltage breaker and a half (BAAH) switchyard. From the BAAH switchyard, two new 500 kV loop-in transmission lines would be constructed to interconnect to the existing SDG&E 500 kV transmission line that travels east-west just south of the Project site, crossing BOR lands and terminating in the Imperial Valley Substation (Substation), southwest of El Centro. No construction would occur within the reduced utility corridor along the Project site's southern and western boundaries. For a complete Project description and summary of the Project location, refer to the POD main text.

Clean, renewable energy generation will have an overall benefit to plant and wildlife species on a local, regional, and global scale by replacing fossil fuel energy sources, reducing toxic emissions, and mitigating the effects of climate change on ecosystems.

## 1.2. Purpose

Common raven (*Corvus corax*) occurs throughout the region. Ravens are predators of flat-tailed horned lizards and Colorado desert fringe toed lizards and thrive in areas of human activity. The Project site supports suitable flat-tailed horned lizard (*Phyrnosoma mcallii*) and Colorado desert fringe-toed lizards *(Uma notata)* habitat and live individuals, and sign have been observed. Common ravens are the only raven species in the area; the terms "raven" and "common raven" are used interchangeably in this plan.

This Raven Management Plan has been prepared to conform to the Desert Renewable Energy Conservation Plan (DRECP) Conservation and Management Action (CMA) LUPA-BIO-6 (Subsidized Predators Standards). This Plan may be revised to conform to requirements of: (1) mitigation requirements of the Project's Final Environmental Impact Report or Environmental Assessment, (2) any USFWS Biological Opinion (BO) or CDFW Consistency Determination or

Incidental Take Permit (ITP) issued for the Project, (3) any revisions to relevant mitigation measures (MMs) that may be adopted in the BLM Record of Decision and/or California Energy Commission (CEC), or (4) any further direction from the resource agencies.

This Plan will be implemented by IP Perkins, LLC and IP Perkins BAAH, LLC (or any future Project owner) to prevent unwanted indirect impacts of the Project to the resident wildlife populations. Please also see the Project Wildlife Protection and Translocation Plan (see POD Appendix U) for additional wildlife protection measures.

## 1.3. Project Site Vegetation and Habitat

There are three primary natural vegetation communities (Sonoran creosote bush scrub, desert dry wash woodland/microphyll woodland, and alkali goldenbush desert scrub) found throughout the Project site and two vegetation communities (arrow weed thickets and common reed marsh) located within portions of the transmission corridor along the edges of the All-American Canal. Desert dry wash woodland is a sensitive vegetation community recognized with a rarity rank of S3 (CDFW 2023). Vegetation communities on the Project site are described in further detail and mapped in the Project's Biological Resources Technical Report (BRTR) (Ironwood 2023) (see POD Appendix S).

**Sonoran Creosote Bush Scrub.** Sonoran creosote bush scrub is dominant vegetation community throughout most of the Project site and transmission line corridor. Creosote bush scrub and white bursage are co-dominants in the shrub canopy with only a few shrubs sparsely distributed that include Emory's indigo (*Psorothmanus emoryi*) and white bursage (*Ambrosia dumosa*), cheesebush (*Ambrosia salsola*), and ephedra (*Ephedra spp*)in some areas with primarily an understory of annual plants.

**Desert Dry Wash Woodland/Microphyll Woodland.** Desert Dry Wash Woodland (also called microphyll woodland) is a sensitive vegetation community recognized with a rarity rank of S3 (CDFW 2023). It is as an open to relatively densely covered, drought-deciduous, microphyllous (small, compound leaves) riparian scrub woodland, often sup-ported by dry braided wash channels that convey water and sediment to the vegetation. This vegetation community on the Project site is characterized by mesquite thickets that is synonymous to mesquite (*Prosopis glandulosa*) woodland alliance (Sawyer et al. 2009) and Sonoran - Coloradan Semi Desert Wash Woodland / Scrub (NVCS). This vegetation community has mesquite trees that cover at least 2-3 percent of the absolute cover for trees and shrubs and was mapped as a patch within the western parcel.

**Alkali Goldenbush Desert Scrub.** Alkali goldenbush desert scrub has a state rarity rank of S3 (CDFW 2023). Within the Project site, alkali goldenbush forms an open shrub layer and on moist or seasonally dry flats, and margins of intermittently saturated vegetated swales. The tree layer, consisting of mesquite, is mostly sparse if present. Stands generally have low cover of vegetation and may be sparse (<10% total vegetation).

**Arrow Weed Thickets.** Arrrow weed thickets have a state rarity rank of S3 (CDFW 2023). This vegetation community is characterized by arrow weed that is more than or equal to 2% of absolute cover with a sparse herbaceous layer of seasonal annuals. This vegetation is usually found near seasonally flooded washes and stream borders. Within the Project site, this vegetation community occurs only within a small portion of the transmission corridor bordering the southern edge of the All-American Canal.

**Common Reed Marsh.** This vegetation community is characterized by more than 2% absolute cover and more than 50% relative cover in the herbaceous layer. This vegetation community is sometimes considered invasive along waterways and wetlands (USDA 2022) and is only located within the edges of the All-American Canal of the transmission corridor.

# 2. BACKGROUND

## 2.1. Regulatory Background

At the direction of the BLM, CDFW, and/or U.S. Fish and Wildlife Service (USFWS), this plan may be revised to conform to requirements of: (1) relevant provisions of the Project's Final Environmental Impact Report or Environmental Assessment, (2) any USFWS Biological Opinion (BO) or CDFW Consistency Determination or Incidental Take Permit (ITP) issued for the Project, (3) any revisions to relevant mitigation measures that may be adopted in the BLM Record of Decision and/or CEC, or (4) any further direction from the resource agencies. The common raven and other native birds are protected from take under the federal Migratory Bird Treaty Act and California Fish and Game Code Sections 3503 and 3513. This Plan conforms to these statutes.

## 2.2. Flat-tailed Horned Lizards

Flat-tailed horned lizard is a state species of special concern and a BLM sensitive species. Their habitat is habitat is sandy desert hardpan or gravel flats with scattered sparse vegetation of low species diversity. Most common in areas with a high density of harvester ants and fine windblown sand, but rarely occurs on dunes. The historic range of this lizard is throughout most of the Colorado desert from the Coachella Valley south through the Imperial Valley and west into the Anza-Borrego desert, south to extreme NE Baja California, extreme SW Arizona and NW Sonora, Mexico. Both CDFW and the USFWS have at one time supported the listing of this species as threatened at state and federal levels, but these decisions were not supported by the California Department of Fish and Game Commission and the Secretary of Interior. USFWS withdrew the proposed rule to list the species in 2003 after threats were reevaluated and determined to be less significant than previously believed.

Fine sand for cover is a critical habitat element. Lizards burrow into the sand to avoid temperature extremes and remain for hours buried just below the surface (Stebbins 1985). Shrubs and clumps of grass often serve as sources of shade during the hottest parts of the day, and lizards have been observed climbing into bushes and clumps of dried grass presumably to avoid contact with the hot substrate. Little is known about habitat requirements for reproduction, but other lizards generally require well-drained, sandy or friable soil for nest construction. The flat-tailed horned lizard feeds primarily on ants but will occasionally eat beetles and other insects.

One hundred live individuals were observed during surveys confirming occupancy on the Project site. Six carcasses, two hundred and seventy-seven tracks, and one hundred and ninety-six scat were observed. Eleven ant hills were recorded (see BRTR, POD Appendix S Figure 9).

## 2.3. Colorado Desert Fringe Toed Lizard

Colorado desert fringe toed lizard is a state species of special concern and a BLM sensitive species. Their habitat is sparsely vegetated arid areas with fine, loose wind-blown sand for burrowing. Suitable habitats include dunes, flats with sandy hummocks formed around the bases of vegetation, washes, and the banks of rivers. it is found in extreme southeast California in the Colorado Desert, from the Salton Sea and Imperial sand hills east to the Colorado River, south to the Colorado River delta, and into extreme northeastern Baja California. It ranges west as far as the east base of Borrego Mountain. Fringe-toed lizards usually seek refuge from enemies by burrowing in the sand within 5-6 cm (2-2.4 in) of the surface. Rodent burrows and the bases of shrubs are also used for cover and thermoregulation (Stebbins 1944).

One live individual was observed during surveys confirming occupancy on the Project site (see BRTR, POD Appendix S Figure 9).

## 2.4. Common Raven Subsidized Predation

Predation by ravens can become a major problem for flat-tailed horned lizard populations. Common raven populations in the California desert have increased in response to expanding human land uses, because ravens habituate to human activities and are subsidized by human-provided resources including food (e.g., trash, road killed animals), water (irrigation or dust control overspray), and perching, roosting, and nesting sites (transmission towers and other structures).

Ravens may nest in native trees, large shrubs, on rock faces, or on other natural features. Anthropogenic features such as buildings, billboards, signs, utility poles, landscape trees, and other structures have introduced suitable raven nesting sites into areas where nest sites were otherwise very limited (Boarman, 2002b). The majority of raven predation on flat-tailed horned lizards can be expected during the spring (April and May) when ravens are feeding their young (Boarman, 2003). Ravens feeding chicks spend most of their time foraging within 400 meters (1/4 mile) of their nest (Boarman, 2002a; Kristan and Boarman, 2003). Therefore, the establishment of a new nest can have significant adverse effects on the local flat-tailed horned lizard populations. Although a nesting raven pair has the potential to prey on a large number of horned lizards, nesting pairs actively defend their territories against intruding ravens; thereby, limiting the number of ravens within a given area during the breeding season.

## 2.5. Existing and Potential Raven Subsidies in the Project Area

There are numerous anthropogenic (human-caused) subsidies for ravens and other predators already present in the Project vicinity. Thus, flat-tailed horned lizards may already be subject to elevated raven predation. Existing subsidies are shown on Figure 2 in POD Appendix A and include:

- **Roads.** There are two main highways that border the Project site including Interstate 8 (I-8) to the north and Highway 98 to the south. Roadkill and food waste are common along roads.
- **Tamarisk Long Term Visitor Area.** The Tamarisk Long Term Visitor Area (LTVA) is a secluded and remote campground south of the Project area, managed by the BLM El Centro Field Office. Visitors to the campground that may leave trash and food would provide a potential raven and predator subsidy.
- **Utility Infrastructure and Transmission Lines.** The Project site is located adjacent to the existing SDG&E Southwest Power Link 500 kV transmission line that travels east-west just south of the southern portion of the site, crossing BOR lands and located within the BLM utility corridor. Several Imperial Irrigation District (IID) low-voltage transmission lines (161 kV and below) run in and out of the IID Drop 4 Substation, located adjacent to the All-American Canal. One future project would be constructed within Corridor K: the North Gila-Imperial Valley #2 (NGIV2) Transmission Project. The transmission line towers could provide nesting, roosting, and perching sites for ravens.

- **All-American Canal.** The southern boundary of the Project site is located within 0.25 mile of the All-American Canal. The Canal holds water yearlong, providing a subsidy for birds and other wildlife. A hydroelectric dam and associated infrastructure is operated in the canal nearby, which provides perching opportunities for common raven.
- **Communications Infrastructure.** A communications tower is located southeast of the Project site, providing perching opportunities for common ravens.

# 3. POTENTIAL PROJECT SUBSIDIES AND SUBSIDY CONTROL MEASURES

The following section describes the potential raven subsidies that could occur during all phases of the Perkins Renewable Energy Project. These potential subsidies, along with IP Perkins, LLC and IP Perkins BAAH, LLC's subsidy control and monitoring measures, are summarized in Table 1. These measures will be implemented and monitored by a pre-approved Lead Biologist and Biological Monitors (see Section 4).

**Table 1. Project Subsidies and Subsidy Control Measures**

| Subsidy | Subsidy Control Measures |
|---|---|
| **Food Sources** | |
| Trash and Waste Management (Construction, O&M, Decommissioning). Food waste can become a raven subsidy if it is either left on the ground (i.e., litter) or left in accessible open containers. Food waste is a potential raven subsidy during all phases of the Project, including operations when the workforce would be small. | IP Perkins, LLC and IP Perkins BAAH, LLC will ensure that all workers or visitors to the facility dispose of all food waste, wrappers, and any other trash that could subsidize or attract ravens, in self-closing raven-proof containers. The only exception will be for temporary waste storage kept within closed vehicles until the end of a shift. No food or food waste will be combined with uncovered construction waste or debris, and workers will not be permitted to dispose of food waste or trash in piles or containers of construction debris. At least one self-closing waste container will be located at any break area, any temporary or permanent building, and in parking areas and any other area where workers or visitors congregate. During Project construction, waste containers will be checked daily and emptied regularly. Any food waste temporarily stored on site will be kept indoors (e.g., in a temporary construction management office or permanent O&M structure) or enclosed within inaccessible dumpsters or similar containers. All waste will be regularly removed from the site and disposed of in a licensed landfill. IP Perkins, LLC and IP Perkins BAAH, LLC will also ensure that all work vehicles will carry strong garbage bags for collection of any refuse found on site. At the end of each day, staff will place bagged refuse into the inaccessible containers. |

| Subsidy | Subsidy Control Measures |
|---|---|
| Surface Disturbance (Construction, O&M, Decommissioning). Grading during site preparation, O&M, and decommissioning phases can injure or kill wildlife, especially small mammals, and reptiles, and can unearth burrowing animals. These animals can provide a food subsidy for ravens. Grading and other earthwork will be most prevalent during the construction and decommissioning Project phases. Grading activities during O&M will be minimal and generally limited to access route maintenance or repair. | IP Perkins, LLC and IP Perkins BAAH, LLC will minimize injury and mortality to animals during all Project phases by relocating wildlife from harm's way as feasible during ground-disturbing activities, minimizing traffic and vehicle impacts, avoiding pitfalls or other traps to wildlife, and reporting injured or dead animals and disposing of road-killed animals. In addition, IP Perkins, LLC and IP Perkins BAAH's Lead Biologist and Biological Monitors will collect and dispose of any animal remains found in any part of the Project area throughout the life of the Project. |
| Roadkill on Access Roads (Construction, O&M, Decommissioning). The Project will account for increased traffic along paved access routes between Highway 98, and the Project site. The traffic increase will be greatest during construction and decommissioning phases, when the workforce and equipment and materials deliveries and pickups are greatest. In addition, vehicle traffic on unpaved roads throughout the site may cause roadkill during all phases of the Project, but especially during construction and decommissioning phases due to higher vehicle traffic volume. Road killed wildlife, including small to medium-sized mammals, reptiles, and (uncommonly) birds, all may serve as raven food subsidies. | IP Perkins, LLC and IP Perkins BAAH, LLC will limit vehicle speeds and check beneath vehicles on Project-related roads and report or dispose of dead or injured wildlife. |
| **Standing or Ponding Water** | |
| Dust abatement (i.e., road watering during construction, O&M, and decommissioning) | IP Perkins, LLC and IP Perkins BAAH, LLC will minimize water usage for dust control and will monitor to identify and correct standing water conditions as needed. |
| Leaking pumps, water lines, storage tanks during construction, O&M, and decommissioning | IP Perkins, LLC and IP Perkins BAAH, LLC will ensure that water tanks are sealed and free of leaks at all times, and that trucks are not overfilled. IP Perkins, LLC and IP Perkins BAAH, LLC will direct all workers to report any water leaks. Any leak causing standing surface water that could be available to ravens will be promptly repaired. IP Perkins, LLC and IP Perkins BAAH, LLC's Lead Biologist and Biological Monitors will be directed to note any leaking or standing water, for inclusion in regular monitoring reports. |
| Irrigation for landscaping and revegetation during construction, O&M, and decommissioning | If irrigation is used at any revegetation or landscaping site, IP Perkins, LLC and IP Perkins BAAH, LLC will monitor and manage the irrigation to use only the minimum amount of water needed, and no accumulation of standing surface water would be allowed to occur. |

| Subsidy | Subsidy Control Measures |
|---|---|
| Solar panel washing (O&M) | Maintenance crews will use only the minimum amount of water needed for panel washing. The wash water will be allowed to run off the panels to the ground below where it is expected to percolate into the soil. No ponding or standing water is expected to result from panel washing. IP Perkins, LLC and IP Perkins BAAH, LLC's Lead Biologist and Biological Monitors will be directed to note any standing water resulting from panel washing, for inclusion in regular monitoring reports. |
| Wastewater (e.g., food preparation, restrooms, hand washing; during construction, O&M, and decommissioning) | No ponding or standing water is expected to result from domestic water use. Wastewater from food preparation, rest rooms, hand washing, or other sources during construction, O&M, or decommissioning would be managed according to requirements of the Imperial County Department of Environmental Health. IP Perkins, LLC and IP Perkins BAAH, LLC's Lead Biologist and Biological Monitors will be directed to note any standing water around Project facilities, for inclusion in regular monitoring reports. |
| **Nesting, Roosting, and Perching Sites** | |
| Project Facilities and Structures (Construction, O&M, Decommissioning). All Project facilities, including transmission line loop-in and gen-tie line towers, solar panels, fences, structures, and electrical infrastructure may provide nesting, roosting, or perching site subsidies throughout the life of the Project. | 500 kV transmission line loop-in structures, gen-tie support structures, and other facility structures will be designed in compliance with current standards and practices to discourage their use by raptors for perching and nesting (e.g., by the use of anti-perching devices). This design will also reduce the potential for increased predation of special-status species, such as the flat-tailed horned lizard. If nesting does occur, IP Perkins, LLC and IP Perkins BAAH, LLC will coordinate with CDFW and USFWS to remove inactive raven nests or other suitable stick nests consistent with transmission line and gen-tie operation safety and with applicable regulations, and by minimizing availability of food and water subsidies throughout the Project facility. No nesting platforms or similar structures will be installed on the structures. However, ravens cannot be fully prevented from nesting, roosting, or perching on Project facilities. In compliance with the federal Migratory Bird Treaty Act and California Fish and Game Code Sections 3503 and 3513, IP Perkins, LLC and IP Perkins BAAH, LLC will not remove active bird nests at any time. Instead, the CDFW and USFWS will be notified of any active raven nests on Project facilities, and the Lead Biologist or Biological Monitors will monitor the nests to identify any evidence of predation on flat-tailed horned lizards (see Section 4, below). |

# 4. MONITORING

## 4.1. Lead Biologist and Biological Monitors

The Project's Lead Biologist will be responsible for implementing and managing the monitoring approach described below and providing monitoring reports to IP Perkins, LLC and IP Perkins BAAH, LLC, BLM, CDFW, and USFWS. Many of the monitoring tasks may be completed by Biological Monitors, overseen by the Lead Biologist. Specific qualifications for the Lead Biologist and Biological Monitors are provided in the mitigation measures developed for NEPA and CEQA compliance (see Attachment A).

The biological monitoring team would consist of a Lead Biologist and Biological Monitors. Additional information regarding the required qualifications and roles is provided in the Nesting Bird Management Plan (see POD Appendix V).

- **Lead Biologist:** The Applicant shall assign a Lead Biologist, approved by BLM, CDFW, and USFWS as the primary point of contact for the BLM and resource agencies regarding biological resources mitigation and compliance.
- **Biological Monitor:** Biological monitors will be overseen by the Lead Biologist and will perform any required surveys, morning clearance sweeps, ground disturbance and construction monitoring, fence installation monitoring, wildlife monitoring, inspections, marking sensitive resource buffers, and revegetation monitoring during Project activities. Biological monitors would be trained (through either a training program or by an experienced biologist) in identifying flat-tailed horned lizards and nests.

## 4.2. Monitoring Tasks: Food and Water Subsidies

**Preconstruction Raven Monitoring:** As outlined in the Nesting Bird Management Plan (NBMP) (see POD Appendix V), any nesting surveys involving passerines should be conducted within 4 days of the initiation of any vegetation clearance or grading, whereas surveys involving raptors will be within 7 days prior. An additional preconstruction survey will be conducted immediately prior to initial Project-related ground disturbing activities to confirm no new nests are found. These surveys will confirm the presence/absence of all nesting birds.

**Daily construction and decommissioning monitoring:** The Lead Biologist, Biological Monitor, or another compliance monitor (supervised and assigned by the Lead Biologist) will conduct daily monitoring inspections of Project activities and potential subsidies (e.g., trash containers, water lines) throughout the solar facility site and transmission line routes during the construction and decommissioning phases of the Project. In addition, they will periodically inspect any Project activities or potential raven subsidies on the solar facility site and transmission line alignments during any O&M activities. Inspections may be skipped on holidays or weekends only if no Project-related activities are scheduled; otherwise, inspections will be made daily. The Lead Biologist, Biological Monitor, or compliance monitor will complete a daily monitoring report form, to confirm inspection of items listed below. A draft report form is provided (see Attachment B). Daily inspections will include the following:

- Trash receptacles (locking lids; any exposed or overflowing trash)
- Food waste or food-related trash on ground or open vehicle (any time or location)
- Trash storage area (dumpsters)
- Vehicle speed (vehicle description, license number or other ID, time, and location)
- Standing water (any time or location, including tanks, pumps, pipes, irrigation sites, trucks, road watering, and panel washing areas)

- Dead or injured animals (any time or location)
- Raven observation (record time, date, location, number of ravens, and activity for each raven observation)

In addition to daily inspections, the Lead Biologist or Biological Monitor will be responsible for the following activities to minimize food subsidies for ravens:

- During all soil disturbing activities, attempt to relocate animals from the area prior to disturbance, and remove any dead or injured wildlife from the work area
- Remove road killed or injured wildlife on direction from CDFW

Daily monitoring logs will be submitted to the Site Supervisor upon completion of monitoring tasks. The log will include fields to confirm inspection of each facility. For any facility or condition in need of review or repair, the log will include fields to record the location, date and time of inspection, and any specific problem. The Lead Biologist or Biological Monitor will also highlight any condition or facility in need of correction for the Site Supervisor’s attention. Completed daily logs will be available to the Lead Biologist and Biological Monitors during follow-up monitoring visits. Follow-up daily inspections will document correction of the problem. All daily monitoring logs will be included as electronic attachments to the annual monitoring reports. Success criteria for all these daily tasks will be that each problem identified/ reported will be corrected or resolved within 24 hours or one full working day after the daily report is filed.

During Project O&M, Project personnel will identify and correct potential raven subsidies (food waste, water leakage, etc.) as part of routine O&M activities.

## 4.3. Monitoring Tasks: Raven Nesting or Nest Availability

**Nest Monitoring.** Project biologists will complete nest searches of Project facilities as part of normal site maintenance and line patrols of the transmission and gen-tie lines including and existing transmission, distribution, and communication infrastructure on or near the Project site. Raven monitoring (nests/individuals) would be part of the quarterly inspections as required by the NBMP (see POD Appendix V). Any raven nest or possible raven nest will be recorded on data forms provided in the Bird and Bat Conservation Strategy (see POD Appendix X). Any nesting activity observed incidentally on non-Project trees or structures, such as parallel transmission or distribution lines, communication facilities, or invasive trees will also be noted. The Lead Biologist or Biological Monitor will follow-up to document the progress and success of any stick nests on the structures and inspect for any evidence of predation on flat-tailed horned lizards. All nest monitoring data will be summarized in annual reports and the data itself will be provided in electronic format as an electronic appendix.

The Lead Biologist will report any active raven nest to IP Perkins, LLC and IP Perkins BAAH, LLC, BLM, CDFW, and USFWS. The Lead Biologist will also report any evidence of raven predation on flat-tailed horned lizards to the agencies.

**Nest Removal.** During early nest construction and before eggs are present, or after nesting activity has ceased at any stick nest suitable for future use by common ravens on Project facilities, the Lead Biologist will coordinate with BLM, CDFW, USFWS, and IP Perkins, LLC and IP Perkins BAAH, LLC, to remove the nests, consistent with operation safety and applicable regulations. Nest removal will be supervised and confirmed by the Lead Biologist or Biological Monitor and reported in the annual monitoring report. As part of annual operations training, construction crews are trained to notify biologists if they identify nests and to not remove or touch any nests.

Errors can occur related to false positive or negative nesting determinations, misidentification of species, and variable searcher's efficiency. In order to account for errors, biologists will take the necessary time to ensure that all determinations are as accurate as possible. Additional biologists may be included to confirm nesting status or species identification and nest removal may be delayed until determinations can be confirmed.

## 4.4. Reporting

During construction and decommissioning, IP Perkins, LLC and IP Perkins BAAH, LLC, will submit annual reports to BLM, CDFW, and USFWS no later than December 31 of each year, documenting monitoring and management measures undertaken during the year, and comparing raven activity to previous years. The first year's observations of raven activity will serve as the baseline data for comparison with future years. Reports will include all observations for O&M activities.

The annual report will include:

- Summary of raven observations and behavior (from daily monitoring report forms)
- Summary of annual nesting season monitoring, including locations and species for all observed stick nests on Project facilities and within 0.25 mile
- Documented raven nesting, roosting, and perching locations
- Number and locations of any stick nests removed from Project facilities
- Recommendations by the Lead Biologist for improving raven management

Biological surveys for raven nests will be conducted both within the Project area, and a 0.25-mile radius to include nearby raven nests that, although not within the Project footprint, could have impacts within the Project footprint. Existing subsidies in the Project vicinity that may attract common raven are described in Section 3.

All monitoring data will be provided electronically. The report itself will be brief, simply reviewing the monitoring requirements, describing any deviations (no monitoring on a certain date due to illness, etc.), and summarizing any problems and how they were corrected. For nest monitoring, reports will list dates of fieldwork and map locations (GPS coordinates) of all nests found; for each nest, the name of the species, the active dates, and the eventual result of the nest (such as abandonment or fledged young) will be recorded.

During Project O&M, observations of active raven nests and evidence of raven predation on flat-tailed horned lizards will be reported to the Project contacts at BLM, CDFW, and USFWS by an electronic mail message within 2 days of the observation. Quarterly compliance inspections and reporting will be submitted to the BLM, to document wildlife mortality and any biological resource issues of note.

During O&M, a compliance monitor may perform the duties of the Lead Biologist, as approved by BLM, CDFW, and USFWS, to ensure that they are adequately trained to carry out the appropriate activities. The monitor would ensure compliance with biological mitigation measures, such as performing inspections for entrapped wildlife, reporting dead or injured wildlife, and avoiding nesting birds.

To be able to understand year-to-year comparisons of raven data, statistical analyses will be used beginning with basic statistics such as frequency distribution, analysis of variance, and significant difference tests. Later, when more data has been collected, a more robust analysis will be applied after reviewing the site-specific field data collected within the first couple years.

# 5. ADAPTIVE MANAGEMENT

Adaptive management measures may be necessary if the Project facilities and related activities provide significant unavoidable subsidies to ravens as quantified during bird surveys and compliance monitoring, or if a future increase in local raven nesting activity is observed and attributable to the Project. Baseline surveys that occurred in Spring 2023 will be used to detect any increase. Unavoidable subsidies could include nesting, roosting, or perching sites on Project facilities. If raven monitoring data indicate a clear increase in local raven nesting activity attributed to the Project, then IP Perkins, LLC and IP Perkins BAAH, LLC and its Lead Biologist will confer with the BLM, CDFW, and USFWS to develop and implement further raven control measures. Adaptive management measures may include additional worker education, more stringent restrictions on water use or trash disposal, installation of nest-prevention or roost-prevention devices on Project facilities (depending on availability of effective devices), or specific measures to “haze” ravens from Project facilities or subsidies. Hazing is only used if ravens become a nuisance to flat-tailed horned lizards or other bird species and would be implemented on a case-by-case basis.

# 6. EDUCATION

IP Perkins, LLC and IP Perkins BAAH, LLC, will prepare and implement a Worker Environmental Awareness Program (WEAP). The WEAP will include the following specific instructions for on-site workers to prevent or minimize raven subsidies:

- Review of raven biology, including flat-tailed horned lizard predation and dependence on human subsidies.
- Specific responsibilities and consequences for all workers.
- Trash and food waste disposal and control.
- Reporting road killed wildlife, water leaks, or other subsidies.

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# Attachment A

## MITIGATION MEASURES

# Attachment B

## DRAFT RAVEN MONITORING FORM

| | | | |
|---|---|---|---|
| **General Location:** | | **Date:** | |
| | | **Surveyor:** | |

| Checked? Y/N | Task | Compliance? Y/N | If non-compliance, Issue and Location | How was the issue Resolved? |
|---|---|---|---|---|
| | **Trash Receptacles** (locking lids, exposed or overflowing trash) | | | |
| | **Dumpsters** (locking lids, exposed or overflowing trash) | | | |
| | **Vehicle speed** (limit on project roads: 15 mph; note vehicle number/description) | | | |
| | **Standing water** (any time or location: tanks, pumps, pipes, irrigation sites, trucks, road watering, and panel washing areas) | | | |
| | **Evaporation pond netting and wildlife access prevention** | | | |
| | **Dead or injured animals** (list species; any time or location) | | | |

| Date and Time | Location, GPS Coordinates | Number Observed | Activities Observed |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

# Appendix M.4 Wildlife Protection and Translocation Plan

# Wildlife Protection and Translocation Plan

## Perkins Renewable Energy Project

***Prepared for***

**IP Perkins, LLC
and IP Perkins
BAAH, LLC**

**subsidiaries of Intersect Power, LLC**

**December 2023**

| **Agency Review Status:** |
|---|
| Bureau of Land Management |
| U.S. Fish and Wildlife Service |
| California Department of Fish and Wildlife |

# CONTENTS



## TABLES



## ATTACHMENTS

## LIST OF ACRONYMS

| | |
|---|---|
| BESS | Battery Energy Storage System |
| BLM | Bureau of Land Management |
| BMP | Best Management Practices |
| BO | Biological Opinion |
| CDFW | California Department of Fish and Wildlife |
| CDV | Canine Distemper Virus |
| CEQA | California Environmental Quality Act |
| DFA | Development Focus Area |
| DRECP | Desert Renewable Energy Conservation Plan |
| ITP | Incidental Take Permit |
| kV | kilovolt |
| LUPA | Land Use Plan Amendment |
| MM | Mitigation Measures |
| MW | megawatt |
| NEPA | National Environmental Policy Act |
| O&M | Operations and Maintenance |
| PV | solar photovoltaic |
| USFWS | United States Fish and Wildlife Service |
| WEAP | Worker Environmental Awareness Program |

# 1. INTRODUCTION

## 1.1. Project Summary

IP Perkins, LLC and IP Perkins BAAH, LLC (Applicants or Proponents), subsidiaries of Intersect Power, LLC, proposes to construct, operate, and decommission the Perkins Renewable Energy Project (Project), a utility-scale solar photovoltaic (PV) electrical generating and storage facility, and associated infrastructure to generate and deliver renewable electricity to the statewide electricity transmission grid. The proposed Project site is located on a combination of Bureau of Land Management (BLM)-managed lands, Bureau of Reclamation (BOR)-managed lands, and private lands. The Project 500kV loop-in transmission lines will traverse Bureau of Reclamation (BOR) lands located in Imperial County east of El Centro, California (see POD [Plan of Development] Appendix A, Figure 1).

BLM public lands within the Project area are designated as Development Focus Area (DFA) by the Desert Renewable Energy Conservation Plan (DRECP) and associated Record of Decision (ROD), and thus, have been targeted for renewable energy development. Because the proposed Project is partially located on federal land under management of the BLM, the BLM is the lead agency under the National Environmental Policy Act (NEPA), 42 U.S.C. section 4321 et seq. California Energy Commission (CEC) will serve as the lead agency under the California Environmental Quality Act (CEQA).

The Project would generate and store approximately 500 to 1,150 megawatts (MW) of renewable electricity via arrays of solar photovoltaic (PV) panels, battery energy storage system (BESS), and appurtenant facilities. The Project would construct a new gen-tie line that would connect the project substation(s) to a new high-voltage breaker and a half (BAAH) switchyard. From the BAAH switchyard, two new 500 kV loop-in transmission lines would be constructed to interconnect to the existing SDG&E 500 kV transmission line that travels east-west just south of the Project site, crossing BOR lands and terminating in the Imperial Valley Substation (Substation), southwest of El Centro. No construction would occur within the reduced utility corridor along the Project site's southern and western boundaries. For a complete Project description and summary of the Project location, refer to the POD main text.

Clean, renewable energy generation will have an overall benefit to plant and wildlife species on a local, regional, and global scale by replacing fossil fuel energy sources, reducing toxic emissions, and mitigating the effects of climate change on ecosystems.

## 1.2. Purpose

The primary purpose of this Plan is to provide a framework for management approach, monitoring, and relocation of multiple special-status wildlife species that may occur within the Project site.

The following species are the focus of the Plan and are referred to as "target species":

- Flat-tailed Horned Lizard *(Phynosoman mcallii)*
- Colorado desert fringe-toed lizard *(Uma notata)*
- Western Burrowing Owl *(Athene cunicularia hypugaea)*
- Desert Kit Fox *(Vulpes macrotis arsipus)*

This Wildlife Protection and Translocation Plan has been prepared to conform to the DRECP Conservation and Management Actions (CMAs) (see POD Appendix D):

- LUPA-BIO-6 (Subsidized Predators Standards)
- LUPA-BIO-9 (Water and Wetland Dependent Species Resources)
- LUPA-BIO-12 (Noise)
- LUPA-BIO-14 (General Standard Practices)
- LUPA-BIO-IFS-12 (Burrowing Owl)
- LUPA-BIO-IFS-13 (Burrowing Owl)
- DFA-BIO-IFS-1 (Individual Focus Species (IFS)

This plan may be revised to conform to requirements of: (1) relevant provisions of the Project's Final Environmental Impact Report or Environmental Assessment, (2) any USFWS Biological Opinion (BO) or CDFW Consistency Determination or Incidental Take Permit (ITP) issued for the Project, (3) any revisions to relevant mitigation measures (MMs) that may be adopted in the BLM and BOR Records of Decision and/or CEC certification, or (4) any further direction from the resource agencies.

Implementation of the Plan will take place during pre-construction and construction phase of the Project. Wildlife avoidance during operation and maintenance and decommissioning will be implemented. Procedures will be established to avoid and minimize any negative impacts to these species during all Project activities for the life of the Project.

# 2. BASELINE CONDITIONS

## 2.1. Summary of Wildlife Surveys and Results

Wildlife surveys on the BLM-managed lands portions of the Project site were conducted in Spring 2023 employed belt transects approximately 20 meters (65.6 feet) apart to provide 100 percent (full) coverage for the proposed solar facility. Surveys were consistent with 2012 CDFW burrowing owl protocol surveys (CDFW 2012) and in conjunction with plant surveys with a 150-meter buffer (see Biological Resources Technical Report (BRTR), POD Appendix S [Ironwood, 2023]). The results of biological resource surveys for the BOR-managed and private lands will be included in a subsequent BRTR addendum to be prepared following Spring 2024 surveys.

Surveys were conducted by walking linear transects and visually searching for live individuals or sign of any sensitive species. All holes detected that may be inhabited by sensitive species as burrows or burrow complexes were carefully inspected for potential occupancy or sign of recent use. Special emphasis was placed on searching around the bases of shrubs and along the banks of shallow washes. Burrows were carefully examined and assigned to the wildlife species that may have inhabited them based on indicator signs within the burrow or near the mouth of the burrow.

During wildlife surveys, biologists recorded all wildlife species observed, regardless of conservation status. Common species were tallied at the end of each transect and recorded throughout each day by each crew. During the spring surveys, additional avian counts were completed in the mornings during surveys until 10 a.m.

The special-status species recorded on the Project site are listed and their occurrences are briefly described in the following paragraphs.

### Reptiles

- **Flat-tailed Horned Lizard *(Phynosoman mcallii)* (BLM-S, SSC[1]):** suitable flat tailed horned lizard habitat is sandy desert hardpan or gravel flats with scattered sparse vegetation of low species diversity. It is most common in areas with a high density of harvester ants and fine windblown sand, but rarely occurs on dunes. The historic range is located throughout most of the Colorado desert from the Coachella Valley south through the Imperial Valley, west into the Anza-Borrego desert, and south to extreme NE Baja California, extreme SW Arizona and NW Sonora, Mexico.

  Fine sand for cover is a critical habitat element. Lizards burrow into the sand to avoid temperature extremes and remain for hours buried just below the surface (Stebbins 1985). Shrubs and clumps of grass often serve as sources of shade during the hottest parts of the day, and lizards have been observed climbing into bushes and clumps of dried grass presumably to avoid contact with the hot substrate. Little is known about habitat requirements for reproduction, but other lizards generally require well-drained, sandy or friable soil for nest construction. The flat-tailed horned lizard feeds primarily on ants but will occasionally eat beetles and other insects.

  One hundred live individuals were observed during surveys confirming occupancy on the Project site. Six carcasses, two hundred and seventy-seven tracks, and one hundred and ninety-six scat were observed. Eleven ant hills were recorded during wildlife surveys (see BRTR, POD Appendix S, Figure 9).

- **Colorado desert fringe-toed lizard *(Uma notata)* (BLM-S, SSC):** The Colorado desert fringe toed lizard inhabits sparsely vegetated arid areas with fine wind-blown sand for burrowing. Suitable habitats include dunes, flats with sandy hummocks formed around the bases of vegetation, washes, and the banks of rivers. It is found in extreme southeast California in the Colorado Desert, from the Salton Sea and Imperial sand hills east to the Colorado River, south to the Colorado River delta, and into extreme northeastern Baja California. It ranges west as far as the east base of Borrego Mountain. Fringe-toed lizards usually seek refuge from enemies by burrowing in the sand within 5-6 cm (2-2.4 in) of the surface. Rodent burrows and the bases of shrubs are also used for cover and thermoregulation (Stebbins 1944). One live individual was observed during wildlife surveys.

## Birds

- **Western Burrowing Owl (*Athene cunicularia hypugaea*) (SSC, BCC, BLM-S, FOC):** The Western burrowing owl inhabits arid lands throughout much of the western United States and southern interior of western Canada (Haug et al. 1993). Suitable habitat for western burrowing owl includes open habitat with available burrowing opportunities, including agricultural fields (active and fallow), creosote scrub, desert saltbush, ephemeral washes, and ruderal areas.

  Burrowing owls are unique among the North American owls in that they nest and roost in abandoned burrows, especially those created by ground squirrels, kit fox, desert tortoise, and other wildlife. Burrowing owls have a strong affinity for previously occupied nesting and wintering sites and will often return to previously used burrows, particularly if they had successful reproduction in previous years (Gervais et al. 2008). They generally depend on other species to dig suitable burrows for use but may also use anthropogenic surrogate burrows such as rubble piles or drainage pipes. If formerly occupied burrows are badly

[1] Listing acronyms: SSC = State species of special concern; BLM-S = BLM sensitive; BCC = USFWS Bird species of conservation concern; FOC = DRECP Focus and Planning Species

damaged or collapsed, burrowing owls cannot repair them and must seek alternate sites. The southern California breeding season (defined as the time from pair bonding of adults to fledging of the offspring) generally occurs from February to August, with peak breeding activity from April through July (Haug et al. 1993).

In the Colorado Desert, burrowing owls generally occur at low densities in scattered locations, but they can be found in much higher densities near agricultural lands where rodent and insect prey tend to be more abundant (Gervais et al. 2008). Burrowing owls tend to be opportunistic feeders, and a large portion of their diet consists of beetles, grasshoppers, and other large arthropods. The consumption of insects increases during the breeding season (Haug et al. 1993). Small mammals, especially mice and voles (Microtus and Peromyscus spp.) are important food items. Other prey animals include herpetofauna, young cottontail rabbits, bats, and birds such as sparrows and horned larks.

Five live individuals were observed during surveys. Nine active burrows were observed. Two carcasses were observed.

### Mammals

- **Desert Kit Fox (*Vulpes macrotis arsipus)* (FOC):** Desert kit fox is protected by the California Code of Regulations (Title 14, CCR: §460) and Fish and Game Commission Section 4000 as a fur-bearing mammal. Title 14 of the California Code of Regulations, Section 460, stipulates that desert kit fox may not be taken at any time. Desert kit fox is a fossorial mammal that occurs in arid open areas, shrub grassland, and desert ecosystems within the Mojave and Sonoran Deserts. Desert kit fox typically occurs in association with its prey base, which includes small rodents, primarily kangaroo rats, rabbits, lizards, insects, and in some cases, immature desert tortoises (CDFW 2023). Burrow complexes that have multiple entrances provide shelter, escape, cover, and reproduction, but desert kit fox may utilize single burrows for temporary shelter. Litters of one to seven young are typically born in February through April (McGrew 1979). Many of desert kit fox burrows observed within the Project site are part of a complex with multiple entrances.

  There is suitable habitat for desert kit fox on the Project site, but no desert kit foxes were observed during surveys on the Project site. One active desert kit fox burrow and thirty-nine inactive burrows were observed within the Project site. The number of burrows will likely change over time since kit fox distribution is dynamic and changes under natural conditions due to prey availability and other environmental factors such as the presence of coyotes that prey on kit fox pups.

## 3. MANAGEMENT APPROACH

This section describes the approach that will be used for wildlife protection and translocation throughout the construction phase of the Project. The bullets below provide a short overview of the translocation strategy:

- Assign a Lead Biologist and a qualified team of biologists with clear communication and reporting responsibilities to the lead agencies and wildlife agencies.
- Survey for special status species along planned fence routes.
- Identify, avoid, and/or relocate all target animals within construction areas where necessary.

- Monitor security fence construction for solar facility sites.
- Conduct full-coverage surveys to identify special-status wildlife within all disturbance areas (fenced solar fields, substation, BAAH switchyard, battery storage facility, transmission line, and gen-tie line disturbance sites).
- Exclude special-status wildlife, according to details described below for each species as needed.
- Conduct compliance monitoring and impact avoidance as needed throughout construction and all Project phases on the solar field, substation, BAAH switchyard, battery storage facility, and transmission and gen-tie lines.

## 3.1. Key Roles

Implementation of this plan will be subject to review and approval by the BLM, BOR, U.S. Fish and Wildlife Service (USFWS), and CDFW. These agencies are referred to throughout this Plan as the permitting and wildlife agencies.

A Lead Biologist appointed by the Project owner and approved by the permitting and wildlife agencies, will be responsible for the implementation of this Plan. The field team will include Biological Monitors all working under direction of the Lead Biologist. The IP Perkins, LLC and IP Perkins BAAH, LLC Environmental Compliance Manager (ECM) will be responsible for other environmental resources that are not stated within this plan and will coordinate with the Lead Biologist if there are potential conflicts.

- **Lead Biologist.** The Lead Biologist will coordinate directly and regularly with permitting and wildlife agency representatives regarding biological resource issues, including biological resource compliance, species relocation efforts, and implementation of best management practices (BMPs). The Lead Biologist will supervise Biological Monitors during pre-construction clearance surveys, burrow/den monitoring, and other measures needed to protect biological resources during the construction phase of the Project. The Lead Biologist and Biological Monitors have authority to halt construction activities in an area if it is deemed necessary to protect a target species or other special-status species.

  The Lead Biologist will also work with the Project owner to prepare the Worker Environmental Awareness Program (WEAP), to be approved by the permitting and wildlife agencies. The WEAP will address the target species that occur on the Project site and the avoidance measures that must be taken during Project activities to avoid adverse impacts to these species. WEAP training for all workers on the Project site will be executed by the Lead Biologist.
- **Biological Monitor.** Biological Monitors are biologists who will work under the direct supervision and guidance of the Lead Biologist to assist with clearance surveys and compliance monitoring. Biological Monitors will support the Lead Biologist in implementation and compliance monitoring tasks and examining excavations and other potential pitfalls for entrapped animals and aid with survey needs/requirements.

## 3.2. Security Fencing

### 3.2.1. Solar Facility Components

Prior to construction of solar facility, security fencing will be installed around the entirety of the approved solar field and associated substation and BESS construction areas, as well as parking and laydown areas.

No more than 10 days prior to the initiation of fence construction, a pre-activity multi-species survey will be conducted using techniques that provide 100% visual coverage of the disturbance area. Qualified biologists will complete a full coverage 20-meter survey for wildlife throughout the potential fencing disturbance area.

A Biological Monitor will be present during all fencing installation activities. The Biological Monitor will inspect the work area for biological resources prior to ground disturbance or vehicle access to ensure that no special-status species have moved into the work area. All parked vehicles and equipment, and the ground beneath them, will be inspected for wildlife prior to being moved. If at any time a special-status species moves into the work area, activities will halt until the animal moves out of the work site on its own accord or is moved from harm's way under state and federal authorization and according to any conditions identified in applicable authorizations.

Fencing will include one or more entrance gates. These gates will remain closed at all times, except when vehicles are entering or leaving the Project area. If it is deemed necessary to leave the gate open for any extended period of time (e.g., during high traffic periods), a Biological Monitor will be present to monitor for wildlife activity in the vicinity.

### 3.2.2. Transmission Line & Gen-tie Components

The linear components of the Project will have no exclusion fencing installed prior to construction activities.

## 3.3. Pre-Construction Multi-Species Clearance Survey

### 3.3.1. Solar Facility Components

Clearance surveys within installed security fencing will occur within the protocol survey periods for burrowing owl to absence within the fenced area. If initiation of construction activities occurs more than two weeks after, then a separate multi-species preconstruction clearance survey will be conducted within 2 weeks of initiating construction activities.

Surveys will be led by biologists experienced with the Imperial Valley and/or the special-status species listed below. In addition to detecting any special-status species that may be present within the fenced area, the surveys will also inform the need for potential exclusion buffers and monitoring for individual species. Surveys will consist of 100% visual coverage using pedestrian belt transects spaced at 5-meter intervals. An additional 500-foot (150-meter) buffer outside the Project boundary will also be surveyed with pedestrian belt transects spaced at 10 meters apart, where possible, to identify any potentially active burrows or complexes that may be indirectly affected by construction activities.

The type of sign that will be searched for during the clearance survey will include the following:

- Flat-tailed horned lizard and Colorado Desert fringe-toed lizard: live individuals, potential burrows, scat, and carcasses. All Flat-tailed horned lizard and Colorado Desert fringe-toed lizard sign will be immediately reported to the Project's Lead Biologist.
- Desert kit fox: live individuals, complexes/dens (marked as either inactive, potentially active, active), and scat

- Burrowing owl: live individuals, burrows (marked as inactive, potentially active, active), whitewash, pellets, and feathers

Any burrows or den complexes identified during this survey will be classified as inactive, possibly active, or active. A burrow/den complex within the Project site that is classified as inactive (no sign of special-status species) and confirmed to be unoccupied will be excavated. Inactive burrows within the buffer zone will be excavated only if they will be directly impacted by construction activities, such as burrows or den complexes just outside Project boundaries that may become occupied later. Excavation and backfilling techniques will be conducted in accordance with standard burrowing owl burrow excavation protocols (CDFW 2012). The burrowing owl protocols are suitable for the other species, and protocol excavation methods for those species are not available. All burrows and kit fox den complexes that are potentially active or active with live individuals inside will be further observed per the requirements of individual species as outlined in Sections 3.5 through 3.7.

After the first pass of the multi-species pre-construction clearance survey is complete, at least one additional 100% visual coverage pass on transects perpendicular to the first, will occur. If no live target species or their sign is observed on these two passes, the clearance survey will be complete.

### 3.3.2. Transmission & Gen-tie Line Components

Preconstruction clearance surveys on the transmission loop-in and gen-tie routes will be conducted by walking one pass of 5 meter transects within the proposed disturbance areas (including roads, pads, and pull areas) no more than 10 days prior to construction. An additional 500-foot (150-meter) buffer will be surveyed with 10 meter transects as possible to identify any active burrows for special-status species that may be indirectly affected by construction activities. The survey results will also inform the need for potential exclusion buffers and additional monitoring for individual species. On-site construction monitoring will be implemented as described below for each species.

Sign of flat-tailed horned lizard, Colorado desert fringe-toed lizard, desert kit fox, burrowing owl, and other special-status wildlife will be recorded, as stated above for solar facility sites. Inactive and unoccupied burrows and dens will be excavated only if they will be directly affected by construction activities. Determination of active or inactive burrows will follow the procedure described below for each species.

## 3.4. Construction Monitoring

### 3.4.1. Fenced Areas

Multi-species pre-construction clearance surveys within fenced construction areas will be conducted within 2 weeks prior to initiating ground disturbance and vegetation removal activities (Section 3.3.1). Biological Monitors will be present during vegetation removal and ground disturbance to ensure that wildlife is not present. Clearing activities may be temporarily paused by the Biological Monitor if any target species or other special-status species, are found in the work area. Clearing activities will proceed at the site only after the animal has either moved away of its own accord or is safely moved from harm’s way by a biologist with state and federal authorization, as required, and according to any conditions identified in applicable authorizations. After vegetation is cleared, biological monitors will perform spot checks in fenced areas immediately prior to initiation of construction to ensure that no wildlife have re-entered the site.

### 3.4.2. Transmission & Gen-tie Line Components

Biological Monitors will be present for any ground disturbing activities that may occur on the linear components. Biological monitors will escort construction vehicles and inspect work areas prior to crews beginning any ground disturbance. All parked vehicles and equipment, and the ground beneath them, will be inspected for wildlife prior to being moved. Work activities may be temporarily paused by the Biological Monitor if any target species or other special-status species, are found in the work area to allow the Biological Monitor, appropriate state and federal authorization, as required, and according to any conditions identified in applicable authorizations, to safely move the animal out of harm's way. Any potential hazards to wildlife (e.g., auger holes, steep-sided depressions) will be covered overnight.

## 3.5. Flat-tailed Horned Lizard and Colorado Desert Fringe-toed Lizard

Monitors trained in identifying flat-tailed horned lizard and Colorado Desert fringe-toed lizard (either through a training program or by an experienced Biologist) will conduct clearance sweeps immediately prior to construction activities each day to ensure no flat-tailed horned lizards or Colorado desert fringe-toed lizards are onsite. If any lizards are found, biological monitors, with appropriate state and federal authorization, as required, and according to any conditions identified in applicable authorizations, will relocate the animal offsite. The Monitors will place the lizard in a bucket with some dirt, to keep the animal cool, and either place them on the other side of the fenced area for release or out of harm's way from transmission line or gen-tie line construction activities.

## 3.6. Desert Kit Fox

### 3.6.1. Den Monitoring and Excavation

All desert kit fox dens identified as potentially active or active within the Project footprint (solar site and transmission line work sites) will be monitored for a minimum of 3 consecutive nights. Surveys shall monitor for tracks in loose dirt at den entrances or using a tracking medium (e.g., diatomaceous earth) and infra-red cameras at the den entrance(s). Using both methods (monitoring tracks and cameras) will help to ascertain whether desert kit fox in photos are actively using den sites or are merely visiting other dens within their range. Steps for den monitoring are outlined below:

#### Setup for Monitoring

- The apron of the den entrances and the start of the tunnel will be swept clean of all tracks and all visible scat will be removed. Any brush used at multiple den locations must be sprayed with a 10% bleach solution after each use to prevent dispersing pathogenic microorganisms. Alternatively, each den/complex can have its own brush for sweeping.
- Tracking media (i.e., diatomaceous earth) will be sifted and spread around den entrances with hard soils, due to low detectability of tracks on this soil type. This technique would not be used during prohibitive weather conditions (i.e., high wind or rain) and at dens located outside Project boundaries within buffer areas.

- An infrared camera will be positioned on a secured stake, away from the den (within 10 meters) so that the field of view captures all den entrances. If it is not possible to capture the entire field of view with one camera, additional cameras will be used as needed to determine activity status. Monitoring dens outside of the Project disturbance area, when required, will be accomplished with infra-red cameras only. Cameras will be disinfected by spraying with a 10% bleach solution prior to moving them to another den location.

### Initial Visits

- Cameras and dens will be monitored daily for confirmation of den occupancy for a minimum of 3 consecutive nights. Where required, cameras off site within buffer areas will be minimally monitored once per week for off-site desert kit fox.
- Following each monitoring visit to a den (after tracking information is collected) the same sweeping or sifting procedures will be used to prepare all entrances for the next monitoring period to prevent re-identification of tracks or other activity from prior visits.
- Biologists visiting dens will disinfect their shoes between visits to each den complex with 10% bleach solution prior to moving to another den site.
- Each active or potentially active den will be further classified as active, non-natal, or natal (pups are present) based on tracks or photos observed after the initial 3 consecutive nights.

### Monitoring Classified Dens

- Potential natal dens will be monitored for a minimum of 3 additional consecutive nights using infra-red beam cameras and/or tracking medium to determine their status. If a den or complex is determined to be natal, the permitting and wildlife agencies will be notified via email within 24 hours of the discovery.
- Natal dens will continue to be monitored by cameras and/or weekly visits until it has been determined that the young are independent enough to travel with the parents off site and hunt on their own. CDFW approval will be required prior to passive relocation.
- Active, non-natal dens can be passively relocated per techniques described in Section 3.7.3.
- If after 3 nights of den monitoring, no desert kit fox tracks are found at the burrow entrance and no photos of the target species using the den are observed, it will be determined that the desert kit fox den is inactive and will be excavated.

### Den Excavation

- Den that will not be directly impacted by construction will not be excavated.
- After confirmation that a burrow located within a proposed disturbance area is inactive or unoccupied, excavation and backfilling will be conducted in accordance with standard approved desert western burrowing owl burrow excavation and protocols. Excavation will use hand tools or a small driver-operated backhoe under close supervision of a qualified biologist, as there are no excavation standards and protocols for desert kit fox.
- At any time if a desert kit fox emerges from a burrow during excavation, activities will cease, and monitoring will be reinitiated.
- Confirmed active dens may be excavated only after successful passive relocation of the animals

(Section 3.7.3). Potentially active natal dens will not be passively relocated or excavated until monitoring confirms that the dens are no longer in active use as natal dens. Active dens identified early in the pupping season, from February 1 to April 30, will not be passively relocated or excavated without prior approval from CDFW.

### 3.6.2. Exclusive Buffer

If an active, non-natal den is detected within the Project footprint area, then a 30 to 90-meter (100 to 300-foot) construction exclusion zone will be established, and passive relocation techniques will be used. The buffer area will be maintained until passive relocation is successfully completed. If an active natal den is detected within the Project footprint area, a 150-meter (500-foot) construction exclusion zone will be established, and passive relocation will not be implemented until monitoring confirms that the den is no longer in active use as a natal den.

### 3.6.3. Passive Relocation

Passive relocation will occur after all dens determined to be inactive have been excavated so that the animals do not move into a previously inactive den in the Project footprint. When an active den is determined to be non-natal, passive relocation methods may be used and are outlined below:

#### Initial Relocation Efforts

- Spray deterrents, transistor radios, and ultrasonic emitters may be used for 3 nights to discourage use of dens.
- If deterrents are unsuccessful in discouraging use of dens, the Lead Biologist will coordinate with CDFW to prepare an alternative relocation method, such as the two methods below.

#### Alternative Options

- The den will be progressively blocked with natural materials (i.e., rocks, dirt, sticks, and vegetation piled in front of the entrance) for the next 3 to 5 nights to discourage continued use.
- Bag barriers consisting of plastic grocery bags or similar size bags made from erosion-control jute net, stuffed loosely with newspaper will be placed at each individual den entrance. Bag barriers will be secured to a nearby shrub, if possible, and loosely placed in the den opening so that a fox can safely emerge without difficulty.
- Either option will be implemented for 3 to 5 nights to discourage continued use of the den. If alternative options are insufficient for successful passive relocation, installation of one-way doors will be implemented.

#### One-Way Doors

- Installation of one-way doors will proceed when all other passive relocation options are unsuccessful.
- Installation of one-way doors will take place at all entrances within a den complex and will occur in the afternoon while desert kit fox is inactive and deep within the den complex.
- If any desert kit fox leaves the den complex during one-way door installation, installation will cease until after the desert kit fox has voluntarily left the vicinity of the den complex.

- Following one-way door installation, daily den monitoring with a tracking medium and cameras will continue. On the third day following one-way door installation, all den entrances will be inspected to ensure they are clear of sign and that desert kit fox has vacated.

After passive relocation is confirmed successful, and the den is confirmed to be unoccupied, it will be excavated according to the techniques described in Section 3.7.3. Weekly visits to the location of passive relocation will occur to ensure that desert kit fox does not re-excavate and reoccupy the area if no active ground disturbing construction is occurring within the vicinity. Monitoring will continue during ground disturbing activities according to mitigation measures (Attachment A).

### 3.6.4. Canine Distemper Virus

Canine Distemper Virus (CDV) is transmitted by contact with body fluids of infected animals (e.g., nose-to-nose contact), and can be transmitted among multiple carnivore species including domestic dogs and desert kit foxes.

The permitting and wildlife agencies will be notified of the results of ongoing den monitoring and survey results. If these efforts suggest that CDV may be present in the population (through observations and camera images of sick, emaciated individuals), then the permitting and wildlife agencies will be notified by email immediately.

## 3.7. Western Burrowing Owl

### 3.7.1. Burrow Monitoring

Potentially occupied burrows or occupied burrows will be monitored further prior to relocation efforts. Methods for monitoring these potentially occupied burrows will be as follows:

- Any sign of burrowing owl (feathers, whitewash, pellets) will be noted and removed prior to burrow monitoring at any potentially occupied burrows.
- Burrows will be visited twice daily for two days (48 hours) for surveillance purposes, to look for any new sign of burrowing owl.
- The use of motion-activated game cameras can assist monitoring efforts and will be used in combination with burrow visits to determine burrow occupancy. If game cameras are used, they will be placed within 10 meters of occupied burrows for a minimum of 48 hours before any occupancy determination is made.
- If a burrow is determined to be occupied, the appropriate exclusion buffer will be delineated and marked (Section 3.7.2) and passive relocation efforts will be employed if timing is suitable (Section 3.7.3).
- If a burrow is determined to be unoccupied, then excavation will occur using standard tortoise burrow excavation techniques, as there are no standard excavation techniques for burrowing owl.

Only burrowing owl burrows (unoccupied and occupied) that will be directly impacted by construction activities will be excavated. Any unoccupied burrows located outside the construction activity zones will be left in their current condition. If there is an occupied burrow outside the Project footprint area but within the buffer distance, monitoring and avoidance of the burrow will be managed on a case-by-case basis in coordination with CDFW and USFWS, depending on the season, nature of nearby construction activities, and whether the construction site is fenced. If monitoring determines that the burrowing owl has left the site, then the burrow will be excavated and collapsed.

### 3.7.2. Exclusion Buffer

If an active burrowing owl burrow is detected within any Project disturbance area, or within a 150-meter buffer of the disturbance area, a 150-meter (500-foot) exclusion buffer will be maintained while the burrow remains active or occupied. The buffer may be reduced to 50 meters (160 feet) during the non-breeding season (September 1 to January 31). The size of the buffer may be adjusted based on the time-of-year, and level of disturbance in the area, after consultation with CDFW. Table 1 provides exclusion buffer guidelines for nesting sites (CDFW, 2012); which may be adjusted in the field by the Lead Biologist, in consultation with agency personnel. The southern California breeding season (defined as the time from pair bonding of adults to fledging of the offspring) generally occurs from February to August, with peak breeding activity from April through July (Haug et al., 1993).

**Table 1. Buffer Distance (m) for Occupied Burrowing Owl Burrows, Based on Time of Year and Level of Disturbance**

| | Buffer Distance (m) and Level of Disturbance* | | |
|---|---|---|---|
| **Time of Year** | **Low** | **Medium** | **High** |
| April 1 – Aug 15 | 200 | 500 | 500 |
| Aug 16 – Oct 15 | 200 | 200 | 500 |
| Oct 16 – Mar 31 | 50 | 100 | 500 |

* Levels of disturbance: Low =drive by, low use, once per week; Medium = 15 minutes to 2 hours of activity, less than 49 decibels, one or two passes per day; High = more than 2 hours of activity, more than 49 decibels.

Source: Based on CDFW, 2012; Scobie and Faminow, 2000.

### 3.7.3. Passive Relocation

Passive relocation will occur only during the non-breeding season, generally September 1 to February 1, but will be adjusted during the late summer months (August and September) if breeding activities are not observed at any occupied burrows. Passive relocation is a technique to exclude burrowing owls from a project site by first, providing replacement burrows off site (if needed); collapsing all unoccupied burrows within the construction site; and finally installing a one-way door on the occupied burrow to evict the burrowing owl without handling it. The methods involved to relocate burrowing owls are outlined below:

**Artificial Burrows.** Artificial burrows may be constructed off site to replace on-site burrows that may be removed for Project construction. The number of artificial burrows (if any) will be dependent on the availability of suitable unoccupied burrows in the surrounding area and on the number of burrowing owls evicted from the site. Prior to initiating passive relocation, biologists will survey nearby public lands and private lands with site control to identify and inventory suitable unoccupied natural burrows that may be available. If two or more natural burrows are available for each burrowing owl to be evicted, no artificial burrows will be constructed. If fewer suitable natural burrows are available, then new artificial burrows will be constructed to provide a total of two suitable burrows for each burrowing owl to be evicted.

- Artificial burrows will be placed 110 meters to 300 meters from suitable natural burrows or from other artificial burrows to minimize territorial conflicts and nest abandonment by neighboring burrowing owl pairs (if any are present).

- Artificial burrows will be located at least 50 meters outside any temporary or permanent Project impact areas, but as close as possible to the original burrow and no more than one mile from the original burrow location if possible. Artificial burrows will be located in coordination with CDFW and BLM on public land.
- Artificial burrows will be designed, constructed, and installed following guidelines provided in CDFW (2012), Barclay (2008), Barclay et al. (2011), and Johnson et al. (2010 unpublished report). Design will include a large nest chamber (approximately 1,750 $cm^2$ to 1,960 $cm^2$ interior floor space) and small diameter (approximately 7.5 cm to 10 cm) entrance tunnel. The tunnel will slope gently downward (1520°) towards the nest chamber, with a 60° bend in the tunnel approximately midway along its length. The floor of the main chamber will be located 91 cm (36 in.) below ground level. Perching locations such as low mounds (e.g., 17 20 cm) or short perches (< 60 cm) will be added outside (in front of) the burrow. Rocks will be placed at the entrance to prevent trampling and deter predator digging.
- The locations of all natural and artificial burrows will be recorded, and the burrows will be photographed. Distances to the nearest construction activity, road, drainage, and any other natural and artificial burrows will also be recorded. A comparison of vegetation, habitat types, fossorial species usage, and other features will be made between the occupied and artificial burrow sites and will be recorded. All data will be included in progress reports (Section 6).

### Artificial Burrow Inspections

- Artificial burrows shall be left in place throughout all phases of the Project.
- All artificial burrows and mapped natural burrows will be monitored for burrowing owl use at least once per quarter throughout the construction phase of the Project. During monitoring visits, the burrows will also be inspected to ensure they are still suitable for burrowing owls.
- As needed, artificial burrows may be cleaned and maintained to ensure suitability for burrowing owl use during the construction phase.
- If natural burrows are no longer suitable for burrowing owl use (e.g., due to mammal digging) new artificial burrows may constructed as replacements, or additional inventories of natural burrows may be needed to ensure sufficient availability.
- After the construction phase of the Project ends, monitoring and maintenance of artificial burrows will be subject to O&M phase monitoring requirements, in coordination with BLM, CDFW, and USFWS.

### Burrowing Owl Exclusion

- Following the elimination of all suitable inactive burrows within the construction area and installation of artificial burrows, burrowing owls will be passively excluded from occupied burrows.
- Burrow exclusion will involve the installation of one-way doors in burrow openings during the non-breeding season. One-way trap doors will be installed, completely sealing the entrances to the burrows, and the doors will be left in place for a minimum of 48 hours to ensure owls have left the burrow.
- Documented natural and artificial burrows adjacent to and outside the Project site will be

monitored twice daily for at least one week following the installation of the trap doors to confirm burrowing owl use of habitat and burrow availability outside of the impact area.

- If burrowing owls are not detected outside the active burrows after the 48-hour exclusion period, scoping and/or remote cameras may be used to confirm the absence of burrowing owls prior to burrow excavation.

**Burrow Excavation**

- Following confirmation that passive exclusion burrows are unoccupied, the burrows will be carefully excavated using hand tools, or small tracked equipment, and backfilled to ensure that they are no longer suitable for burrowing owl use.
- If at any time, a burrowing owl emerges during excavation, all activities will halt, and burrow monitoring and passive relocation will begin again.
- The excavation and closure of burrows, including entrance exposure, will be documented, and photographed.

# 4. DISPOSITION OF SICK, INJURED, OR DEAD WILDLIFE

If an injured, sick, or dead special-status wildlife species is detected within the Project site or buffer during construction, operation, or decommissioning, the Lead Biologist or Project owner will immediately notify the appropriate resource agencies by email (CDFW for all special-status wildlife; USFWS for migratory birds or federally listed species; and BLM and BOR for special-status species located on federal lands. Written follow-up notification via email will be submitted within 24 hours of the incident. Notification will include, at a minimum, the location (GPS record) of the animal, photographs (if available), and any relevant observations made at the time of detection. The animal will be handled only on direction from the wildlife agencies. Health and safety precautions such as gloves will be used at all times when handling the animal.

Sick or injured animals will be transported by the resource agency or under direction of the resource agency to an approved wildlife rehabilitation or veterinarian clinic (see BBCS, POD Appendix X for list of nearby clinics). The resource agency will determine the final disposition of the injured animal. The Project Lead Biologist will maintain communication with the rehabilitation clinic or veterinarian to monitor the animal's progress or demise and include the outcome in compliance reports (Section 6).

Dead special-status animals will be collected with gloves and immediately frozen (dry ice will not be used). A mortality incident form will be completed with relevant information and photographs. Appropriate transport methods and final disposition of the carcass will be completed as directed by the wildlife agencies. Prior to transport, the carcass will be double-bagged and placed on ice or with ice packs into a cooler or Styrofoam container, contained by a cardboard box. If directed to do so, the carcass will be submitted to CDFW or a CDFW-approved lab for necropsy as soon as possible. The Project will be responsible for the expenses incurred resulting from injured, sick, or dead animals within the Project area or buffer.

# 5. ADAPTIVE MANAGEMENT

Adaptive management may be employed whenever unexpected issues or special-status species not previously identified occur. Adaptive management may be needed at any time during construction, operations and maintenance, and decommissioning. Generally, adaptive management measures would be implemented if there is evidence of Project-related disturbance to a special status species, where initial protection methods have been deemed ineffective. Monitoring, management, reporting, and adaptive measures will be developed in coordination with the appropriate resource agencies.

# 6. REPORTING

During the construction phase, reporting per this Plan will be provided in weekly, quarterly, and annual compliance reports to the permitting and wildlife agencies, as required. During O&M, reports will be provided quarterly unless circumstances arise that require more frequent reporting. These reports will provide a summary of activities performed and will describe the results for each species. Any data recorded will be submitted as appendices to each report or as separate electronic files. Prompt reporting or notification requirements for specific incidents or circumstances (e.g., dead or injured special-status wildlife) are identified above.

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# Attachment A

## MITIGATION MEASURES

# Appendix M.5 Restoration and Integrated Weed Management Plan

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# RESTORATION AND INTEGRATED

## Perkins Renewable Energy Project

**IP Perkins, LLC and IP Perkins BAAH, LLC**

**subsidiaries of Intersect Power, LLC**

**December 2023**

| **Agency Review Status** |
| --- |
| Bureau of Land Management |
| U.S. Fish and Wildlife Service |
| California Department of Fish and Wildlife |

# CONTENTS



# TABLES

## ATTACHMENTS

## LIST OF ACRONYMS

| | |
|---|---|
| BLM | United States Bureau of Land Management |
| CDFA | California Department of Food and Agriculture |
| CDFW | California Department of Fish and Wildlife |
| Cal-IPC | California Invasive Plant Council |
| EPA | United States Environmental Protection Agency |
| gen-tie line | Generation interconnection-tie line |
| GPS | Global positioning system |
| IWMP | Integrated Weed Management Plan |
| mph | Miles per hour |
| MW | Megawatt |
| PEIS | Programmatic Environmental Impact Statement |
| PV | Photovoltaic |
| USFWS | United States Fish and Wildlife Service |

# 1. INTRODUCTION

## 1.1. Project Summary

IP Perkins, LLC and IP Perkins BAAH, LLC (Applicants or Proponents), subsidiaries of Intersect Power, LLC, proposes to construct, operate, and decommission the Perkins Renewable Energy Project (Project), a utility-scale solar photovoltaic (PV) electrical generating and storage facility, and associated infrastructure to generate and deliver renewable electricity to the statewide electricity transmission grid. The proposed Project site is located on a combination of Bureau of Land Management (BLM)-managed lands, Bureau of Reclamation (BOR)-managed lands, and private lands. The Project 500kV loop-in transmission lines will traverse Bureau of Reclamation (BOR) lands located in Imperial County east of El Centro, California (see POD [Plan of Development] Appendix A, Figure 1).

BLM public lands within the Project area are designated as Development Focus Area (DFA) by the Desert Renewable Energy Conservation Plan (DRECP) and associated Record of Decision (ROD), and thus, have been targeted for renewable energy development. Because the proposed Project is partially located on federal land under management of the BLM, the BLM is the lead agency under the National Environmental Policy Act (NEPA), 42 U.S.C. section 4321 et seq. California Energy Commission (CEC) will serve as the lead agency under the California Environmental Quality Act (CEQA).

The Project would generate and store approximately 500 to 1,150 megawatts (MW) of renewable electricity via arrays of solar photovoltaic (PV) panels, battery energy storage system (BESS), and appurtenant facilities. The Project would construct a new gen-tie line that would connect the project substation(s) to a new high-voltage breaker and a half (BAAH) switchyard. From the BAAH switchyard, two new 500 kV loop-in transmission lines would be constructed to interconnect to the existing SDG&E 500 kV transmission line that travels east-west just south of the Project site, crossing BOR lands and terminating in the Imperial Valley Substation (Substation), southwest of El Centro. No construction would occur within the reduced utility corridor along the Project site's southern and western boundaries. For a complete Project description and summary of the Project location, refer to the POD main text.

Clean, renewable energy generation will have an overall benefit to plant and wildlife species on a local, regional, and global scale by replacing fossil fuel energy sources, reducing toxic emissions, and mitigating the effects of climate change on ecosystems.

## 1.2. Purpose

This Restoration and Integrated Weed Management Plan describes IP Perkins, LLC and IP Perkins BAAH, LLC's strategy to addresses the revegetation of disturbance areas during construction or other Project activities, describes the proposed Project activities and components that may facilitate weed infestations, and assesses potential risks that weeds may pose to natural resources values on the Project site and in the surrounding area. IP Perkins, LLC and IP Perkins BAAH, LLC, will revegetate or restore all disturbance areas, such as temporary access roads, construction work areas, temporary lay-down areas, and staging areas. Most of the Project's temporary disturbance will be within the solar facility, where disturbance areas will largely be beneath solar panels. In these areas, this Plan is intended to minimize dust, erosion, weed invasion, and fire hazard throughout the solar facility to the extent feasible.

The Restoration and Integrated Weed Management Plan conforms with DRECP Conservation and Management Actions (CMAs) as follows. Full text of CMAs can be found in POD Appendix D, Applicability of DRECP CMAs.

- **CMA LUPA-BIO-7**: Restoration of Areas Disturbed by Construction Activities but Not Converted by Long-Term Disturbance, which requires restoration of disturbed project areas.
- **CMA LUPA-BIO-VEG-1**: General Vegetation Management (VEG), which requires that management of cactus, yucca, and other succulents follow BLM policy.
- **CMA LUPA-BIO-VEG-5**, which requires that BLM regulations and policies be followed for salvage and transplants of cactus, yucca, other succulents, and BLM sensitive plants.

The associated IWMP conforms with **CMA LUPA-BIO-10**: Standard Practices for Weed Management.

This Plan may be revised to conform to requirements of: (1) relevant provisions of the Project's Final Environmental Impact Report or Environmental Assessment, (2) any USFWS Biological Opinion (BO) or CDFW Consistency Determination or Incidental Take Permit (ITP) issued for the Project, (3) any revisions to relevant mitigation measures that may be adopted in the BLM Decision Record and/or by California Energy Commission (CEC) certification, or (4) any further direction from the resource agencies.

## 1.3. Vegetation Communities

As identified in spring 2023 surveys, there are three primary natural vegetation communities (Sonoran creosote bush scrub, desert dry wash woodland/microphyll woodland, and alkali goldenbush desert scrub) found throughout the project site and two vegetation communities (arrow weed thickets and common reed marsh) located within portions of the transmission corridor along the edges of the All-American Canal. Desert dry wash woodland is a sensitive vegetation community recognized with a rarity rank of S3 (CDFW 2023). Vegetation communities on the project site are described in further detail and mapped in the project's Biological Resources Technical Report (BRTR) (Ironwood, 2023) (see POD Appendix S).

**Sonoran Creosote Bush Scrub.** Sonoran creosote bush scrub is dominant vegetation community throughout most of the project site and transmission corridor. Creosote bush scrub and white bursage are co-dominants in the shrub canopy with only a few shrubs sparsely distributed that include Emory's indigo (*Psorothmanus emoryi*) and white bursage (*Ambrosia dumosa*), cheesebush (*Ambrosia salsola*), and ephedra (*Ephedra spp*)in some areas with primarily an understory of annual plants.

**Desert Dry Wash Woodland/Microphyll Woodland.** Desert Dry Wash Woodland (also called microphyll woodland) is a sensitive vegetation community recognized with a rarity rank of S3 (CDFW 2023). It is as an open to relatively densely covered, drought-deciduous, microphyllous (small, compound leaves) riparian scrub woodland, often sup-ported by dry braided wash channels that convey water and sediment to the vegetation. This vegetation community on the Project site is characterized by mesquite thickets that is synonymous to mesquite (*Prosopis glandulosa*) woodland alliance (Sawyer et al. 2009) and Sonoran - Coloradan Semi Desert Wash Woodland / Scrub (NVCS). This vegetation community has mesquite trees that cover at least 2-3 percent of the absolute cover for trees and shrubs and was mapped as a patch within the western parcel.

**Alkali Goldenbush Desert Scrub.** Alkali goldenbush desert scrub has a state rarity rank of S3

(CDFW 2023). Within the Project site, alkali goldenbush forms an open shrub layer and on moist or seasonally dry flats, and margins of intermittently saturated vegetated swales. The tree layer, consisting of mesquite, is mostly sparse if present. Stands generally have low cover of vegetation and may be sparse (<10% total vegetation).

**Arrow Weed Thickets.** Arrrow weed thickets have a state rarity rank of S3 (CDFW 2023). This vegetation community is characterized by arrow weed that is more than or equal to 2% of absolute cover with a sparse herbaceous layer of seasonal annuals. This vegetation is usually found near seasonally flooded washes and stream borders. Within the Project site, this vegetation community occurs only within a small portion of the transmission corridor bordering the southern edge of the All-American Canal.

**Common Reed Marsh.** This vegetation community is characterized by more than 2% absolute cover and more than 50% relative cover in the herbaceous layer. This vegetation community is sometimes considered invasive along waterways and wetlands (USDA 2022) and is only located within the edges of the All-American Canal of the transmission corridor.

# 2. RESTORATION/REVEGETATION

After construction, the temporary impacts of work throughout the solar facility and transmission loop-in and gen-tie tower sites will be mitigated through revegetation to prevent further degradation of disturbance areas. The site would not be restored to pre-disturbance habitat values. The temporary disturbance areas will be revegetated to stabilize soils; maximize the likelihood of vegetation recovery over time; and minimize soil erosion, dust generation, and weed invasions.

Prior to construction, IP Perkins, LLC and IP Perkins BAAH, LLC, will contract with a qualified Restoration Ecologist to evaluate and prescribe specific seed collection, mulching, salvage, and restoration measures at each work site. The Restoration Ecologist will coordinate with the Project Lead Biologist and with IP Perkins, LLC and IP Perkins BAAH, LLC, to ensure that sufficient seed collection, salvage, and storage of trimmed or mowed plant material can be performed on-site prior to site disturbance and that the prescriptions for restoration are implemented as written. Unless otherwise directed by the Restoration Ecologist, native vegetation removed, trimmed, mowed, or chipped during construction will be stockpiled, for replacement onto the site either as crushed mulch, or as “vertical mulch” to reduce sun and wind exposure to the soil surface and germinating plants.

## 2.1. Site Preparation

IP Perkins, LLC and IP Perkins BAAH, LLC, does not anticipate mass grading on the Project site, therefore, this Plan does not include measures for topsoil salvage, storage, or replacement. However, construction activities would result in widespread removal of vegetation throughout the site. Substation, battery energy storage system (BESS) containers, O&M facility, and internal and external road locations would require mowing, grubbing, grading, and compaction. Inverter station locations would require light grubbing. Woody vegetation in the solar array areas would be crushed, mowed, and/or trimmed. Desert dry wash woodland is a sensitive ephemeral riparian community that provides important hydrologic functions and is comprised of irregular topography. Desert dry wash woodland would be avoided by Project design, including a 200-foot buffer, per DRECP CMAs (LUPA-BIO-RIPWET 1, LUPA-BIO 13, LUPA-BIO-SVF-6). Other irregular areas would be more-or-less leveled or smoothed to provide for construction access and PV panel installation.

The site cut and fill would be approximately balanced; minimal import/export would be necessary. On-site pre-assembly of trackers would take place in the staging area.

Site preparation measures prior to restoration work will be determined on a site-by-site basis, based on the advantages and disadvantages of soil treatment or site preparation methods to restore natural contours, protect the site from erosion damage by wind or water, and maximize likelihood of vegetation recovery.

Post-construction soil decompaction can increase soil vulnerability to weeds or erosion, increase dust, or cause further damage to surviving rootstocks that may be present. The Restoration Ecologist (see Section 5.2) will qualitatively evaluate soil compaction and prescribe either no treatment, limited treatment using hand tools, light harrowing or disking with a tractor, or deeper disking or ripping, depending on specific circumstances.

Where construction disturbance causes alterations to natural channel morphology or runoff patterns, the Restoration Ecologist will prescribe recontouring per the requirements of regulatory permits. Consistent with the Integrated Weed Management Plan (see Section 6), any such materials to be used at any Project work site will be certified weed free.

## 2.2. Plant Materials

The primary source of seed used for revegetation will be collected from on-site native vegetation prior to being cleared from the Project site. The Restoration Ecologist will direct the timing and collection of seed prior to site disturbance, to ensure that use of on-site seed sources is maximized. IP Perkins, LLC and IP Perkins BAAH, LLC, will re-seed disturbance areas with a native seed mix approved by BLM, BOR, and CDFW. The determination of where to re-seed and, if so, seeding rates (i.e., pounds per acre) will be made by the Restoration Ecologist, based on the nature of disturbance, condition of soils, and evidence (if any) of re-sprouting from remaining rootstocks. The seed mix will consist of the following native species, if available, all of which are characteristic early-successional species in the Sonoran Desert.

- White bursage (*Ambrosia dumosa*)
- Creosote bush (Larrea tridentata)
- Ephedra (Ephedra trifurca)
- Cheesebush (Ambrosia salsola)
- Honey mesquite (Prosopis glandulosa)
- Screwbean mesquite (*Prosopis pubescens*)
- Emory’s indigo (Psorothamnus emoryi)

On sites where construction-phase vegetation and soil disturbance are limited by trimming or mowing, re-seeding may not be necessary, unless these areas show inadequate natural recovery (e.g., re-sprouting rootstocks) or excessive soil compaction that may inhibit seed germination (see Section 4.1, Site Preparation).

IP Perkins, LLC and IP Perkins BAAH, LLC, will arrange for adequate seed supplies to be obtained from the Project site prior to disturbance or otherwise from within the provisional seed transfer zone for each species (Shryock et. al 2021). Due to the unpredictable rainfall and drought conditions throughout the Sonoran Desert region, seed cannot be reliably collected or acquired in any given year. Immediately following the Notice to Proceed, the Restoration Ecologist or Lead

Biologist will estimate the total number of acres to be reseeded and determine quantities of seed needed. IP Perkins, LLC and IP Perkins BAAH, LLC, will collect seed from the Project site prior to disturbance, or will contract with suppliers or collectors to acquire and store enough seed for all projected reseeding work. Seed collection will occur at the appropriate time for each species and seed storage specialists will store the seeds under existing regulations and standard handling practices. For common species, seeds will be obtained from the Project site, provisional seed transfer zones, or seeds may be purchased. The Restoration Ecologist will be responsible for maintaining a seed inventory, based on the sample format shown in Table 1.

**Table 1. Sample Seed Inventory Management Format**

| Species (Latin and Common Names) | On Hand (lb.) | On Order (lb.) | Quantity Needed for Upcoming Years (lb.) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Total seeding rate will be no less than 10 pounds per acre. Specific proportions will be based upon seed availability and recommendations of the Restoration Ecologist. IP Perkins, LLC and IP Perkins BAAH, LLC will collect seed on-site from Project areas to be mowed or graded. The collection of adequate seed supplies will likely necessitate repeated visits to any given collection area, depending on seasonality and annual productivity of the target plants. Depending on seed availability, other native species occurring on the site or nearby at similar exposure and elevation may be selected to replace or supplement those listed above.

Any off-site plant material used in revegetation will be locally native (Imperial Valley), occurring on or near the Project site or part of the provisional seed transfer zone for that species. All seed to be used in revegetation will originate from the Sonoran Desert region of California, between approximately sea level and 2,500 feet elevation and within the provisional seed transfer zone. Any seed from vendors or contracted collectors will be certified weed free. If seed is purchased from a vendor or contract seed collector, IP Perkins, LLC and IP Perkins BAAH, LLC will require the supplier to provide the origin (i.e., location and elevation information) for each seed lot and will not purchase or use seed originating outside these geographic and elevational bounds. IP Perkins, LLC and IP Perkins BAAH, LLC will be responsible for acquiring adequate seed to implement this plan. Seed collections by IP Perkins, LLC and IP Perkins BAAH, LLC or its contractors or vendors will be made according to the following guidelines:

- Seed collection from plants to be removed or mowed for Project construction will be unrestricted.
- No seed will be collected from designated Wilderness Areas, ACECs, or critical habitat, except within any approved Project disturbance areas (i.e., transmission line and gen-tie work sites).
- Any seed collection on public lands will be completed only under authorization from the BLM and/or BOR.
- No more than 40 percent of seeding plants in any collection area (excluding Project disturbance areas) will be harvested. No more than 10 percent of mature seed on any single plant will be harvested.
- Access to collection areas will be via open, designated routes, or on foot; there will be no cross-county vehicle travel.

- Collectors will record and track seed lots, including collection date, collection location, elevation, dominant species at location, stand conditions, test data, bulk weight, and net weight (as pure live seed).
- Seed Storage facilities will be sufficient to maintain collected seed in a viable condition until needed for reseeding.

## 2.3. Seeding Methods and Schedule

The Project's temporary disturbance areas will generally be small, or inaccessible to equipment (such as seed drill or hydroseeding equipment) because of panel installation. Therefore, seed will be broadcast using manually operated cyclone-type bucket spreaders, mechanical seed spreaders, blowers, or rubber-tired all-terrain vehicles equipped with mechanical broadcast spreaders. Seed in the spreader hoppers will be mixed to discourage separation of the component seed types. Where broadcast seeding is employed, seeded areas may be raked or harrowed to cover the seed, at the direction of the Project Restoration Ecologist.

Re-seeding will be scheduled outside of the spring and summer to minimize potential seed loss to granivorous birds and small mammals and maximize exposure to seasonal rainfall. Seeding will be done in late summer or early fall, to ensure that seed is in place prior to the onset of seasonal rain in late fall or early winter. Later seeding is likely to result in failed germination due to inadequate moisture availability. If rainfall is lacking after seeding, the areas may be watered using watering trucks or other suitable equipment to facilitate seed germination. Seeds would be watered at a frequency determined by the Project Restoration Ecologist, depending on plant species.

Due to the arid climate and variable rainfall, germination and establishment success of seeded plants is not predictable. During dry years, low germination success in the first year following re-seeding may be consistent with the goal of this plan (i.e., to prevent or minimize further site degradation), when fluvial soil erosion and high weed germination is less problematic than in high rainfall years. However, IP Perkins, LLC and IP Perkins BAAH, LLC, may need to take additional measures to minimize wind erosion and dust generation from sites where adequate plant cover does not re-establish (Section 4.5).

## 2.4. Restoration / Revegetation Site Maintenance

Restoration and revegetation sites will not be irrigated after initial watering of seeds. The sites will be monitored for weed presence and abundance, and weed control will be implemented as needed, according to the Project Integrated Weed Management Plan (see Section 4). Additional maintenance activities will consist of erosion control, soil stabilization, or other measures as needed, based on the results of monitoring.

## 2.5. Success Criteria

If the following success criteria have not been met within three years of initial revegetation, IP Perkins, LLC and IP Perkins BAAH, LLC will be responsible for implementing remediation measures as needed. Following remediation work, the site will be subject to the success criteria and monitoring period as required for the initial restoration or revegetation.

1. Total vegetation cover including herbaceous and woody species will be no less than 80 percent of total vegetation cover on nearby comparable sites that were not subject to Project

disturbance. Project sites that were previously covered by native vegetation will be compared to the surrounding undisturbed native vegetation sites; Project sites previously disturbed by anthropogenic activities will be compared to nearby, similarly pre-disturbed sites.

2. Cover and density of non-native plant species within the temporarily disturbed areas will be no more than 25% of total cover or no more than the cover and density in comparable adjacent lands that have not been disturbed by the Project. Note that weed management according to the Integrated Weed Management Plan (see Section 4) will be coordinated with restoration and revegetation to achieve this standard.

3. Soil stability and potential for erosion or dust source will be comparable to adjacent lands that have not been disturbed by the Project.

# 3. LEAD BIOLOGIST AND RESTORATION ECOLOGIST RESPONSIBILITIES

## 3.1. Lead Biologist

The Lead Biologist, to be designated by IP Perkins, LLC and IP Perkins BAAH, LLC and approved by the BLM, BOR, and CDFW, will be responsible for managing and implementing this Plan, as follows:

- Ensure that no unauthorized off-road vehicle access occurs on the site during pre-construction surveys and other special-status species clearance or exclusion.
- Ensure that no off-road vehicle access occurs off site for seed collection, or other Project-related activities, except as specifically authorized according to final Project authorization.
- Schedule all pre-construction clearance surveys for all Project components, including seasonal surveys for all special-status plant and animal species in areas where they have been previously documented.
- Ensure that each person assigned to survey, collect seed, reseed, monitor, or any other aspect of this Plan is qualified for each task. Botanists conducting pre-construction surveys and seed collection must be skilled and qualified in locating and identifying target plant species within the Project area; and workers conducting seeding and maintenance must be skilled and qualified in such practices.
- In order to avoid special-status plants, the Lead Biologist will designate and mark buffer areas surrounding each special-status plant location and will be responsible for monitoring the buffer sites throughout the construction phase of the Project.
- Review the qualifications and recommendations of the contracted Restoration Ecologist, and support coordination among the Restoration Ecologist, resource agencies, and IP Perkins, LLC and IP Perkins BAAH, LLC.
- Review plans and recommendations made by the Restoration Ecologist
- Review and approve plant materials, erosion control materials, and other materials to ensure they are certified weed-free.
- Communicate with IP Perkins, LLC and IP Perkins BAAH, LLC and resource agencies regarding restoration and revegetation activities.
- Coordinate restoration and revegetation activities with other Project activities during

construction and maintenance.

- Be aware of mitigation and compliance requirements, such as implementing the Integrated Weed Management Plan.
- Conduct an annual inspection to identify accumulated dead vegetation, wildlife attractants, barren soils, or other areas susceptible to erosion or likely to become sources of dust.
- Coordinate with the Restoration Ecologist to implement identified site treatments as needed.
- Prepare and submit monitoring reports.

## 3.2. Restoration Ecologist

In coordination with the Lead Biologist, the Restoration Ecologist, to be designated by IP Perkins, LLC and IP Perkins BAAH, LLC, and approved by the BLM, BOR and CDFW, will be responsible for site-specific reclamation activities and for supporting the Lead Biologist in managing and implementing this Restoration and Integrated Weed Management Plan, as follows:

- Review all temporary disturbance sites to evaluate soil compaction, vegetation condition, and susceptibility to erosion, weed invasion, or dust sources. Specify site-specific treatments such as erosion control, soil treatment, decompaction, mulch application, or reseeding for each site.
- Estimate overall Project seed requirements; update estimates as needed; and coordinate with the Lead Biologist and IP Perkins, LLC and IP Perkins BAAH, LLC to obtain and maintain seed inventory.
- Oversee and manage site treatments, including soils, erosion control, reseeding, and other requirements.
- Oversee monitoring and evaluate success at each reclamation or revegetation site.
- Plan and direct follow-up remedial work, as needed, to meet success criteria.
- Prepare and submit annual reports to IP Perkins, LLC and IP Perkins BAAH, LLC and resource agencies, in coordination with the Lead Biologist.

# 4. INTEGRATED WEED MANAGEMENT PLAN

This Integrated Weed Management Plan (IWMP) describes the proposed Project activities and components that may facilitate weed infestations and assesses potential risks that weeds may pose to natural resources values on the Project site and in the surrounding area. It summarizes baseline data regarding weeds in the Project vicinity and describes monitoring and control measures to be implemented to minimize those risks. Control measures may consist of mechanical and/or chemical methods.

Throughout this IWMP, the word “weed” is used to include any non-native plant that may interfere with natural resource values on the Project site or on surrounding lands. The most important effect of weeds on natural resources is invasion into natural habitats. Invasive weeds can displace native species, supplant wildlife food plants or other habitat elements (e.g., cover), alter natural habitat structure and ecological function, alter natural wildfire patterns, or displace special-status plant occurrences and habitat (Zouhar et al., 2008; Lovich and Bainbridge, 1999). Due to this disruption of habitat and natural systems, these plants are considered “weeds” or “pest plants” when they invade natural landscapes (Bossard et al., 2000). The spread of invasive plants is an important threat to biological resources in the California desert. Human activities, including the proposed Project, can affect weed distribution and abundance in two ways: they can introduce new weed species to an area, and they can facilitate propagation and spread of weeds already present.

Weeds and pest plants addressed in this IWMP will not be limited to “noxious weeds” as designated by federal and state agencies. Instead, weeds are defined here to include any species of non-native plants identified on the weed lists of the California Department of Food and Agriculture (CDFA), the California Invasive Plant Council (Cal-IPC), or of special concern identified by BLM, BOR, or CDFW. In addition, any non-native species found on the site that has not been evaluated for its potential to invade or alter surrounding natural lands will be considered a weed for purposes of IWMP implementation.

## 4.1. Integrated Weed Management Plan Objectives

The weed management objectives for the Perkins Renewable Energy Project include the following:

**Prevention.** This IWMP seeks to prevent weeds already present on the site from becoming larger or more persistent infestations, and to prevent new weeds from becoming established on the site.

**Detection/identification.** The monitoring measures described in this plan are designed to identify weed infestations for further control efforts.

**Control.** Control strategies will be based on the potential threat of any given infestation. Control strategy will be based on the threat posed by a given weed species, and the location, abundance, and extent of the infestation. For each infestation, potential control strategies are:

- *Eradication*. This control objective is to eliminate all individuals of a particular species within a specified area. This will be the goal for weed species that are new to the area (i.e., unknown threat) or known species posing (1) significant environmental concern; and (2) not already widespread in surrounding landscapes.
- *Suppression*. This objective will be selected for weed species and populations already widespread throughout the region and common on disturbed soils. The objective will be to reduce infestation density and minimize seed production and the threat for off-site spread, but not necessarily to reduce the total area or boundary of the infestation. This strategy will apply to many widely distributed, high- density weeds where eradication is not feasible.
- *Containment*. This objective will be aimed at preventing infestation expansion and spread and may be conducted with or without any attempt to reduce infestation density. Containment focuses on halting spread until suppression or eradication can be implemented and is practical only to the extent that the spread of seeds or vegetative propagules can be prevented.

This IWMP has been prepared to conform to the DRECP Conservation and Management Action (CMA) LUPA-BIO-10 (Standard Practices for Weed Management). This plan may be revised to conform to requirements of: (1) mitigation requirements of the Project’s Final Environmental Impact Report or Environmental Assessment, (2) any USFWS Biological Opinion (BO) or CDFW Consistency Determination or Incidental Take Permit (ITP) issued for the Project, (3) any revisions to relevant mitigation measures (MMs) that may be adopted in the BLM and BOR Records of Decision and/or by CEC, or (4) any further direction from the resource agencies.

## 4.2. Known and Potential Weed Occurrences

Numerous invasive weeds have already become widespread throughout the Sonoran Desert and for some invasive species the prevention of further spread is impracticable. Examples of these species include Mediterranean grass (*Schismus barbatus*), Russian thistle (*Salsola tragus*), and Saharan mustard (*Brassica tournefortii*). Others (e.g., saltcedar, *Tamarix ramosissima*) are damaging to specific habitat types but pose little or no threat to widespread upland desert habitat.

Invasive species that have been found on the solar facility site and in the surrounding areas include Saharan mustard, Russian thistle, Tamarisk or saltcedar, Mediterranean grass, Bermuda grass *(Cynodon dactylon)*, and common reed *(Phragmites australis)* (Ironwood 2023).

Other non-native plant species observed on the Project site that are not considered invasive but have become naturalized include date palm *(Phoenix dactylifera)*, Mexican fan palm *(Washingtonia robusta)*, prickly lettuce *(Lactusa serriola)*, spiny sowthistle *(Sonchus oleraceus)*.

These and other invasive species with potential of occurring on the site now or in the future are listed in Attachment A.

Attachment A presents threat rankings for each species as assigned by the CDFA and by Cal-IPC (CDFA 2023, Cal-IPC 2023) (as applicable). Species were selected for inclusion in the table based on occurrence on or around the Project site and transmission corridors, or from comparable habitats of the broader Sonoran Desert region in California.

BLM Risk Assessment guidelines recommend ranking risks according to (1) likelihood that a weed will spread to the project site, and (2) consequences of its establishment on the site.

BLM's recommended assessment of the first factor (likelihood of spread to the site) range from "none" to "high," based on occurrence and abundance in the surrounding area. However, these guidelines do not account for potential weed introduction via vehicle traffic from outside a project area, and therefore do not address the most likely vector for weed introduction onto the Project site. For most weed species below, the likelihood of spread to the Project site from adjacent areas is low or none (the only exceptions are those species already occurring on the Project site). However, any of these species, as well as species of unknown threat, could be spread to the Project area by vehicle traffic during Project construction, operation, or decommissioning. The most likely vector would be via seed or rhizomes that may be caught in the undercarriages of construction equipment.

Similarly, the BLM guidelines addressing consequences of establishment primarily refer to on-site consequences. These guidelines appear to address local habitat or range improvement projects, rather than land use conversions to renewable energy facilities. Whereas many weed infestations could degrade a range project, most weed infestations would have only minimal consequences for the solar facility. For the Project, the most important consequences of any potential weed infestation are the likelihood that infestations may spread off the site and into surrounding natural landscapes.

Due to the general inapplicability of the BLM guidelines to renewable energy land use conversion, the descriptions of likelihood of occurrence at the Project site and consequences of occurrence/spread in Attachment A are based upon field experience on the site and throughout the Sonoran Desert in California, rather than the BLM's recommended risk assessment methodology.

Human activities such as transportation and trade provide a constant source of new exotic species into California, including the Sonoran Desert region, and serve to disperse exotic species already established into new areas. We cannot predict what new weed species might become problematic on the Project site or the surrounding area in coming decades. Therefore, the monitoring section of this IWMP includes measures to identify and control (generally by eradication) any non-native species new to the area that may be discovered on the site.

## 4.3. Weed Management Biologist Responsibilities

IP Perkins, LLC and IP Perkins BAAH, LLC, will identify a Weed Management Biologist (e.g., a botanist or restoration specialist), responsible for coordination of biological resources compliance requirements among the Project owner and regulatory agencies throughout Project construction, operation, and decommissioning. The Weed Management Biologist's responsibilities will include managing and implementing weed monitoring and control efforts, as follows:

- Schedule all weed monitoring for all Project components.
- Verify that vehicle inspections are conducted properly and completely.
- Review planting materials, erosion control materials, and other materials to ensure they are weed free.
- Ensure that each person assigned to monitor for weeds is skilled in weed identification.
- Manage weed monitoring data.
- Prioritize and implement control efforts.
- Communicate with IP Perkins, LLC and IP Perkins BAAH, LLC and resource agencies regarding weed management needs and priorities; and
- Prepare and submit reports.

## 4.4. Prevention

Prevention or minimization of weed introduction and establishment will be implemented as follows:

- **Design and Construction.** The extent of soil disturbance will be limited to the fenced Project area and the minimum necessary area at each transmission loop-in and gen-tie tower, pull site, or other work area.
- **Worker Environmental Training.** Weed management information will be incorporated into the mandatory Worker Environmental Awareness Program (WEAP) training for all contractors, subcontractors, inspection personnel, construction managers, construction personnel, groundskeepers, maintenance personnel, and all individuals bringing vehicles or equipment onto the site during construction, operations, and decommissioning phases of the Project. Training will include an explanation of the importance of weed management to maintain natural resource values; specific requirements for vehicle washing; and other applicable measures to prevent the introduction and spread of weeds. Training will be incorporated into the Worker Environmental Awareness Program.

  Workers will be required to inspect their clothing, shoes, and personal equipment before arriving on the site and to remove and dispose of weed seed and plant parts. The material will be bagged for disposal in an offsite landfill.
- **Vehicle, Equipment & Tool Inspections.** Prior to entering the Project site, all vehicles, equipment, and tools will be cleaned to remove weed seeds and propagules, dried mud, or any other potential source of weed seed. Vehicles shall be cleaned at construction yards or commercial car or truck washes. This shall include cleaning of wheels, undercarriages, fuel pans, skid plates, bumpers, and vacuuming interiors. Heavy equipment and hand tools

(shovels, rakes, hand clippers, pruners) and power tools (i.e., chainsaws) shall also be washed before entering the Project site.

The Project owner shall ensure that all equipment (including heavy equipment entering the site on trailers) and vehicles that enter the Project area have been cleaned and will conduct inspections of vehicles and equipment before entering the work areas. All vehicles entering the site for the first time or returning to the site after being operated outside the vicinity (i.e., the Imperial Valley), will be inspected. The inspector will ensure that vehicles (including vehicle interiors) and equipment are free of soil and debris capable of transporting weed seeds, roots, or rhizomes before the vehicles and equipment are allowed to use access roads. Vehicles, equipment, or tools failing the inspection will not be permitted to enter the site. The Project owner will maintain a record of all vehicles inspected, available for BLM or BOR review upon request.

- **Weed-Free Materials.** Any plant materials (such as hay bales, wattles, or other erosion control materials) brought onto the site shall be certified weed free. Any seed used in revegetation efforts will be sourced from within the appropriate provisional seed zone. Natural materials for erosion control will be certified weed free and will consist only of plant species native to the Imperial Valley. Additional products such as gravel, sandbags, silt fences, and mulch may also carry weeds. Such products will be obtained from suppliers who can provide certified weed free materials. Where feasible, mulch used for erosion control will be generated from native vegetation cleared from the site itself. The Weed Management Biologist will be responsible for checking deliveries and confirming certification of all materials. Installed erosion control materials will be inspected at the appropriate time of the year for winter and spring germinating weed species to ensure that they are weed free (see Section 4.5.2 below).

## 4.5. Monitoring

### 4.5.1. Weed Identification, Mapping, and Data Management

Effective monitoring for weed infestations necessitates accurate identifications of weeds, and accurate distinction among native and non-native species, especially during early growth and before the plants mature and set seed, to allow for early control or eradication. All weed monitoring will be conducted by a biologist experienced with the regional flora and experienced with seedling and early vegetative growth forms of regional weeds (Attachment A) and common native species on the Project site. All monitoring reports will include comprehensive species lists of all native and non-native species observed in the survey area. Any species not recognized in the field will be collected and identified using regional identification manuals (e.g., Baldwin et al., 2002). Botanists will make pressed specimens of seedling, early flowering, and mature plant samples of all native and non-native species found on the Project site for further reference and training purposes. Any species not readily identifiable using regional identification manuals will be preserved as a labeled specimen and forwarded to a recognized herbarium for identification by experts.

For certain weed species already known from the site, or that are ubiquitous in the region, infestations will be recorded where the density and extent is greater (based on visual estimation) than baseline abundance in the surrounding natural landscape. This will apply only to the following species (see Attachment A):

- Saharan mustard
- Bermuda grass

Baseline abundance will vary from year to year, depending on rainfall. Therefore, the Weed Management Biologist and qualified monitors will develop guidelines to estimate baseline abundance for each seasonal monitoring period. For all other non-native species, every occurrence documented during monitoring efforts will be recorded and targeted for follow-up treatment.

The locations of all weed infestations will be recorded and mapped during monitoring efforts using hand- held global positioning system (GPS) units; short descriptions of the location, extent, abundance, and phenology of each weed species (if known) will be recorded. Locations of any species (other than those listed above), including any species not previously known from the site will also be flagged in the field to enable precise control efforts or other follow-up measures (Section 4.6). All monitoring data will be retained and managed by the Weed Management Biologist in a spreadsheet or other data management software, along with all data regarding follow-up control efforts and monitoring.

### 4.5.2. Scheduling and Field Methods

Monitoring for weeds will be conducted throughout the entire Project area, including the solar facility, the transmission loop-in lines, gen-tie, BESS and substation areas, internal roadways, and throughout a 100-foot buffer area in any undisturbed and adjacent to any work area (such as tower sites, access roads, and conductor pull sites).

Monitoring will be conducted twice annually throughout the construction, operations, and decommissioning phases of the Project, and for a minimum 5-year period following decommissioning, or until any high-priority target weed species has been effectively controlled or eradicated. Complete weed-monitoring surveys will be conducted once in early spring (February or March) to detect winter-germinating species before they set seed; and once in late summer or early fall, to detect summer-germinating species. Depending on timing and amount of annual rainfall on the site (per the data collected at the on-site meteorological station) survey schedules may be adjusted or suspended, based on recommendation of the Weed Management Biologist and written agreement of BLM, BOR, California Department of Fish and Wildlife (CDFW), and U.S. Fish and Wildlife Service (USFWS).

Full-coverage weed monitoring of the Project area will be conducted by walking over all access routes, parking areas, lay-down areas, other disturbance areas (including internal roads throughout the site and the transmission line access routes), and throughout a 100-foot buffer in natural lands surrounding the work sites. Special emphasis will be given to areas vulnerable to colonization including roadsides, soil stockpiles, wash stations, previously disturbed areas, areas of prior weed infestation, areas near known weed infestations, and all areas with disturbed soils.

Along the Project's linear features, in the adjacent buffer areas, and within the entire weed monitoring area, monitors will also record locations of special status plant occurrences or any other biological resources where herbicide application would be inappropriate.

In addition, the Weed Management Biologist or other qualified Biological Monitor will periodically monitor all water sources or other wet areas on the site to check for water leaks and to determine if any weeds have become established at those locations. These areas will include, but will not be limited to:

- Water tanks
- Roadsides where dust control water may collect

- Water pipelines on the ground surface
- Bathrooms, eating areas, wash stations, or any other sites where workers may use water.

Monitoring of these sites will be conducted monthly at minimum, and records of each monitoring date and results will be maintained in the Perkins Renewable Energy Project data files.

## 4.6. Weed Control

### 4.6.1. Control Strategies and Prioritization

Weeds will be treated according to abundance and extent of infestations and potential threat to on- and off-site habitat. The treatment strategy for weeds that are ubiquitous in the region (e.g., Russian thistle, Mediterranean grass, and Saharan mustard) will be suppression, with the objective of maintaining densities and extent at or below baseline levels. Strategies for weeds that are actively spreading in the region, species that are strongly invasive in riparian habitats, or species altogether new to the region will be immediate treatment and eradication if possible, and containment until eradication is complete.

Infestation sites flagged during monitoring (see Section 4.5 above) will be targeted for treatment as early as feasible, to prevent weeds from going to seed, or reestablishing their seed bank, and spreading into surrounding areas beyond their current extent. Until control is implemented, the infestations will be encompassed by temporary orange vinyl construction fencing to prevent vehicles or pedestrians from entering the area and risking further spread of the targeted weeds. The Weed Management Biologist will be responsible for ensuring that temporary fencing is in place and maintained as necessary.

Specific treatment methods will be planned and implemented for each infestation. The Weed Management Biologist will review and approve each method prior to its implementation.

Weed infestations on linear Project features, in high-traffic areas such as Project staging areas, and along access routes shall be high priority for treatment. Weeds that are common within the site and surrounding area will generally be given low priority where they occur in relatively low densities or in the interior of the area, distant from surrounding native vegetation. However, these infestations will be given higher priority if abundance is high enough to create a significant new seed source that may increase weed infestation densities on adjacent lands.

### 4.6.2. Mechanical Treatment

Where weed infestations are small, or where they are adjacent to native vegetation or other sensitive biological resources (e.g., the site perimeter or in buffer areas), mechanical control methods will be implemented. Mechanical treatment may be appropriate for any of the three control strategies (suppress, contain, or eradicate), depending on the species and extent of the infestation. Mechanical treatment must be scheduled and implemented to prevent further spread of weed seeds. Ideally, mechanical treatment will be scheduled early enough in the growing season to remove weeds before their seeds mature. If seeds have matured and begun to disperse, then control measures must be designed to prevent further spread of seeds from the infestation site, and (if feasible) recover or destroy seeds that may have already fallen from the plants. Soil solarization (covering the infestation area with plastic for several weeks during summer) may be effective in killing weed seeds.

Mechanical control methods include hand pulling of weeds and the use of hand or power tools to uproot, girdle, or cut plants. Lever arm tools such as Weed Wrench™ and Root Jack™ may be used to pull out woody shrubs such as tamarisk. Hand removal by pulling is appropriate when the plants are large enough that they will not break and leave the roots in the soil, where they would be likely to re-sprout. For control of small numbers of rooted woody species, this is the most effective method.

Hand pulling is less effective for weed species that spread via rhizomes (e.g., Bermuda grass). Hoeing or other methods may be effective for these infestations, by carefully avoiding any adjacent native plants. Hoeing or other mechanical disturbance should not be used if weeds have set seed, to avoid further seed dispersal. Hoeing works best on patches of small weeds and on weeds that have a single root mass. It is less effective on larger weeds that can regenerate from cut roots.

Power weed-whips can be used for removal of tall annual species (such as Saharan mustard) but they should not be used on weeds approaching maturity unless all cut material is carefully collected and removed from the site to prevent spreading seeds. Even seeds that have not matured at the time of cutting can finish maturing on the cut material, and then propagate the infestation.

Any plant material removed by mechanical control methods will be bagged and removed from the site and transported to a landfill in a covered vehicle. No mulch or green waste from weed material will be stored or disposed of on the Project site.

### 4.6.3. Chemical Control

Where infestations are too large for effective mechanical control and are not adjacent to native vegetation or other sensitive biological resources, herbicides generally will be used for control. Herbicides and associated adjuvants[1] may be used for any of the three control strategies (suppress, contain, or eradicate), depending on the species and extent of the infestation. Herbicides and adjuvants used on the Project site will be those approved by the BLM in the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (BLM 2007) and Vegetation Treatments of the Western 17 States.

This section describes the permitting and regulatory requirements relevant for chemical control of invasive weeds, the types of herbicides available, general application and handling procedures, and specific herbicide application methods for pre- and post-emergent application.

#### Permitting and Regulatory Requirements

Prior to herbicide use on BLM-administered lands, the BLM requires that a Pesticide Use Proposal (PUP) and a site-specific Environmental Assessment (EA) be submitted to ensure that all applications would follow BLM and Department of Interior policies regarding herbicide use. The analysis of herbicide use on the Perkins Project site will be included within the Project EA; however, a separate PUP will be submitted.

As submitted by a 3rd party proponent, the PUP must be submitted by a State-licensed and registered Pesticide Control Advisor (PCA) and provided to BLM on the most currently approved form, for inclusion into BLM's VMAP database. The PUP details all the required information for

1 An adjuvant is a substance in an herbicide formulation, added to the spray tank, to improve herbicidal activity or application characteristics. Adjuvants include, but are not limited to, such substances as surfactants, spreaders, and marking dyes.

herbicide use on a project, including which herbicides and associated adjuvants will be used for treatment, location of applications, responsible parties, timeline for treatment, application methods, application rates and maximum annual amounts, target species, and precautions for humans, sensitive resources, and non-target vegetation. The PUP is then approved by BLM personnel at the local field office and State level.

All herbicides will be applied in accordance with applicable laws, regulations, and permit stipulations. Only herbicides and adjuvants approved by the BLM for use on public lands will be used within the Project site.

### Types of Herbicides

Herbicides can be characterized as pre-emergent, post-emergent, selective, and non-selective. A pre- emergent herbicide is one that generally controls un-germinated seeds by inhibiting germination. Post-emergent herbicides are generally lethal to plants after germination, but not to seeds. A few herbicides have both pre- and post-emergent activity. Herbicides can be selective or nonselective. If an herbicide is selective, it will affect some species of plants and not others, e.g., monocots (grasses) vs. dicots (broadleaf plants). A non-selective herbicide is one that is lethal to any plant species to which it is applied.

Herbicides kill plants through contact or systemic action. Contact herbicides are most effective against annual weeds and kill only the plant parts to which the chemical is applied. Systemic herbicides are absorbed either by roots or foliar parts of a plant and are then translocated within the plant. Although systemic herbicides can be effective against annual and perennial weeds, they are particularly effective against established perennial weeds. Pre-emergent herbicides inhibit germination of annuals from seed, but generally do not control perennial plants that germinate from bulbs, corms, rhizomes, stolons, or other vegetative structures. Common herbicide classes include the following:

- **Pyridine (Picolinic Acid):** Examples of this class are clopyralid (Transline™) and triclopyr (Garlon 4™). These herbicides provide for post-emergence control of annual and perennial woody and herbaceous broadleaf weeds, particularly plants in the Asteraceae (sunflower family), Fabaceae (legume family), Solanaceae (nightshade family), Polygonaceae (knotweed family), and Violaceae (violet family). These herbicides are degraded primarily by microbial action in the soil and are moderately persistent in soils.
- **Sulfonylurea:** Examples include chlorsulfuron (Telar XP™). These selective broad-leaf herbicides are pre- emergent or early post-emergent herbicides used in non-cropland areas.
- **Imidazolinone:** Examples include Imazapyr (Polaris™). Non-selective herbicide used for the control of a broad range of weeds including terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species. It breaks down slowly in the soil via microbial metabolism and photolysis.
- **Glyphosates:** The most commonly used post-emergent, non-selective herbicides are in a group called glyphosates. Glyphosate (e.g., Roundup™) is a nonselective, systemic herbicide that is effective on many annual and perennial plants. Glyphosate is most effective if the entire plant is covered. Glyphosate should not be applied when the temperature exceeds 90°F. Glyphosate has a low toxicity to humans, is no more than slightly toxic to birds, and is practically nontoxic to fish, aquatic invertebrates, and honeybees (EPA, 2018).
- **Adjuvants:** Spray adjuvants are generally grouped into activator adjuvants and special purpose adjuvants. Special purpose adjuvants widen the range of conditions under which an

herbicide formulation is useful. They include compatibility agents, buffering agents, antifoam agents, and drift control agents. Activator adjuvants are used to enhance post-emergence herbicide performance, and can increase herbicide activity, absorption into plant tissue, and rainfastness. They include surfactants, crop oil concentrates, nitrogen fertilizers, spreader-stickers, wetting agents, and penetrants.

All herbicides and adjuvants that could be utilized during implementation of the IWMP are listed in Table 2.

**Table 2. Herbicides Proposed for Perkins Renewable Energy Project**

| Active Ingredient | Trade name | Manufacturer | EPA Reg.# | Formulation |
|---|---|---|---|---|
| **Herbicides** | | | | |
| Clopyralid | Transline | Dow | 62719-259 | Liquid |
| Chlorsulfuron | Layer Telar XP | DuPont | 432-1561 | Extruded Pellet, Dry flowable |
| Glyphosate | Roundup Custom | Monsanto | 524-343 | Liquid |
| | Roundup PROMax | Monsanto | 524-579 | Liquid |
| Imazapyr | Polaris | Nu Farm | 228-480 | Liquid |
| Triclopyr | Garlon4 | Dow AgroSciences | 62719-40 | Liquid |
| **Adjuvants** | | | | |
| Non-ionic surfactant {NIS) | Activator 90 | Loveland | CA#34704-50034 | Liquid |
| Modified Seed Oil | MSO | Loveland | CA#34704-50067 | Liquid |

## Application and Handling

It is the responsibility of the herbicide user to observe all directions, restrictions, and precautions on herbicide labels, to store all herbicides in original containers with labels intact and behind locked doors, and to keep herbicides out of the reach of children. The following general precautions will be implemented for herbicide application:

- Use herbicides at correct label application rates and intervals to avoid harmful residues from injuring plants and animals.
- Use herbicides carefully to avoid drift to or contamination of non-target areas.
- Surplus herbicides and containers should be disposed of in accordance with label instructions to prevent contamination of water and other hazards.
- Follow directions on the herbicide label regarding restrictions as required by state or federal laws and regulations.
- Avoid any action that may threaten a rare, threatened, or endangered species or its habitat, including BLM sensitive species.

## Limitations

Herbicide applications must follow EPA label instructions. Application of herbicides will be suspended when any of the following conditions exists:

- Wind velocity exceeds 6 miles per hour (mph) during application of liquids or 15 mph during application of granular herbicides.
- Snow or ice covers the foliage of weeds.

- Precipitation is occurring or is imminent.
- Air temperatures exceed 90°F.

### Transport and Mixing

Herbicides will be transported within the site with the following provisions:

- Only the quantity needed for that day's work will be transported at any given time.
- Concentrate will be transported in approved containers only and in a manner that will prevent tipping or spilling, and in a location that is isolated from the vehicle's driving compartment, food, clothing, and safety equipment.
- Mixing will occur over a drip-catching device, and at a distance greater than 200 feet from open or flowing water, wetlands, or other sensitive resources. No herbicides will be applied at these areas unless authorized by appropriate regulatory agencies.
- Herbicide equipment and containers will be inspected for leaks daily. Disposal of spent containers will be in accordance with the herbicide label.
- During the operations phase, herbicides will be stored only in cabinets of approved design and will be under lock and key.

### Spray Methods

Broadcast application of herbicides consists of applying a spray solution uniformly over an entire treated area. Broadcast applications are conducted using vehicle-mounted sprayers (e.g., handgun, boom, and injector) which will be used only in open areas that are readily accessible by vehicle and that are appropriate for this type of application.

Spot application of herbicides consists of directed spray only on individual target plants, limiting impacts to non-target vegetation. Spot or hand application methods (e.g., backpack spraying) will be used to treat small or scattered weed populations or in rough terrain.

Calibration checks of equipment will be conducted at the beginning of spraying and periodically throughout treatment to ensure proper application rates.

### Herbicide Spills and Cleanup

Reasonable precautions will be taken to avoid herbicide spills. In the event of a spill, immediate cleanup will be implemented. Contractors will keep spill kits in their vehicles and in herbicide storage areas to allow for quick and effective response to spills. The following items are to be included in the spill kit:

- protective clothing and gloves
- absorptive clay, "kitty litter," or other commercial adsorbent
- plastic bags and bucket
- shovel
- fiber brush and screw-in handle
- dust pan
- caution tape
- highway flares (use on established roads only)
- detergent

Response to herbicide spills will vary with the size and location of the spill, but general procedures include the following:

- traffic control
- dressing the cleanup team in protective clothing
- stopping any leaks
- containing spilled materials
- cleaning up and removing the spilled herbicide or contaminated adsorptive material and soil
- transporting the spilled herbicide and contaminated material to an authorized disposal site

### Herbicide Application Methods by Plant Type

**Controlling post-emergent herbaceous species:**

- Apply a foliar application of chosen herbicide from Table 2 on each plant at a minimum rate of 2.5 percent (plus 2 percent by volume [V/V] of nonionic surfactant). The Weed Management Biologist will determine the appropriate herbicide to use at each location. Different herbicides should be used in different years, or on a rotation, to prevent the selection of herbicide-resistant strains of target invasive plant species.
- Provide applications on a spray-to-wet basis with coverage uniform and complete.
- Avoid contact with established native shrub and grass species.
- Temporarily discontinue work in the event of gusty winds or winds in excess of 6 mph.
- Temporarily discontinue in the event of rainfall.
- Ensure applicators possess current pest control licenses valid in the State of California and wear gloves, masks, and long sleeves as protection from chemical injuries.
- Leave sprayed vegetation undisturbed for 7 days until visible effects of herbicide application are present such as wilted and brown foliage.
- If any seeds reached maturity, remove all treated plant materials by placing all weed material potentially containing propagules in durable bags. Bags shall be sealed prior to transport. All weed material shall be disposed of by covered transport to an appropriate landfill.

### Controlling post-emergent woody species:

- Cut sprouts or woody stems to a height of 12 inches or less above ground and remove all aboveground debris for disposal at a suitable landfill.
- Apply Round-Up™ or Garlon 4™ at a 100 percent rate to the cut sprouts or stems within 2 minutes of cutting. Use Round-up™ in upland areas. The Weed Management Biologist will determine the appropriate herbicide to use at each location.
- Cover all loads with a tarpaulin to transport vegetation trimmings.
- Apply follow-up foliar applications as described in the previous section to stem regrowth that occurs after initial control effort.
- Continue monitoring cut stems for as long as necessary to ensure complete mortality.

### Controlling seed banks with pre-emergent herbicides:

Pre-emergent herbicides may be used in areas that have repeated infestations of annual weeds, with evidence of a persisting seed bank. These areas will be sprayed with pre-emergent herbicides during appropriate pre-germination periods. Application will follow the spray application guidelines described above for post-emergent herbaceous species.

### 4.6.4. Proposed Herbicide Application

The primary use of herbicides at the Project will be for control of invasive annual herbaceous upland weeds expected to propagate on disturbed soils throughout all Project facilities. The most common annual upland weeds are likely to be Saharan mustard, Russian thistle, and Mediterranean grass. Herbicide treatment will be used within the solar generation site and related facilities, and on disturbed soils at the transmission loop-in and gen-tie structures and other work sites (only as compatible with revegetation efforts). Herbicides will not be used within or adjacent to any undisturbed native vegetation, such as buffer areas beyond the perimeter of the Project site and work areas.

The method of herbicide treatment for the control of upland weeds would not be expanded beyond those herbicides analyzed in the BLM's 2007 Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement (PEIS). Ground applications of herbicides approved for use in California such as Glyphosate, Imzazpyr, or Clopyralid-based herbicides would be used at application rates consistent with the label and the BLM 2007 PEIS. See Table 3 for maximum and prescribed rates of herbicide application for the Perkins Renewable Energy Project. Application methods consistent with the label would be used to treat upland weeds. These methods would consist of using a hand-held compression sprayer (broadcast application) or backpack sprayer (spot treatment). All treatments would be supervised or overseen by a certified pesticide applicator who is knowledgeable in plant identification and familiar with proper herbicide application techniques.

**Table 3. Maximum and Prescribed Rates of Herbicide Application[1]**

| | Maximum Application[2] Rate/Acre/Year | | Prescribed Application[3] Rate/Acre | |
|---|---|---|---|---|
| **Herbicide** | **Product** | **AI/AE** | **Product** | **AI/AE** |
| Round-Up Custom | 256 oz. (2 gallons) | 8.0 lbs. a.e. | 3 quarts | 2 lbs. a.e. |
| Roundup PROMax | 224 oz. (1.75 gallons) | | 2.67 quarts | |
| Transline | 1.33 pints | 0.5 lb. a.e. | 15 oz. | 0.35 lb. a.e. |
| Polaris[4] | 6 pints | 1.5 lbs. a.e. | 1.33 pints | 0.3 lb. a.e. |
| Telar XP | 3.0oz. | 0.141 oz. a.i. | 1 oz. | 0.047 oz. a.i. |
| Triclopyr | 2.0 gal/ac | 8.0 lbs. a.e. | 0.5 gal/ac | 2.0 lbs. a.e,/ac |
| MSO,[5] when used, will be used at a concentration of 1% volume/volume in each tank mixture. | | | | |
| Activator 90, when used, will be used at a concentration of 0.5% v/v in each tank mixture. | | | | |

1 - Choice of prescription will depend on site constraints, target species, and time of year. Treatments will be directed foliar.
2 - Maximum total application amount throughout the entire project area per year based on active ingredient.
3 - Maximum amount per application event; multiple applications may occur in a year, if needed to control weeds, until maximum annual application amount is reached.
4 - Polaris (Imazapyr) will be used only in disturbed habitat
5 - Either "MSO Concentrate" from Loveland or "Hasten" from Wilbur Ellis is recommended.
a.e. Acid Equivalent
a.i. Active Ingredient
ac Acre
gal Gallon
lbs Pounds

Treatment sites would be accessed via existing roads or new roads to be constructed as a part of the Perkins Project. No additional access routes would be constructed for weed management, and there would be no vehicle access off established roads. Herbicide, equipment, and personnel would be brought to treatment sites by a truck, van, or car that are weed free as described in Section 4.4 above.

In addition to the specifications identified in this Plan, all herbicide application will conform to any requirements or authorizations from the BLM.

Table 4 provides an herbicide application matrix that outlines herbicides, application rate treatment method(s), and treatment timeframe for a variety of weeds that could occur on site.

**Table 4. Herbicide Application Matrix**

| Weed Species | Treatment Timeframe | Treatment Method(s) | Active Ingredient/ Application Rate |
|---|---|---|---|
| Salt cedar (tamarisk) | Year-round | Cut stump or foliar | Imazapyr (3 qt./acre) or Triclopyr (2 gal./acre) |
| Saharan mustard | Early spring | Foliar | Glyphosate (4 qt./acre) |
| Russian thistle | Early spring | Foliar | Imazapyr (2-3 pt./acre) or Glyphosate (4 qt./acre) |
| Common annuals, including red brome, redstem filaree, and Mediterranean grass | Spring | Foliar | Glyphosate (1 qt./acre) |

### 4.6.5. Potential Effects of Herbicide Use

Herbicides pose risks to terrestrial and aquatic vegetation. Several terrestrial herbicides are non-selective and could adversely impact non-target vegetation near treatment areas through overspray or drift. Herbicides may also pose risks to wildlife by persisting on vegetation used as habitat or food and in soils used by burrowing animals (e.g., desert tortoise, burrowing owl, special-status reptiles). Section 4.6.4 includes specific measures to avoid application at Project perimeters, in the vicinity of native vegetation or special-status plants, and to avoid overspray or spillage in any areas.

Soil quality and soil health is critical to a healthy habitat and functioning ecosystem and can be impacted through invasive plant control. Soil quality is defined as the capacity of each soil to function, sustain productivity, enhance water and air quality, and to support human and animal health and habitation (Graber 2021). Soil quality is an inherent characteristic of a soil, such as water capacity, and it varies from soil to soil. Soil health, however, is the condition of the soil and its potential to sustain biological functions, maintain environmental quality, and promote plant and animal health (Graber 2018). Soils may be impacted when herbicides persist in the environment after application, reducing soil health. Utilizing herbicides in compliance with Section 4.6.4 will assist in minimizing and mitigating such harmful effects.

## 4.7. Reporting

Throughout the construction, operation, and decommissioning phases, and for a minimum of 3 years following completion of decommissioning, the Weed Management Biologist will be responsible for providing annual Weed Management Reports to the BLM and BOR for review and approval. In addition, the Weed Management Biologist will be responsible for providing a short memo to each agency after completing each of the two annual monitoring efforts (early spring and late summer/early fall). These memos will summarize the results of monitoring, briefly describe planned (or completed) control efforts, and highlight any new or unexpected findings, particularly any weeds new to the Project site or to the area.

Each annual report will include the following contents:

- The location, species, extent, and density of weeds on the Project site. Data will include maps, text, tabular data, and photographs of any significant findings (previously unrecorded weed species, or any dense weed infestations resistant to control and threatening to spread off-site);
- A description of management efforts, including date, location, type of treatment implemented, results, and ongoing evaluation of success of treatments;
- A summary of implementation and success of preventative measures, including status of equipment wash facilities, list of workers that have completed the worker environmental training program (WEAP), and copies of vehicle wash and inspection logs; and
- Tabulation of ambient air and earth surface temperature during herbicide application.

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# Attachment A

## WEEDS OF THE IMPERIAL VALLEY AREA

| Weed Species | Habitats, Range, and Control Notes | Rankings[1] | Likelihood of Occurrence at Project Site | Consequences of Occurrence/Spread[1] |
|---|---|---|---|---|
| *Brassica tournefortii* Saharan mustard | Widespread and abundant in California deserts; common in interior valleys (e.g., W Riverside Co.); especially invasive in open sands and in disturbed soils (including natural disturbance) | CDFA: None<br>Cal IPC: High Impacts/Invasiveness/ Distribution: A/A/B | Found on the Project site and throughout the region. | Minimal consequence for chronic low-density infestation; high-density infestation could increase wildfire fuel load and habitat conversion. High density and frequent fires may deplete soils of important nutrients, making native habitat recovery more difficult. |
| *Cynodon dactylon* Bermuda grass | Widespread and abundant in much of California; new intro-ductions are probably chronic in region; in deserts, requires mesic soil conditions | CDFA: C<br>Cal IPC: Moderate Impacts/Invasiveness/ Distribution: B/B/B | Found on the Project site and throughout the region. | Outcompetes native species, particularly in riparian areas. |
| *Lactuca serriola* Prickly lettuce | Widespread and abundant in western California; limited in desert to slightly mesic or shaded locations; spread may be limited in low desert by soils and climate | Not in the Cal-IPC Inventory | Found on the Project site | Not included in the Cal-IPC Inventory. Reduces resources for native annuals. |
| *Phoenix dactylifera* Date palm | Stream corridors, waterway near areas of date palm cultivation (ref. to *P. canariensis*) | Not in the Cal-IPC Inventory, however *P. canariensis* is Cal-IPC Rating: Limited and CDFA Rating: None. | Found on the Project site | Date palms tend to grow in clusters that form a dense canopy that excludes light from reaching the ground, leading to a loss of native plants. |
| *Phragmites australis* Common reed | Freshwater wetlands, readily invades degraded salt marshes; also river edges, shores of lakes and ponds, roadsides and disturbed areas | Not in the Cal-IPC Inventory | Found on the Project site | Alters the structure and function of diverse marsh ecosystems. Dense phragmites stands decrease biodiversity and quality of wetland habitat, particularly for migrating |

| Weed Species | Habitats, Range, and Control Notes | Rankings[1] | Likelihood of Occurrence at Project Site | Consequences of Occurrence/Spread[1] |
|---|---|---|---|---|
| | | | | waders and waterfowl species. |
| *Salsola tragus* Russian thistle | Widespread and often abundant throughout much of California; including deserts | CDFA: C<br>Cal IPC: Limited-Moderate Impacts/Invasiveness/ Distribution: vary by species | Found on the Project site | Can impede traffic, create fire hazards, and host the beet leaf-hopper, an agricultural insect pest. |
| *Schismus arabicus* Mediterranean grass | Widespread and often abundant throughout much of California; including deserts | CDFA: C<br>Cal IPC: Limited Impacts/Invasiveness/ Distribution: B/C/A | Found on the Project site | Contributes to the conversion of desert shrubland into annual grassland by carrying fire across open areas, where they ignite and kill native shrubs. |
| *Sonchus asper* Spiny sowthistle | Widespread and abundant in western California; limited in desert to slightly mesic or shaded locations; spread may be limited in low desert by soils and climate | Not in the Cal-IPC Inventory | Found on the Project site | Not included in the Cal-IPC Inventory. Reduces resources for native annuals. |
| *Sonchus oleraceus* Sowthistle | Widespread and abundant in western California; limited in desert to slightly mesic or shaded locations; spread may be limited in low desert by soils and climate | Not in the Cal-IPC Inventory | Found on the Project site | Not included in the Cal-IPC Inventory. Reduces resources for native annuals. |
| *Tamarix ramossisma* Tamarisk | Widespread and strongly invasive in riparian habitats throughout California and southwestern desert regions | CDFA: B -- included in the CCR Section 4500 list of California State Noxious Weeds.<br>Cal IPC: HIGH | Found on the Project site | Associated with dramatic changes in geomorphology, groundwater availability, soil chemistry, fire frequency, plant community composition, and native wildlife |

| Weed Species | Habitats, Range, and Control Notes | Rankings[1] | Likelihood of Occurrence at Project Site | Consequences of Occurrence/Spread[1] |
|---|---|---|---|---|
| | | | | diversity. May hybridize with *Tamarix gallica* or *Tamarix chinensis* |
| *Tamarix chinensis* Tamarisk | Widespread and strongly invasive in riparian habitats throughout California and southwestern desert regions | CDFA: B -- included in the CCR Section 4500 list of California State Noxious Weeds.<br>Cal IPC: HIGH | Found on the Project site | Associated with dramatic changes in geomorphology, groundwater availability, soil chemistry, fire frequency, plant community composition, and native wildlife diversity. May hybridize with *Tamarix gallica* or *Tamarix ramosissima* |
| *Washingtonia robusta* Mexican fan palm | Commonly used as a landscape ornamental that has become invasive in riparian areas, orchards, and landscaped areas. | CDFA: None<br>CAL-IPC: Moderate Alert | Found on the Project site | Invasive in riparian areas, orchards, and landscaped areas. Known to create monospecific stands in riparian areas, and dead fronds of the tree can create a fire hazard. |

[1] Cal-IPC Distribution: (Cal-IPC, 2023)

# Appendix M.6 Decommissioning & Revegetation Plan

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# DECOMMISSIONING AND REVEGETATION PLAN

## Perkins Renewable Energy Project

**IP Perkins, LLC and IP Perkins BAAH, LLC**

**subsidiaries of Intersect Power, LLC**

**December 2023**

| Agency Review Status |
| --- |
| Bureau of Land Management |
| U.S. Fish and Wildlife Service |
| California Department of Fish and Wildlife |

# CONTENTS



## TABLES

# 1. INTRODUCTION

IP Perkins, LLC and IP Perkins BAAH, LLC (Applicants or Proponents), subsidiaries of Intersect Power, LLC, have prepared this framework Decommissioning and Revegetation Plan (Plan) for Perkins Renewable Energy Project (Project), a utility-scale solar photovoltaic (PV) electrical generating and storage facility, and associated infrastructure, which would generate and deliver renewable electricity to the statewide electricity transmission grid. The Project is located in Imperial County east of El Centro, California on a combination of U.S. Bureau of Land Management (BLM)-managed lands, Bureau of Reclamation (BOR)-managed lands, and private lands. The Project 500kV loop-in transmission lines will traverse Bureau of Reclamation (BOR) lands (see POD Appendix A, Figures 1 and 2).

The Plan and the procedures and standards outlined herein would apply to federal lands within the project area. The Plan serves as a guideline document for the facility contractors and other parties involved in a variety of conceptual activities related to the decommissioning phase, safety procedures, and revegetation. The revegetation procedures outlined in this document describe the methodologies, monitoring, and reporting requirements for revegetating disturbances associated with the Perkins Renewable Energy Project.

This Plan describes the framework for the development of a final Revegetation Plan. The Plan would be updated based on the changing conditions of the Perkins Renewable Energy Project. It is intended to be adaptive to changing conditions and technologies over the useful life of the project, and the federal Authorized Officer(s) would have discretion to update, modify, or change the procedures if warranted due to site conditions or other factors.

# 2. OBJECTIVE

The Project has a useful life of 50 years or more, at the end of which the solar facility and loop-in and gen-tie lines would be decommissioned and dismantled. The project's decommissioning has the following goals:

1. Remove aboveground structures unless converted to other uses;
2. Remove the underground equipment unless it is determined that it is preferable to abandon them in place to avoid further impacts;
3. Restore the lines and grades in the disturbed area to match the natural gradients of the site;
4. Re-establish native vegetation in the disturbed areas, depending on the local climatic conditions present at the site at the time of decommissioning, and in consultation with the BLM and BOR;[1] and
5. Conform to applicable laws, ordinances, regulations, and standards and local/regional plans.

Revegetation objectives emphasize eventual ecosystem reconstruction to maintain a safe and stable landscape and meet the desired outcomes of the land use plan, which means returning the land to a condition approximate to or better than pre-disturbance conditions. For purposes of this Plan, revegetation is defined as the rehabilitation of a disturbed area to make it equal to or closely approximating that which existed before the land was disturbed. Revegetation objectives include

[1] Both BLM and BOR will be issuing leases for Project components on their respective lands. The extent of BLM and BOR authority during decommissioning under this Plan will be restricted to their respective lease boundaries.

initial stabilization and long-term revegetation to ensure biophysical conditions are maintained in the short term to achieve the long-term goals of revegetation and ecosystem reconstruction.

To achieve long-term revegetation, interim revegetation may be necessary to maintain viable, healthy ecosystems until decommissioning. Interim revegetation would likely be used on stabilized areas that may be re-disturbed during operation and maintenance. Interim revegetation goals and objectives include maintaining active topsoil, establishing erosion control measures, and minimizing habitat, visual resource, and forage loss. Final, long-term revegetation would take place on all surfaces that would not be disturbed during operations and maintenance activities, as well as during decommissioning of all areas.

Local effects of global climate change in the project area are expected to have dramatic consequences on local habitats and therefore the efficacy of restoration efforts. This is discussed in more detail in Section 5.2.

# 3. PROJECT SUMMARY

The Project would generate and store approximately 500 to 1,150 megawatts (MW) of renewable electricity via arrays of solar photovoltaic (PV) panels, battery energy storage system (BESS), and appurtenant facilities. The Project would construct a new gen-tie line that would connect the project substation(s) to a new high-voltage breaker and a half (BAAH) switchyard. From the BAAH switchyard, two new 500 kV loop-in transmission lines would be constructed to interconnect to the existing SDG&E 500 kV transmission line that travels east-west just south of the Project site, crossing BOR lands and terminating in the Imperial Valley Substation (Substation), southwest of El Centro. No construction would occur within the reduced utility corridor along the Project site's southern and western boundaries. For a complete Project description and summary of the Project location, refer to the POD main text.

BLM public lands within the Project solar application area are lands designated as Development Focus Area (DFA) by the Desert Renewable Energy Conservation Plan (DRECP) and associated Record of Decision (ROD), and thus, have been targeted for renewable energy development. Because the proposed Project is partially located on federal land under management of the BLM, the BLM is the lead agency under the National Environmental Policy Act (NEPA), 42 U.S.C. section 4321 et seq. California Energy Commission (CEC) is the lead agency under the California Environmental Quality Act (CEQA).Clean, renewable energy generation will have an overall benefit to plant and wildlife species on a local, regional, and global scale by replacing fossil fuel energy sources, reducing toxic emissions, and mitigating the effects of climate change on ecosystems.

# 4. PROJECT DECOMMISSIONING AND RECYCLING

The procedures described for Perkins Renewable Energy Project decommissioning are designed to promote public health and safety, environmental protection, and compliance with applicable regulations. Decommissioning includes removal of the facilities and materials that were employed to support the operation of the solar facility, substation, BAAH, BESS, and loop-in lines supporting the solar facility. Decommissioning consists of the removal of aboveground and certain belowground facility components, management of excess wastes and materials, and the revegetation of native habitat. Underground conduit and foundations would be removed two feet below the surface and backfilled with native soils. Decommissioning is assumed to begin within one (1) year after termination of the commercial operation of the solar facility and is assumed to occur in a phased, sequential manner. Upon ultimate decommissioning, a majority of project components will be suitable for recycling or reuse, and project decommissioning would be designed to optimize such salvage as circumstances allow and in compliance with all local, State, and federal laws and regulations as they exist at the time of decommissioning. Following removal of the Project components as defined above, the site would be restored to its pre-solar facility conditions, or such condition as appropriate in accordance with County policy at the time of decommissioning.

The Perkins Renewable Energy Project has a useful life of 50 years or more; however, depending on economic or other circumstances, the real life of the project could vary. The activities involved in its decommissioning would depend on the expected future use of the site, as determined by the BLM and BOR (e.g., decommissioning for open space habitat would involve returning the land to natural conditions). At the time when the solar facility would not be further used by the public or private utility or power generator, this decommissioning plan would be updated if needed and submitted to the BLM and BOR for review and approval.

In general, decommissioning would attempt to maximize the recycling of all facility components, including panels; substation, BAAH, and BESS components, O&M facility and 500 kV transmission loop-in and gen-tie lines overhead conductors and towers. All steel and aluminum from overhead conductors would be recycled. Procedures would be designed to ensure public health and safety, environmental protection, and compliance with all applicable laws, ordinances, regulations, and standards.

## 4.1. Pre-Decommissioning Activities

Pre-decommissioning activities consist of preparing the site area for dismantling and removal of Project components. These activities include scouting the ROW for residues and products, such as diesel fuel, gasoline, and other materials (to the extent feasible) in order to reduce potential personnel and environmental exposure and to facilitate decommissioning. If found, hazardous material and containers would be rinsed clean, to the extent feasible, and the waste fluid would be collected for off-site disposal in compliance with federal, state, and local requirements and consistent with related project management plans. The Project would maintain electrical power, potable water, and sanitary services for use by decommissioning project workers on the solar facility.

Prior to commencement of decommissioning, the Project’s pre-construction cultural survey records would be consulted, and biological resources surveys may be required. Sensitive cultural and biological resources potentially impacted by decommissioning activities would be avoided to the extent practicable through flagging or temporary fencing. If sensitive resources cannot be avoided, decommissioning would employ the same suite of mitigation measures required of project construction, including implementation of the project’s cultural resources monitoring plan and biological monitoring plans.

## 4.2. Decommissioning Plan

Decommissioning activities would include the following:

- Document and establish health and safety procedures.

- Conduct pre-decommissioning activities, including preparation of a final decommissioning plan and any pre-decommissioning surveys.
- Dismantle equipment items that are to be sold on the used equipment market.
- Demolish the aboveground structures (dismantling and removal of cables, solar panels, track units, transformers, inverters, substation, distribution lines, O&M buildings, switchyard, etc.) in a phased approach.
- Demolish and remove belowground conduit and foundations to a depth of 2 feet below the ground surface and backfill with native soils.
- Remove primary roads (aggregate-based).
- Remove septic system and leach field.
- Recycle project component materials to the extent feasible.
- Dispose of hazardous materials, hazardous waste, and any contaminated soil to appropriate facilities for treatment/disposal or recycling.
- Upon consultation with appropriate agencies, post-project topography may be minimally graded to match the natural gradient to the extent practical, and disturbance areas revegetated to the extent practical.

Although various types of decommissioning/demolition equipment would be used to dismantle each type of structure or piece of equipment in the project ROW, decommissioning and dismantling would proceed according to the following general staging process:

1. Assess existing site conditions, survey the site grounds, and prepare the site for demolition.
2. Dismantle and remove aboveground structures as well as concrete flooring and structures.
3. Remove belowground conduit and foundations to a depth of two feet below the ground surface and backfill with native soils.
4. Excavate and potentially remove non-native soils in disturbed areas (i.e., roadbed aggregate), if necessary.
5. Minimize disturbance of site soils and vegetation during decommissioning to the extent feasible.
6. Contour and revegetate the site and roads used only for the Perkins Renewable Energy Project (per agency coordination and in accordance with applicable laws, ordinances, regulations, and standards), to the extent feasible, while disturbing as little of the other site areas as feasible.

Because the conditions that would affect the decommissioning decision and overall goals for revegetation are uncertain, this Plan would be reviewed at least 12 months prior to the planned permanent closure, and a final Plan would be prepared and submitted to the BLM and BOR for approval. The activities and processes described in Section 5.2 for revegetation would be updated and incorporated in the Final Plan. However, if an unplanned closure occurs, and a final Plan is not prepared, the relevant processes in this interim Plan would be implemented unless no longer appropriate. Upon cessation of operations, all structures constructed on the site would be removed.

The full extent of removal would depend on the planned use of the ROW following termination of the solar facility. If the ROW is planned to continue use for industrial or commercial purposes, certain infrastructure may remain with the approval of the BLM and BOR, as applicable. If the ROW will not be developed, it would be made available for reversion to open space.

Water would be obtained from an on- or off-site groundwater supply as approved for the Perkins Renewable Energy Project.

# 5. REVEGETATION PLAN

Once removal of all project equipment is complete, the ROW area would be prepared for revegetation with the intent to minimize dust, erosion, and weed infestations. As described below, appropriate portions of the site may be seeded with a native seed mix. Supplemental irrigation and planting container stock are not currently practical for large-scale projects in the Southern California desert; however, the use of container stock, consisting of the same species noted in the seed mixes below, would be considered as an option in the Plan. Furthermore, advancements in desert restoration may occur over the next few decades and possibly lead to alternative revegetation techniques to be proposed in the Plan. Proper preparation of the soil is imperative for success in the revegetation process. Sufficient rains would allow the best opportunity for seed establishment.

## 5.1. Goals and Success Standards

Revegetation success is defined by the progression of vegetation and soils toward preconstruction conditions, to the extent practicable. The revegetation would be considered successful when:

- Total vegetative cover and relative cover of native and nonnative plant species within restored lands is similar to that observed in reference areas in the immediate site vicinity (e.g., within two standard deviations of the mean of total vegetative cover, relative cover for each vascular plant species, and relative cover of native vascular plant species compared to all vegetation present).
- Soil surface is stabilized to reduce dust and erosion to a degree at or below natural background levels and to reduce cover of non-native plants.

The project owner at the time of decommissioning would be responsible for monitoring revegetation efforts for the project. Revegetation success would be evaluated by the BLM and BOR by comparing project-affected treatment sites with control site conditions in terms of desirable species density and cover and reduction of project contrast compared to the landscape surrounding the ROW. Revegetation of treatment sites would be considered successful if each site is within a specified percentage of the mean native species density and cover of the control site and the specified percentage of sensitive plants are re-established in each area of disturbance affecting sensitive plants. The BLM and BOR would establish acceptable revegetation success standard percentages in accordance with this Plan. Control sites would be representative areas that exhibit the same target plant community located adjacent to or near the project-affected treatment sites. The establishment of control sites in undisturbed communities would allow for comparison of revegetation progress of the treatment site against the control site.

Revegetation success is highly dependent on vegetation community type, natural (unassisted) recovery potential, environmental conditions, avoidance of further disturbance, and proper implementation of revegetation actions. If the final monitoring report concludes that typical environmental conditions, proper implementation of revegetation actions, and lack of disturbance is evident, revegetation success would be based on a trend toward the desirable vegetation cover and density for each community type and the number of sensitive plants that occupy each area of disturbance affecting sensitive plants.

If these conditions are not evident by the final monitoring report, adaptive management and/or remedial actions may be required by the BLM and BOR. Target percentages (to be determined by the BLM and BOR) of desirable vegetation cover (amount of vegetation canopy per unit) and desirable species density (number of plant species per unit) for revegetation success would be evaluated relative to control plot conditions, typically adjacent to the ROW. Target percentages of sensitive plants for revegetation success would be evaluated based on the numbers of sensitive plants, measured by stem count, that occupied the areas of disturbance prior to disturbance that are re-established in each area of disturbance affecting sensitive plants. Percentage of vegetation cover, species density, and sensitive plants would be based on the quantitative data collected from the control plot for each monitoring site.

## 5.2. Revegetation

The ROW consists of five natural vegetation communities: Sonoran creosote bush scrub, alkali goldenbush desert scrub, desert dry wash woodland/microphyll woodland, arrow weed thickets, and common reed marsh. The proposed drive-and-crush method is expected to reduce the recovery time of impacted desert shrubs. Regardless, construction of the project may result in soil compaction, a decrease in total vegetative cover, or a change in species composition. In addition, local impacts of global climate change are expected to substantially affect the native habitats surrounding the project area as modeled by climate prediction algorithms (CalAdapt, 2018[2]). Finally, groundwater drawdown activities outside of the project owner’s control may result in unsuitable conditions for the survival of native plant species. Therefore, the maintenance of pre-project native vegetation may not be possible due to extreme heat, drought, and other conditions outside of the project owner’s control. Following decommissioning, revegetation with native species would be implemented where feasible in areas of disturbance within the ROW and roads. However, only ROW areas exclusive to the IP Perkins, LLC and IP Perkins BAAH, LLC Grant would be revegetated; if future Grantees have ongoing uses for the solar facility, BESS, loop-in and gen-tie lines, medium voltage line, and road facilities beyond the life of the IP Perkins, LLC and IP Perkins BAAH, LLC Grant or any extension thereof, the BLM and BOR would release IP Perkins, LLC and IP Perkins BAAH, LLC of further obligations to revegetate these ROW areas. A Restoration Ecologist would determine which of these areas are overly compacted and require decompaction following decommissioning. During the revegetation process, the Restoration Ecologist would prescribe remedial measures, if necessary, to ensure the success of the revegetation, where feasible in consideration of climatic and groundwater conditions at the time.

### 5.2.1. Supplemental Seeding

Large areas that require seeding (e.g., areas that were subject to grading or disturbed during removal of infrastructure) would be either hydroseeded using a two-stage hydroseed application method, imprinted, drill seeded, or alternative methods deemed effective by the project owner,

[2] https://cal-adapt.org/tools/extreme-heat/

BOR, and BLM. Preventive measures would be implemented to avoid damage to adjacent desirable vegetation (i.e., spraying and covering plants with mulch, damaging plants with hoses). Seeding would be performed in the fall prior to the onset of rains to optimize potential for plant germination and establishment.

### 5.2.2. Plant Seed Selection

Two different vegetation types occur within the impacted areas within the ROW. Seed palettes for the dominant vegetation types are presented in Tables 1 and 2. The species included in the seed mix are based on the species found as identified in the project's Biological Resources Technical Report (POD Appendix S). The amount of seed required would be based on the pure live seed, percent purity, local climatic conditions, and percent germination data available at the time seeding is required. The seed would be from genetically appropriate sources within the ecoregion. Prior to ordering the seed, the Restoration Ecologist would: (1) obtain up-to-date pure live seed, percent purity, and percent germination data from the seed supplier; (2) make any needed adjustments to the species composition of the lists; and (3) determine how many pounds per acre of each species would be installed.

At the time of Perkins Renewable Energy Project decommissioning and revegetation, recommendations for species may change due to seed availability, climate change, or other factors. The seed mixes provide the main recommended plant species and several optional species that could be applied, depending on availability. The installed seed palette would be documented within the as-built report and annual monitoring reports. In the event that species essential to the composition of the habitat type to be seeded (i.e., dominant or co-dominant species) are not available, those species would be custom-collected by a qualified seed supplier, if available. Because seed production is unpredictable in a desert environment, seed collection may need to start well in advance of the start of revegetation. Commercial sources for selected species would be allowable if the germplasm source is from within the same ecoregion provisional seed zone as the project site. Seeding rates may also need to be increased due to granivore predation. To deter granivore predation, sterile grain seed may be applied prior to application of the native seed mixes.

**Table 1. Revegetation Seed Mix Palette for the Sonoran Creosote Bush Scrub**

| Scientific Name | Common Name | Pounds of Pure Live Seed/Acre |
|---|---|---|
| *Ambrosia dumosa* | White bursage | 2.0 |
| *Asclepias subulata* | Rush milkweed | 1.5 |
| *Atriplex canescens* | Fourwing saltbush | 0.75 |
| *Atriplex lentiformis* | Big saltbush | 0.75 |
| *Ephedra trifurca* | Ephedra | 3.0 |
| *Isocoma acradenia* | Alkali goldenbush | 1.0 |
| *Larrea tridentata* | Creosote bush | 3.0 |

**Table 2. Revegetation Seed Mix Palette for the Desert Dry Wash Woodland**

| Scientific Name | Common Name | Pounds of Pure Live Seed/Acre |
|---|---|---|
| Ambrosia salsola | Cheesebush | 3.0 |
| Aristida purpurea | Purple threeawn | 1.0 |

| Scientific Name | Common Name | Pounds of Pure Live Seed/Acre |
|---|---|---|
| Lycium andersonii | Water jacket | 1.0 |
| Pluchea sericea | Arrow weed | 0.75 |
| Prosopis glandulosa | Honey mesquite | 2.0 |
| Prosopis pubescens | Screwbean mesquite | 2.0 |
| Psorothamnus emoryi | Emory's indigo | 2.0 |

# 6. MONITORING AND MAINTENANCE

This Plan requires revegetation monitoring to evaluate success of revegetated areas associated with the project facilities, identify the need for adaptive management measures, and make a final determination regarding revegetation success to release IP Perkins, LLC and IP Perkins BAAH, LLC from further monitoring and revegetation actions.

## 6.1. Reporting

Quarterly reports would be provided to document restoration efforts to date; preparing quarterly reports would provide an opportunity for the Restoration Ecologist and Designated Biologists to identify and correct any problems that arise with all aspects of the restoration activities. The quarterly reports would include a description of the existing condition of each of the revegetated areas and any change in conditions from the previous visit. Annual monitoring reports are required to evaluate monitoring results to determine whether performance standards are being achieved. All weed management activities would be reported in annual monitoring reports prepared for the ROW and would include the dates of surveys and treatment activities, personnel conducting these activities, locations and approximate numbers of weeds treated (including maps), treatment methods, and disposal methods. The applied seed mix palette would be documented within the annual monitoring reports.

Annual monitoring reports would be provided for up to 5 years, with the possibility of up to an additional 5 years, if revegetation performance standards are not met. The vegetation management, habitat revegetation, and invasive species management reports would document the progress of management activities. The annual reports would be submitted to the BLM, BOR, CDFW, and USFWS, and would, at a minimum, include:

- A summary of the quarterly monitoring;
- A summary of all weed management activities performed during the year, including the treatment method, and duration, location, and time of treatment;
- An assessment of whether the performance standard for having less than a 10 percent increase of weed species or overall weed cover than the adjacent habitat would be achieved by the end of year three and proposed remedial measures if necessary;
- A description of the existing condition of each of the revegetated areas, including descriptions of vegetation composition and weed species and any change in conditions from the previous visit to the site;
- A summary of the qualitative and quantitative monitoring data collected, with a focus on plant species included in the applied seed mix;
- Cover of weeds within the revegetation areas relative to adjacent reference areas;

- A description of the maintenance activities (including weed removal activities within the revegetation areas) and dates of when they were conducted;
- Descriptions of any wildlife observed, including special-status species or their sign, within the revegetation areas;
- A discussion of problems encountered and any adaptive or remedial measures implemented;
- A figure identifying habitat types, sampling locations, photo station locations, etc., as appropriate;
- Photo documentation at permanent photo stations;
- Yearly precipitation data;
- Any field memos from the monitoring site visits;
- Recommended remedial measures, if necessary, to ensure the project ROW supports the desired native plant species; and
- An assessment of whether revegetation efforts are considered successful and if the performance standards have been or would be achieved during the course of the initial 5year monitoring period.

Remedial actions or adaptive management measures may be needed based on monitoring observations for sites that have not demonstrated a trend toward revegetation success. If required, implementation of remedial actions would be determined by the BLM, BOR, CDFW, and USFWS based on the monitoring data and annual reports to be submitted for up to 5 years following decommissioning. After 5 years of monitoring, a final report would be submitted to the BLM and BOR summarizing monitoring data, observations, and the overall trend toward successful revegetation for each vegetation community.

Areas with sensitive plant occurrences affected by project activities would be monitored to determine whether the sensitive plants are recolonizing the site, whether soils are stable, or erosion is occurring, and whether weeds are present. If needed, a site-specific treatment plan to encourage establishment of the sensitive plants and other desired vegetation, stabilize soils, and address weeds in these areas would be provided by the project owner/Contractor(s) or Restoration Ecologist for review and approval by BLM, BOR, CDFW and USFWS.

The project owner at the time of decommissioning would be released from further revegetation and monitoring after the report and annual monitoring data are submitted to the BLM and BOR documenting that revegetation success criteria have been met and the BLM and BOR have accepted the report. However, revegetation in soils with low moisture and high salt content or areas with sensitive plant occurrences may take longer than 5 years to reestablish satisfactory vegetative cover, and the project owner would maintain responsibility for monitoring for these additional areas. If, after the initial 5-year monitoring period has expired, the BLM and BOR determine that success criteria have not been met, additional monitoring and potential further remedial action would be required until a trend toward revegetation success is demonstrated.

## 6.2. Monitoring Requirements

The monitoring practices include standard techniques for monitoring sites and data collection, as well as the quantitative (numerical) and qualitative (descriptive) measures to be used in monitoring revegetation success. Specific monitoring requirements, including the site-specific data analysis protocol, would be developed by the Revegetation Subcontractor(s) in cooperation with the BLM and BOR prior to start of revegetation activities. This would allow the BLM and BOR to make more accurate conclusions pertaining to revegetation success based on site-specific conditions, such as biotic community and climatic conditions, once revegetation has been completed.

The specific location of monitoring sites associated with these different activities in key areas would be identified, reviewed, and approved by the BLM and BOR. Once monitoring sites have been approved, the project owner/Contractor(s) or Revegetation Subcontractor(s) would establish the sites in the field and collect baseline data for subsequent post-revegetation monitoring. For disturbed areas affecting sensitive plants, at minimum, photos from permanent photo plots, individual counts of sensitive plants in the affected areas, and weed presence and treatment data would be collected and reported annually in the Revegetation Monitoring Report with an evaluation of whether recolonization is occurring.

## 6.3. Route Monitoring

A general field review of the entire ROW, where accessible by vehicle, would be conducted in conjunction with annual site monitoring. The intent of this review is to document overall recovery conditions associated with the development of the project and assess visual and land-use resources rehabilitation. Conditions to be observed may include areas of dead preserved plants, the establishment of noxious weed populations in the ROW or along access roads, and/or significantly eroded soils. In lieu of establishing transects, documentation may include establishing single photo-points at agreed-upon locations with the BLM and BOR, estimating area or plant populations affected, and/or recording the apparent cause or remediation efforts required. Site locations may be documented by global positioning system coordinates or the loop-in line structure number.

Rehabilitation of visual impacts can be evaluated by conducting a contrast analysis of the constructed towers in relation to the surrounding landscape. Each annual visit would be used to assess designated route monitoring locations and document new locations where appropriate.

## 6.4. Site Monitoring

Preliminary site monitoring locations would be established within the ROW and temporary disturbance areas based on project engineering data. Monitoring sites would be selected for the vegetation communities traversed by the Perkins Renewable Energy Project.

- Paired (treatment and control) monitoring site(s) shall be selected for the combination of each vegetation community based on the size of the community's affected area.
- Transect site selection would be prioritized to include areas near sensitive plant species, Critical Habitat areas, and locations with high visual resource values.
- At least one pair of monitoring sites shall be in each area of disturbance affecting sensitive plants.
- Where possible, site monitoring locations would meet more than one of these selection criteria, and the number of sites would be determined by the BLM and BOR.

Once monitoring site locations are finalized, photographs would be taken: (1) prior to any decommissioning disturbance, (2) when initial revegetation efforts have been completed, and (3) during each yearly monitoring visit.

Plots would be examined annually, and a variety of vegetation data would be collected, including quantitative and descriptive information. Revegetation monitoring sites would assess noxious and invasive weed establishment that may require remedial actions, such as removal or treatment. However, it should be noted that monitoring for known noxious weed locations may occur independently of revegetation monitoring, as outlined in the Restoration and Integrated Weed Management Plan. Revegetation monitoring would include the consideration of erosion control as a key indicator to measure the trend toward revegetation success (where applicable), and remedial actions may be taken in conjunction with monitoring efforts to control erosion, as recommended by the BLM and BOR. These remedial actions also would follow requirements as stipulated in the Fugitive Dust Control Plan.

# 7. DATA COLLECTION

Revegetation monitoring would include both qualitative (descriptive) and quantitative (numerical) data collection at the designated monitoring sites approved by the BLM and BOR. Quantitative monitoring would document the trend and degree of change at each site, and qualitative monitoring would detect the initiation of change and changes resulting from environmental conditions, such as precipitation, allowing for a record of change over time.

Revegetation monitoring for the Perkins Renewable Energy Project would use vegetation as the main indicator of recovery, but observations of soil conditions also would be collected and considered when assessing progress toward functionality. Measurements and descriptions would be accompanied by photographs that would be used to help document the status of recovery at all monitoring sites. Sampling points would be located and mapped according to global positioning system coordinates. Photographic reference points would be the primary method of qualitative monitoring for the Perkins Renewable Energy Project. A protocol for taking photographs and a standardized data-recording form would be developed by the BLM and BOR to ensure consistency of monitoring. Qualitative (descriptive) and quantitative (numerical) information that would be gathered during general route monitoring and site monitoring are described in detail below.

## 7.1. Qualitative Information

Qualitative data collection would occur annually for both route and site monitoring. The goal of qualitative monitoring is to document site conditions and assess the need for remedial actions to ensure sites are progressing toward the success standard established by the BLM and BOR. Qualitative evaluations conducted at predetermined monitoring sites during monitoring would serve as representative indicators for similarly disturbed areas in the same vegetation community. These site evaluations would then serve as a baseline when conducting general overall route surveys for the remainder of the treated areas in that vegetation community. Any outstanding or non-project-related disturbances that could affect revegetation also would be described during the general route monitoring. Recovery from disturbance activities, such as clearing and grading in the semi-arid and arid climatic zones, typically does not occur in a short amount of time, and it is for this reason the monitoring plan would assess the trend toward revegetation success standards outlined above.

Revegetation success may be assessed by the presence or condition of certain site characteristics that encourage recruitment of native vegetation. Revegetation actions of a given site, if implemented successfully, are anticipated to contribute to the stabilization of soils, seedling or seedbank recruitment, and avoidance of the establishment of noxious weeds. Lack of erosion at a site provides evidence that soils have been adequately stabilized, while natural recruitment and/or reproduction indicates important functional processes are in place that initiate regeneration, such as pollination and seed dispersal. Noxious weeds could potentially compete with native perennial species, and relatively high abundances can have negative effects on site conditions. Evidence of animal use also is used as an indicator that habitat conditions have been revegetated; however, grazing can negatively affect revegetation success if unmanaged. Patterns of established vegetation help to determine whether large bare areas are indicative of site conditions or simply a result of the patchiness of surrounding vegetation. Each of these site characteristics would help determine trends that relate to revegetation success. Once recruitment conditions have been met, established vegetation is anticipated to contribute to the maintenance and functionality of the community to ensure continued success after monitoring has concluded.

## 7.2. Quantitative Information

Desirable vegetation cover would be numerically measured on those treatment sites during the third and fifth growing seasons (or sooner if deemed appropriate) to determine if there is a trend toward revegetation success based on comparison of the control transect for each site. Quantitative assessment during the third year would provide enough time for vegetation establishment of the affected areas based on climatic trends for the area. Trends toward revegetation success, as well as remedial actions (if needed), would be identified during the third year. Quantitative monitoring in year five would allow any remedial actions or climatic events to discernibly affect treated areas. Density monitoring records the number of plants per unit of area. This technique is sensitive to changes in the vegetation community caused by climatic conditions and resource uses and provides useful information on seedling emergence, survival, and mortality.

Not all plant species present would be monitored. Monitoring would focus on indicator perennial species as determined by control site observations of the adjacent plant community. Species density would be evaluated by comparing the total number of indicator species in the treatment site to that of the control site. Other plant species would be inventoried, but densities would not be evaluated. Vegetation cover monitoring records the coverage of vegetation canopy per unit of area. Density and cover data, along with other biometrics, would be recorded on standard field data sheets to be developed by the Revegetation Contractor and approved by the BLM and BOR.

# 8. ADAPTIVE MANAGEMENT AND SITE RELEASE

The BLM requires an adaptive management approach designed to allow frequent review and feedback on the progress of revegetation implemented as a part of monitoring activities for the project. Adaptive management greatly increases the potential for revegetation success by providing early detection of problems and the opportunity to implement remedial actions to address these problems. Effective monitoring is an essential element of adaptive management because it provides reliable feedback on the effects of revegetation actions. Adaptive management actions may be recommended on a case-by-case basis where feasible, and as determined by the BLM and BOR, during the 5-year monitoring time frame.

If it has been determined that adaptive measures are necessary, monitoring data (both qualitative and quantitative) would provide information on revegetation components that are deficient, such as desirable vegetation cover, soil compaction, or lack of natural surface material. Based on this information, appropriate revegetation actions may include measures such as supplemental seeding, mulching, and additional weed and/or erosion control measures. Recommendations also could include waiting to determine if favorable germination/establishment conditions are expected. All adaptive management actions would be subject to the review and approval of the BLM and BOR.

The Contractor(s) and Revegetation Subcontractor(s) would use all reasonable methods to help the Project owner at the time of decommissioning to ensure revegetation is progressing toward the success standards identified above. It is possible some sites would be incapable of supporting adequate vegetation to progress toward the success standards due to conflicting land management and environmental limitations not associated with the Perkins Renewable Energy Project. For instance, revegetation may fail in areas with unmanaged off-highway vehicle (OHV) access, grazing of domestic livestock, natural disasters, such as fire or flooding, and construction of other utility projects. If revegetation failure on federally managed lands is determined by the BLM or BOR to be caused by these conditions, neither the project owner, nor any of its contractors or subcontractors, would be held responsible for continued revegetation and monitoring of these sites.

# Appendix N Cultural Resources Technical Reports

# Appendix N.1 Records Search (Confidential)

# Appendix N.2 Archaeological Inventory Report (Confidential)

# Appendix O Preliminary Geotechnical Engineering Report

# Perkins Solar

## Preliminary Geotechnical Engineering Report

February 7, 2024 | Terracon Project No. 60235062

**Prepared for:**

IP Perkins, LLC

Explore with us

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- Geotechnical
- Materials

Terracon

January 26, 2024, Revised February 7,2024

IP Perkins, LLC

Attn: Mr. Levi Mitchell, P.E., P.M.P.
P: (218) 830-8064
E:levi.mitchell@intersectpower.com

Re: Preliminary Geotechnical Engineering Report
Perkins Solar
Imperial County, California
Terracon Project No. 60235062

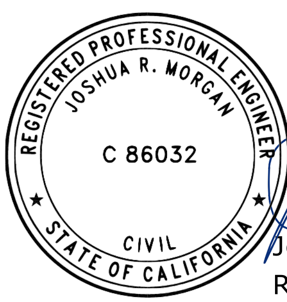
Dear Mr. Mitchell:

We have completed the scope of Preliminary Geotechnical Engineering Report services for the above referenced project in general accordance with Terracon Proposal No. P60235062 dated November 13, 2023 and revised December 11, 2023 between Terracon and IP Perkins, LLC. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of access roads and foundations for the proposed solar facility. This report is intended for permitting purposes and will be revised pending lab test results.

We appreciate the opportunity 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**




Janna Valdez, E.I.T.
Staff Engineer

Joshua R. Morgan, P.E.
Regional Geotechnical Manager

# Table of Contents

## Attachments



**Note:** This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

# Geohazards

| Item | Overview Statement [1] |
|---|---|
| **Pile Drivability** | All piles were driven to target depths with no refusals encountered. Pile driving difficulty is not anticipated to be a concern at the site. |
| **Shallow Bedrock** | All borings and test pits were advanced to target depths. Therefore, we anticipate shallow bedrock is not a concern at the site. |
| **Shallow Groundwater** | Shallow groundwater was encountered in borings B-1 to B-6 at approximate depths of 11 to 24 feet below ground surface (bgs). This depth is equivalent to approximate elevations of 80 to 85 feet mean sea level (MSL). This report includes recommendations and construction considerations with respect to impacts of shallow groundwater on the proposed project. |
| **Liquefaction** | Although previous mapping for liquefaction hazard is not publicly available, the encountered depth of groundwater and subsurface soil condition indicates that the site is susceptible to a liquefaction hazard. As such, liquefaction analyses is included in this report. Liquefiable soils are anticipated between the depths of 22 to 36 feet bgs or approximately 60 to 73 feet MSL. Drilled piers should not rely on end bearing or skin friction within this zone. Based on the calculation results, the seismically induced settlement is estimated to be on the order of 2½ inch. This report includes design considerations for the proposed foundations to minimize the impacts of seismic settlements on the proposed structures. |
| **Lateral Spreading** | Based on the preliminary liquefaction analysis and the gentle sloping topography of the site, lateral spreading has the potential to occur. We recommend that during the exploration of the entire site as part of the final design level effort, the potential for and magnitude of lateral spreading should be assessed. |
| **Karst** | Karst is not a concern at this site. |
| **Expansive Soils** | The encountered onsite soils are primarily sand with no plasticity. Therefore, expansive soil is not a concern at the site |

1. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

# Introduction

This report presents the results of our subsurface exploration and Preliminary Geotechnical Engineering Report services performed for the proposed Perkins Solar project north of California State Route 98 and south of Interstate-8 (Kumeyaay Highway) in Imperial County, California. The purpose of these services was to provide information and preliminary geotechnical engineering recommendations relative to the proposed solar development. Sections included in this report are:

- Subsurface soil conditions
- Groundwater conditions
- Seismic site classification per California Building Code (CBC)
- Site preparation and earthwork
- Foundation design and construction
- Access Roads Design and construction

The geotechnical engineering Scope of Services for this project included soil borings, field electrical resistivity testing, pile testing, laboratory thermal resistivity testing, laboratory corrosion testing, and pile load testing. Additional details can be found in the See **Exploration and Testing Procedures** section of this report. The geotechnical engineering Scope of Services for our current scope of work included the following:

- Two (2) soil test boring to an approximate depth of 50 feet bgs
- Four (4) soil test borings to an approximate depth of 21.5 to feet bgs
- Three (3) test pits to approximate depths of 10 feet bgs
- Six (6) field electrical resistivity testing
- Six (6) pile load testing targeting approximate depth of 5 to 10 feet embedment depths. Pile testing included two axial tension and lateral tests, and one axial compression test at each location.

Terracon's scope of work also includes corrosion testing on soil samples obtain from three (3) locations and lab thermal resistivity testing on soil samples obtained from three (3) locations.. Results of the testing have not been received as of the time of this report and will be issued with the final report.

# Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

| Item | Description |
|---|---|
| **Information Provided** | The following information was provided by IP Perkins on September 18, 2023:<br>■ Desktop Geotechnical Risk Assessment – Perkins Solar Project Prepared by Westwood dated May 5, 2023<br>■ Perkins Solar Plan of Development dated July 13, 2023 (Revision 2)<br>■ Scope of Work for Field Geotechnical Investigation Services for Solar Projects prepared by Intersect Power dated September 13, 2023<br>■ Project Boundary KMZ, undated<br>■ Furthermore, Terracon was instructed via email on September 18, 2023 to assume 4,200 acres of buildable land for scoping purposes. However, as requested by IP Perkins, we have prepared a preliminary geotechnical engineering report for the study of 300 acres of buildable area within private land only.<br>The following information was provided by IP Perkins on November 4, 2023:<br>■ Project Boundary KMZ dated November 3, 2023<br>■ Geotechnical Field Study – Bid Form (Private Land #1) |
| **Project Description** | It is our understanding that the Client intends to develop a 500 MWac photovoltaic (PV) electric power plant with a buildable area of about 4,200 acres. However, as instructed by the Intersect Power team, we have prepared this preliminary geotechnical report that characterizes only 300 acres of the buildable area.<br>Ultimately, the power plant will consist of solar panels installed on steel structures and inverters. We have prepared a report that provides recommendations for the proposed arrays in the buildable area within private lands. |
| **Proposed Structures** | The proposed project will include the construction of ground-mounted solar panels on steel racks, preferably founded on driven W-Section steel beams (W6x9 or similar) or screw piles.<br>Electrical equipment substation/BESS/switchyard facility elements are anticipated to be supported on mat foundations, spread footings, or drilled piers. |
| | Structural loads were not provided, but have been estimated based on our experience:<br>■ Panel array racking system: |

| Item | Description |
|---|---|
| **Maximum Loads** (Assumed) | ■ PV Module Downward: 1 – 7 kips<br>■ PV Module Uplift: 0.5 – 3 kips<br>■ PV Module Lateral: 1 – 2 kips<br>■ PV Module Moment: 0.1 to 30 kip-ft<br>Ancillary Electrical Equipment in the Array:<br>■ 50 kips |
| **Grading/Slopes** | Grading and/or site plans were not provided at this stage of the project. We anticipate array fields will generally follow existing grades with minimal remedial grading. |
| **Access Roads** | We understand that access roads are anticipated on site. We anticipate low-volume access roads that will have a maximum load ranging from 30,000 lbs. (maintenance vehicles) to 75,000 lbs. (firetrucks) and will travel over the access roads only once per week. |

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

# Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

| Item | Description |
|---|---|
| **Parcel Information** | The project site is located in Imperial County, California and is approximately 4,200 acres in size. The proposed area of interest for this stage of the project is 300 acres.<br>Coordinates near the approximate center of the project site is 32.7171°N, -115.1678°W. |
| **Existing Improvements** | Site is primarily undeveloped. |
| **Current Ground Cover** | Primarily earthen cover with light to very dense desert vegetation. |
| **Existing Topography** | The site is relatively flat with approximate elevations ranging from 227 feet at the north boundary to 239 feet at the south boundary. |

# Geotechnical Characterization

## Subsurface Conditions

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The GeoModel and individual logs can be found in the **Exploration Results** attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

| Model Layer | Layer Name | Density/Consistency |
|---|---|---|
| **01** | **Poorly Graded Sand with Silt** | Loose to medium dense |
| **02** | **Silty Sand** | Medium dense to very dense |
| **03** | **Poorly Graded Sand** | Loose to very dense |

## Lab Results

Laboratory tests were conducted on selected soil samples and the test results are presented in the **Exploration Results** section and on the boring logs. Atterberg limit test results indicate that the on-site soils generally are non-plastic. Maximum density/optimum moisture content testing conducted in accordance with ASTM D1557(Modified Proctor) indicate that near surface soils have a maximum dry density range of 111.5 and 115.4 pounds per cubic feet (pcf) and optimum water content of range 10 and 10.8 percent. Direct shear test performed on samples taken at a depth of 5 and 7.5 feet bgs indicate that these soils have effective cohesion values of 180 and 0 psf and an effective friction angle of 28° and 34°, respectively. Results of California Bearing Ratio (CBR) test performed on bulk samples near the surface indicate the site has an estimated CBR value of 8.

## Groundwater

Groundwater was encountered observed during drilling in borings B-1 to B-6 at approximately 11 to 24 feet bgs. These encountered groundwater depths are equivalent to approximately 80 to 85 feet mean sea level.

Long term observation after drilling could not be performed as borings were backfilled immediately upon completion due to safety concerns. Groundwater levels can best be determined by implementation of a groundwater monitoring plan.

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 our review of available historical topographic and aerial maps, the All-American Canal is located approximately 0.4 miles south and parallel from the project site. According to data collected from the Unites States Geological Survey (USGS) from a nearby monitoring well, Brock Reservoir Outlet, located south of the site with a Well ID of 09527660, historic groundwater levels between January 2023, to December 2023, were recorded at 24 feet below ground surface.[1] This groundwater data based on the site's proximity to the canal corresponds to conditions observed on-site.

# Seismic Site Class

The 2022 California Building Code (CBC) Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool. This web-based software application calculates seismic design parameters in accordance with ASCE 7-16 and 2022 CBC. The 2022 CBC requires that a site-specific ground motion study be performed in accordance with Section 11.4.8 of ASCE 7-16 for Site Class D sites with a mapped $S_1$ value greater than or equal 0.2.

However, Section 11.4.8 of ASCE 7-16 includes an exception from such analysis for specific structures on Site Class D sites. The commentary for Section 11 of ASCE 7-16

[1] United States Geological Survey. https://waterdata.usgs.gov/monitoring-location/09527700/#parameterCode=00065&period=P7D&showMedian=false

(Page 534 of Section C11 of ASCE 7-16) states that "In general, this exception effectively limits the requirements for site-specific hazard analysis to very tall and or flexible structures at Site Class D sites." Based on our understanding of the proposed structures, it is our assumption that the exception in Section 11.4.8 applies to the proposed structure. However, the structural engineer should verify the applicability of this exception.

Based on this exception, the spectral response accelerations presented below were calculated using the site coefficients ($F_a$ and $F_v$) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2022 CBC.

| Description | Value |
|---|---|
| **2022 California Building Code Site Classification (CBC)**[1] | D[2] |
| **Site Latitude (°N)** | 32.7171 |
| **Site Longitude (°W)** | 115.1678 |
| **$S_s$ Spectral Acceleration for a 0.2-Second Period** | 1.416 |
| **$S_1$ Spectral Acceleration for a 1-Second Period** | 0.527 |
| **$F_a$ Site Coefficient for a 0.2-Second Period** | 1 |
| **$F_v$ Site Coefficient for a 1-Second Period** | 1.776 |

1. Seismic site classification in general accordance with the *2022 California Building Code*.
2. The 2022 California Building Code (CBC) requires a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope does not include the 100-foot soil profile determination. Borings were extended to a maximum depth of 51.5 feet, and this seismic site class definition considers that similar or denser soils continue below the maximum depth of the subsurface exploration.

## Faulting and Estimated Ground Motions

The site is located in the southern California, which is a seismically active area. The type and magnitude of seismic hazards affecting the site are dependent on the distance to causative faults, the intensity, and the magnitude of the seismic event. As calculated using the USGS Unified Hazard Tool, Imperial fault segment, which is considered to have the most significant effect at the site from a design standpoint, has a maximum credible earthquake magnitude of 7.42 and is located approximately 16.54 kilometers from the site.

Based on the USGS Design Maps Summary Report, using the American Society of Civil Engineers (ASCE 7-16) standard, the peak ground acceleration ($PGA_M$) at the project site is expected to be 0.55g. Based on the USGS Unified Hazard Tool, the project site has a mean magnitude of 6.87. Furthermore, the site is not located within an Alquist-Priolo

Earthquake Fault Zone based on our review of the California Geologic Survey Fault Hazard Maps[2].

# Corrosivity

In accordance with our proposed scope of work, soil samples are being tested for laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH level. The 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. As discussed with the client, results of that testing have not been received as of the time of this report and will be issued with the final report.

# Electrical Resistivity Testing

Terracon performed field measurements of soil electrical resistivity for the support of grounding design. Soil resistivity data was obtained from one perpendicular arrays at six (6) locations in the proposed PV array areas. The approximate location of the tests are shown in the **Exploration Plan**. The testing was performed in general accordance with Wenner Array (4-pin) method per ASTM G57. This method was performed in with IEEE Standard 81, IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System. The test locations included perpendicular arrays with "a" spacings 0.5, 1, 2, 5, 10, and 15 feet. The "a" spacing is generally considered to be the depth of influence of the test. The electrical resistivity test results are presented in **Exploration Results**.

# Thermal Resistivity Testing

Terracon subcontracted Geotherm USA to perform laboratory thermal resistivity testing. Testing was conducted on three (3) bulk samples from the proposed array areas. Samples were taken from a depth of 1 to 4 feet bgs. The bulk samples collected for the array areas were conducted on soil samples remolded to 85% compaction effort (as determined by ASTM D1557) of the material's maximum dry density for a total of three (3) tests. Dry out curves targeted the higher of either the in-situ moisture content of the optimum moisture content as determined by ASTM D1557, totally dry condition, and two intermediate points.

In accordance with our proposed scope of work, bulk samples were shipped to Geotherm USA to perform thermal resistivity testing. As discussed with the client, results of that

[2] California Geological Survey. https://maps.conservation.ca.gov/cgs/informationwarehouse.

testing have not been received as of the time of this report and will be issued with the final report.

# Liquefaction

Liquefaction is a mode of ground failure that results from the generation of high pore water pressures during earthquake ground shaking, causing loss of shear strength. Liquefaction is typically a hazard where loose sandy soils exist below groundwater. The California Geological Survey (CGS) has designated certain areas as potential liquefaction hazard zones. These are areas considered at a risk of liquefaction-related ground failure during a seismic event, based upon mapped surficial deposits and the presence of a relatively shallow water table.

The site has not been mapped for liquefaction hazard by the California Geologic Survey. According to Imperial County COSE Environmental Inventory Report Section 2.4 Geology and Soils, published June of 2015, countywide assessments identifying liquefaction potential in the county has not been performed.[3] However, based on the subsurface soil conditions and encountered depth of groundwater, soil conditions are potentially susceptible to liquefaction.

## Seismic Settlement

Our explorations indicate the native soils encountered in exploratory borings generally consisted of loose to very dense sand to the maximum exploration depth of 51½ feet bgs. Groundwater was encountered in borings B-1 to B-6 at approximate depths ranging from 11 to 24 feet bgs while drilling. Historic high groundwater levels were recorded at approximately 24 feet bgs.

To evaluate the presence of liquefiable soils and determine the amount of settlement of saturated/unsaturated soils during seismic shaking, we performed liquefaction analysis in accordance with the DMG Special Publication 117.

We utilized the software "LiquefyPro" by CivilTech Software, using soil from borings B-3 and B-6. A Peak Ground Acceleration ($PGA_M$) of 0.55g and assumed a magnitude of 6.87 were used. Settlement analysis used the Tokimatsu, M-correction method. The fines

[3] Imperial County Planning & Development Services. https://www.icpds.com/assets/planning/conservation-and-open-space-update/reports-and-documents/06geology-soils.pdf

percentage were corrected for liquefaction using the Idriss/Seed method. For this analysis a groundwater depth of 11 feet has been utilized.

Based on the calculation results, the seismically induced settlement is estimated to be on the order of 2½ inch due to the presence of loose to medium sandy soil layers and seismic shaking anticipated at the site. Liquefiable soils are anticipated between the depths of approximately 60 to 73 feet MSL. Differential seismic settlement can be taken as one-half of the total seismic settlement.

Results and calculations for the liquefaction analysis are included in the **Supporting Documents** section of this report.

# Pile Load Testing

## Test Pile Installation

Terracon subcontracted Sunstall, Inc. to install W-section steel piles for the pile load tests. Gayk HRE equipment with a hydraulic attachment was utilized for installation. A total of eighteen (18) piles were installed under Terracon supervision at six (6) test locations (three piles per location). All eighteen (18) piles were installed directly into existing ground.

The test locations are indicated in the **Exploration Plan** section of this report. The approximate GPS coordinates of the center piles of each group are documented on the pile load testing plots.

Driven piles targeted embedment depths of 5 to 10 feet bgs. All piles were driven within an approximate total drive time ranging between 7 and 55 second seconds. The time required to drive the pile per incremental foot of embedment, was recorded during installation. The table provided in the **Exploration Results** section of this report includes the incremental driving time (in seconds) per foot of pile embedment.

## Test Pile Details

Terracon provided the steel piles to the job site. The piles were driven to facilitate performing tension (pull-out), lateral, and compression tests. The bare steel sections have the following properties[4]:

| Parameter | W6x9 |
|---|---|
| **Depth** | 5.900 in |
| **Flange Width, $b_f$** | 3.940 in |
| **Flange Thickness, $t_f$** | 0.215 in |
| **Web Thickness, $t_w$** | 0.170 in |
| **Moment of Inertia, $I_x$** | 16.40 $in^4$ |
| **Section Area, A** | 2.68 $in^2$ |
| **Young's Modulus, $E_s$** | 29,000 ksi |
| **Yield Stress, $F_y$** | 50 ksi |
| **Hot Dip Galvanization** | None |

## Pile Load Testing

The pile load testing was performed in general accordance with ASTM D3689 Test Methods for Deep Foundations under Static Axial Tensile Load, ASTM D3966 Test Methods for Deep Foundations under Lateral Load, and ASTM D 1143, Standard Test Method for Deep Foundations under Static Axial Compressive Load.

**Axial-Tension (Pull-Out) Load Testing:** Our scope of services included testing (2) of the test piles at each location (for a total of 12 test piles) were load tested under axial tensile load by Terracon a minimum of 72 hours after installation.

Terracon's proprietary tripod system was used to develop the vertical tension reaction. A locking "E"- plate clamp was used to grip the top of the web for the tension tests. A load cell was used to record the applied load, and deflections were recorded using a pair of calibrated indicators (dial or digital) secured to each flange of the test pile with magnetic mounting brackets.  The indicators rested on reference beams supported at least five feet

[4]American Institute of Steel Construction (AISC), *"Steel Construction Manual – Fourteenth Edition"* February 2012.

from the pile. Terracon applied loads in approximately 500-lb. increments up to 10,000 lbs. (our equipment's maximum safe working load) or to the target ultimate failure criteria of 0.75-inch. Yield deflection was recorded at 0.25-inch. Terracon recorded deflections after the load was brought back to zero from the target load.

**Lateral Load Testing:** Our scope of services included testing (2) piles at each location (for a total of 12 test piles) for lateral capacity a minimum of 72 hours after installation. The test piles were connected to a reaction force using a system of appropriately rated shackles and chain. The load displacement testing occurred along the strong axis direction of the test pile. A hydraulic jack was placed along with the load cell between the test pile and the reaction force. The system was connected to the test piles using a flange clamp at approximately 30 inches above ground surface. Two calibrated dial gauges were used to measure the deflection of each pile near the ground surface (approximately 6 inches above grade). Terracon applied loads cyclically in approximately 500-lb. increments up to the target load of 7,000 pounds or to the target failure criteria of 1-inch of lateral displacement measured at 6 inches above grade. Deflections were recorded at each increment. The target yield deflection was 0.5-inch at 6 inches above grade. Terracon recorded deflections after the load was brought back to zero from the target load.

**Axial Compression Load Testing:** Our scope of services included testing (1) pile at each of the six (6) locations for axial compressive capacity.

The test was performed on a pile embedded at the same depth as the shortest embedment depth for that location. Axial compression pile testing was performed using load increments of 500 lbs. up to a maximum compressive load of 13,000 lbs. or the limits of the soil capacity, whichever occurred first. The limit of soil capacity during a compression test was defined as movement in excess of 0.75-inch. Yield deflection was recorded at 0.25-inch. Elastic deflection was measured at each load increment. In addition, permanent deflection was measured by unloading and allowing the pile to rebound after the maximum achieved load/deflection.

For axial and lateral tests, the deflections were measured at each load increment until pile movements were stabilized. The final deflection measurements recorded during the pile load tests are presented on the data reports included in the attachments.

# Geotechnical Overview

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings, provided that the findings and recommendations presented in this report are incorporated into project design and construction.

Based on the geotechnical engineering analyses, subsurface exploration, and laboratory test results, we anticipate that the panels will be installed on ground-mounted systems likely supported on driven piles. Equipment pads and other electrical equipment associated with the inverters and other self-contained electrical equipment within the solar arrays are likely to be supported on shallow foundations bearing on engineered fill or drilled shaft.

Due to the low bearing capacity of the near surface soils, shallow foundations bearing on engineered fill are recommended for support of the proposed structures bearing on engineered fill extending to a minimum depth of 2 feet below the bottom of foundations or 4 feet below existing site grades, whichever is greater.

Grading for the proposed structures should incorporate the limits of the overexcavation plus a lateral distance of 2 feet beyond the outside edge of perimeter footings. Overexcavation and replacement is not required for support of drilled shaft or driven pile foundations.

Geotechnical engineering recommendations for trenching and other earth connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations

# Earthwork

The following presents recommendations for site preparation, excavation, subgrade preparation, and placement of engineered fills on the project. The recommendations presented are for the design and construction of foundations 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.

## Site Preparation

Strip and remove existing vegetation, debris, and other deleterious materials from proposed foundation and roadway areas. Exposed surfaces within these areas should be free of mounds and depressions which could prevent uniform compaction.

Stripped materials consisting of vegetation and organic materials should be wasted from the site or used to revegetate landscaped areas or exposed slopes after completion of grading operations. If it is necessary to dispose of organic materials on site, they should be placed in non-structural areas, and in fill sections not exceeding 5 feet in height.

Although no evidence of fills, utilities, or underground facilities such as septic tanks, cesspools, basements, and utilities was observed during the site reconnaissance, such features could be encountered during construction. If unexpected fills, utilities, or underground facilities are encountered, such features should be removed, and the excavation thoroughly cleaned prior to backfill placement and/or construction.

## Subgrade Preparation

The proposed structures may be supported by a shallow concrete foundation system. Due to the low bearing capacity of the near surface soils, shallow foundations bearing on engineered fill are recommended for support of the proposed structures bearing on engineered fill extending to a minimum depth of 2 feet below the bottom of foundations or 4 feet below existing site grades, whichever is greater. Alternatively, the proposed structures may be supported by drilled shafts or driven steel piles.

Subgrade soils beneath exterior slabs and roadways should be scarified to a minimum depth of 12 inches, moisture conditioned, and compacted. The moisture content and compaction of subgrade soils should be maintained until slab or roadway construction.

Structures supported on either drilled shafts or driven piles may be constructed without the above recommended remedial grading.

All exposed areas which will receive fill, once properly cleared and benched where necessary, should be scarified to a minimum depth of 10 inches, moisture conditioned as necessary, and compacted per the compaction requirements in this report. Compacted structural fill soils should then be placed to the proposed design grade and the moisture content and compaction of subgrade soils should be maintained until foundation or roadway construction.

Based upon the subsurface conditions determined from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively workable; however, the workability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unworkable conditions develop, workability may be improved by scarifying and drying.

## Excavation

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

Onsite soils consist of cohesionless sandy soils. Such soils have the tendency to cave and slough during excavations. Therefore, formwork may be needed for foundation excavations.

Individual contractors are responsible for designing and constructing stable, temporary excavations. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

## Fill Materials and Placement

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

On-site soil may be used as fill materials for the following:

- general site grading
- foundation areas
- exterior non-structural slab areas
- roadway areas

Imported soils for use as fill material within proposed structure areas should conform to low volume change materials as indicated in the following specifications:

| **Gradation** | **Percent Finer by Weight (ASTM C 136)** |
|---|---|
| 6″ | 100 |
| 3″ | 90-100 |
| No. 4 Sieve | 50-100 |
| No. 200 Sieve | 10-30 |

- Liquid Limit ........ 30 (max)
- Plasticity Index ........ 15 (max)
- Maximum Expansion Index* ........ 20 (max)

*ASTM D4829

The contractor shall notify the Geotechnical Engineer of import sources sufficiently ahead of their use so that the sources can be observed and approved as to the physical characteristic of the import material. For all import material, the contractor shall also submit current verified reports from a recognized analytical laboratory indicating that the import has a "not applicable" (Class S0) potential for sulfate attack based upon current ACI criteria and is "mildly corrosive" to ferrous metal and copper. The reports shall be accompanied by a written statement from the contractor that the laboratory test results are representative of all import material that will be brought to the job.

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.

## Compaction Requirements

Recommended compaction and moisture content criteria for engineered fill materials are as follows:

| Material Type and Location | Per the Modified Proctor Test (ASTM D 1557) | | |
|---|---|---|---|
| | Minimum Compaction Requirement | Range of Moisture Contents for Compaction Above Optimum | |
| | | Minimum | Maximum |
| **On-site soils and low volume change imported fill:** | | | |
| **Beneath foundations:** | 90% | 0% | +4% |
| **Exterior Slabs:** | 90% | +2% | +5% |
| **Miscellaneous backfill:** | 85% | +2% | +5% |
| **Utility trenches (structural areas)*:** | 90% | 0% | +4% |
| **Utility trenches (nonstructural areas areas)*:** | 85% | +2% | +5% |
| **Aggregate base:** | 95% | 0% | +4% |
| **Fill greater than 5 feet in depth:** | 95% | 0% | +4% |

1. Upper 12 inches should be compacted to 95% within structural areas. Compaction requirements within utility trenches should be verified with electrical engineer based on thermal resistivity and may be modified accordingly. Low-volume change imported soils should be used in structural areas

## Grading and Drainage

All grades should provide effective drainage away from shallow concrete foundations, during and after construction, and should be maintained throughout the life of the structure. Water retained next to shallow concrete foundations can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential foundation movements.

Backfill against footings and in utility trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

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## Utility Trenches

It is anticipated that the on-site soils will provide suitable support for underground utilities and piping that may be installed. Any soft and/or unsuitable material encountered at the bottom of excavations should be removed and be replaced with an adequate bedding material.

A nonexpansive granular material with a sand equivalent greater than 30 should be used for bedding and shading of utilities, unless allowed or specified otherwise by the utility manufacturer.

On-site materials are considered suitable for backfill of utility and pipe trenches from one foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. If trenches are placed beneath footings, the backfill should satisfy the gradation and expansion index requirements of engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

## Exterior Slab Design and Construction

Exterior slabs-on-grade, exterior architectural features, and utilities founded on, or in backfill may experience some movement due to the volume change of the backfill. To reduce the potential for damage caused by movement, we recommend:

- minimizing moisture increases in the backfill;
- controlling moisture-density during placement of backfill;
- using designs which allow vertical movement between the exterior features and adjoining structural elements;
- placing effective control joints on relatively close centers

## Earthwork Construction Considerations

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of roadways. 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 recompacted prior to roadway construction.

Should unstable subgrade conditions develop stabilization measures will need to be employed. Stabilization measures may include placement of aggregate base and multi-axial geogrid. Use of lime, fly ash, kiln dust or cement could also be considered as a stabilization technique. Laboratory evaluation is recommended to determine the effect of chemical stabilization on subgrade soils prior to construction.

We recommend that the earthwork portion of this project be completed during extended periods of dry weather if possible. If earthwork is completed during the wet season (typically November through April) it may be necessary to take extra precautionary measures to protect subgrade soils. Wet season earthwork operations may require additional mitigative measures beyond that which would be expected during the drier summer and fall months. This could include diversion of surface runoff around exposed soils and draining of ponded water on the site. Once subgrades are established, it may be necessary to protect the exposed subgrade soils from construction traffic.

The individual contractor(s) is responsible for designing and constructing stable, temporary excavations 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 Occupational Safety and Health Administration (OSHA) excavation and trench safety standards.

## Construction Observation and Testing

The geotechnical engineer 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.

The exposed subgrade and each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the structural areas and 5,000 square feet in roadway areas. One density and water content test for every 50 linear feet of compacted utility trench backfill. This testing frequency criteria may be adjusted during construction as specified by the geotechnical engineer of record.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. In the event that unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer’s evaluation of subsurface conditions, including assessing variations and associated design changes.

# Shallow Foundations

Recommendations for foundations for the proposed structures and related structural elements are presented in the following paragraphs.

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

## Foundation Design Recommendations

| Item | Description |
|---|---|
| **Foundation System** | mat foundations or slab-on grade |
| **Maximum Allowable Bearing pressure[1,2]** | 2,000 psf up to 8 feet wide<br>1,000 psf up to 14 feet wide |
| **Required Bearing Stratum** | Engineered fill extending to a minimum depth of 2 feet below the bottom of foundations, or 4 feet below existing grades, whichever is greater |
| **Minimum Embedment Below Finished Grade** | 18 inches |
| **Minimum Dimensions** | Square footings and mats: 24 inches<br>Strip footings: 18 inches |
| **Design Modulus of Subgrade Reaction, k[3]** | 200 pounds per square inch per inch (psi/in).<br><br>The modulus was obtained based on estimates obtained from NAVFAC 7.1 design charts. This value is for a small-loaded area (1 Sq. ft or less) such as for forklift wheel loads or point loads and should be adjusted for larger loaded areas. |
| **Modulus Correction Factor[3]** | $Kc = k\,[(B+1)/(2B)]^2$ |
| **Ultimate Passive Resistance[4]** | 360 pcf |
| **Ultimate Coefficient of Sliding Friction[5]** | 0.35 |
| **Estimated Total Settlement from Structural Loads** | About 1-inch |
| **Estimated Differential Settlement** | About ½ of total settlement over a horizontal distance of 40 feet |

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has

been applied. These bearing pressures can be increased by 1/3 for transient loads unless those loads have been factored to account for transient conditions.
2. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in Earthwork.
3. k values should be reduced to account for dimensional effects of largely loaded areas. Where kc is the corrected or design modulus value and B is the mat width in feet.
4. Use of passive earth pressures requires the footing forms be removed and compacted structural fill be placed against the vertical footing face. A factor of safety of 2.0 is recommended.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions. A factor of safety of 1.5 is recommended.

Settlement calculations were performed utilizing Westergaard and Hough's methods[5] to estimate the static settlement for various foundation widths with an allowable settlement of 1-inch.

Finished grade is defined as the lowest adjacent grade within five feet of the foundation for perimeter (or exterior) footings.

The allowable foundation bearing pressure applies to dead loads plus design live load conditions. The design bearing pressure may be increased by one-third when considering total loads that include wind or seismic conditions. The weight of the foundation concrete below grade may be neglected in dead load computations.

Foundations should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. 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.

# Driven Pile Foundation

## Driven Pile Design Recommendations

We anticipate that the PV panels will be installed on ground-mounted systems likely supported on driven piles.

[5] FHWA Geotechnical Engineering Circular No. 6 – Shallow Foundations, FHWA-SA-02-054.

## Lateral Capacity Recommendations

The L-PILE analyses considered pile tests performed at select locations. The analyses considered test piles with their top at the load application height of 30 inches and the embedded pile depths of up to 10 feet based on field installation. Subsurface conditions were modeled as "Sand (Reese)". Friction Angle was determined based on the subsurface conditions encountered in our borings. Unit weights were based on results of laboratory testing. The results of pile tests were reviewed and based on the range of results, the lowest lateral result (PLT-4A was selected for LPILE modeling to determine the p-multiplier).

The L-PILE analyses were performed by applying the field test load at the point of load application that resulted in the approximately ½ inch of lateral deflection measured at 6 inches above the ground surface.  The p-multiplier was then adjusted (by trial-and-error method) such that the applied load resulted with the approximately ½ inch deflection value that matched the in-situ test results.

Since no lateral deflections were measured below the ground surface during the testing, we have assumed in our analyses that the soil-structure interaction is simulated by a long slender pile and that the pile behaves in a flexural manner as depicted on the LPILE Lateral Deflection versus Depth curve generated and included in the **Supporting Information** section of this report.  Actual lateral deflections of the test and production piles below the ground surface may vary from the results depicted from our analyses.

The following table provides the soil characteristics modeled from the current load tests on-site.

| Depth (feet bgs) | L-Pile Soil Type[1] | Effective Unit Weight (pcf) | Friction Angle (◦) | p-multiplier |
|---|---|---|---|---|
| **0-9** | Sand (Reese) | 100 | 32 | 1.45 |

A depth of neglect should be considered to account for utilities and anticipated disturbance around piles. This depth of neglect should be provided by the pile designer and verified by the civil engineer.

## Axial Capacity Recommendations

The allowable axial resistance coefficient of a straight-sided pile at the site was determined based on the axial load test results. Based on the results of the pile load testing program, the below table of values is recommended for use in the areas of the designated pile load tests:

| Allowable Axial Resistance | |
|---|---|
| **Tension** | **$F_{ST}$ (lbs) =40 x P x $h^2$** |
| **Compression** | **$F_{SC}$ (lbs) = 80 x P x $h^2$ + 5,500** |

Where:
$F_{ST}$ = Allowable Axial Resistance (lbs) Tension
$F_{SC}$ = Allowable Axial Resistance (lbs) Compression
P = Pile perimeter = 2 * Flange Width + 2 * Depth (ft)
$h$ = depth of embedment of pile (ft)

The allowable axial resistance parameters utilize a minimum factor of safety of 1.5. The above skin resistance values are applicable for piles that are driven a minimum of 6 feet embedment using equipment similar to a GAYK Model HRE 1000 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.

# Deep Foundations

## Drilled Shaft Design Recommendations

We anticipate that the proposed equipment pads and other appurtenant electrical equipment supported on drilled shaft foundations.

## Drilled Shaft Axial Loading

Due to the presence of liquefiable soils between depths of about 22 feet and 36 feet below existing ground surface, drilled piers should not rely on end bearing or skin friction within this zone.

Total required embedment of the drilled shaft should be determined by the structural engineer based on structural loading and parameters provided in this report.

Allowable skin friction and total capacity charts are attached to our **Supporting Information** section at the end of this report. The values presented for allowable side friction and end bearing include a factor of safety of 2.5.

Drilled piers should have a minimum (center-to-center) spacing of three diameters. Closer spacing may require a reduction in axial load capacity. Axial capacity reduction can be determined by comparing the allowable axial capacity determined from the sum of individual piers in a group versus the capacity calculated using the perimeter and base of the pier group acting as a unit. The lesser of the two capacities should be used in design.

The allowable uplift capacities should only be based on the side friction of the shaft; however, the weight of the foundation should be added to these values to obtain the actual allowable uplift capacities for drilled shafts. Tensile reinforcement should extend to the bottom of shafts subjected to uplift loading.

## Drilled Shaft Lateral Loading

Based on our review of the subsurface conditions, our laboratory testing, and the Standard Penetration Test (SPT) results, engineering properties have been estimated for the soils conditions as shown in the following table. Due to potential for disturbance within the upper soils around the shaft, lateral and axial capacity of soils within the upper 2 feet should be neglected.

Recommended geotechnical parameters for lateral load analyses by others of drilled shaft foundations have been developed for use in the LPILE computer program. The following table summarizes input values for use in LPILE analyses. LPILE estimated values of $k_h$ may be used. Since deflection or a service limit criterion will most likely control lateral capacity design, no safety/resistance factor is included with the parameters.

| Stratigraphy[1] | | L-Pile Soil Model | $\phi$[2] (°) | $\gamma'$ (pcf)[2] |
|---|---|---|---|---|
| Layer | Depth Below Finished Grade (feet) | | | |
| 1 | 2 | Sand | 29 | 100 |
| | 5 | | | |
| 2 | 5 | Sand | 31 | 100 |
| | 11 | | | |
| 3 | 11 | Sand | 30 | 55 |
| | 22 | | | |
| 4 | 22 | Sand | 5[1] | 55 |
| | 36 | | | |
| 5 | 36 | Sand | 32 | 55 |
| | 50 | | | |

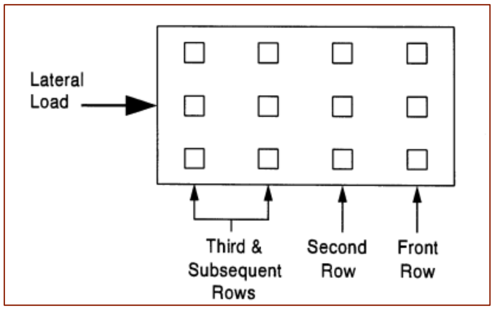
1. This zone is reduced to represent liquefaction potential
2. Design water table is 11 feet

Tensile reinforcement should extend to the bottom of piers subjected to uplift loading. The depth below ground surface indicated in the table above is referenced from the existing site surface at the time of the field exploration. If fill is placed to raise the site grades, the depths shown in the charts and table above must be increased by the thickness of fill placed. The required depths of shaft embedment should also be determined for design lateral loads and overturning moments to determine the most critical design condition.

Lateral load design parameters are valid within the elastic range of the soil. The coefficient of subgrade reaction are ultimate values; therefore, appropriate factors of safety should be applied in the shaft design or deflection limits should be applied to the design.

It should be noted that the loaded capacities provided herein are based on the stresses induced in the supporting soils. The structural capacity of the shafts should be checked to assure that they can safely accommodate the combined stresses induced by axial and lateral forces. Furthermore, the response of the drilled shaft foundations to lateral loads is dependent upon the soil/structure interaction as well as the shaft's actual diameter, length, stiffness and "fixity" (fixed or freehead condition). We can provide additional analyses and estimates of lateral deflections for specific loading conditions upon request. The load-carrying capacity of shafts/piles may be increased by increasing the diameter and/or length.

When piers are used in groups, the lateral capacities of the piers in the second, third, and subsequent rows of the group should be reduced as compared to the capacity of a single, independent pier. Guidance for applying p-multiplier factors to the p values in the p-y curves for each row of pier foundations within a pier group are as follows:




1. Front row: $P_m = 0.8$;
2. Second row: $P_m = 0.4$
3. Third and subsequent row: $P_m = 0.3$.

For the case of a single row of piers supporting a laterally loaded grade beam, group action for lateral resistance of piers would need to be considered when spacing is less than five pier diameters (measured center-to-center). However, spacing closer than 3D (where D is the diameter of the pier) is not recommended due to the potential for the installation of a new pier disturbing an adjacent installed pier, likely resulting in axial capacity reduction.

## Drilled Shaft Construction Considerations

The Geotechnical Engineer should observe the installation of drilled piers to verify the soil conditions and the diameter and depth of piers. Drilled piers should be constructed true and plumb.

Drilling for the proposed drilled shafts to design depths should be possible with conventional single flight power augers If shafts extend below the depth of groundwater, a tremie should be used for concrete placement.

Temporary steel casing may be required to properly drill and clean shafts prior to concrete placement. The drilling speed should be reduced as necessary to minimize vibration and caving of the silty sand materials. The contractor should be prepared to use casing or other approved means to prevent caving. The contractor should review the boring logs to make sure they are familiar with the anticipated subsurface conditions prior to beginning construction of the deep foundations.

In the event drilled hole walls slough during drilling, we recommend the use of slurry drilling methods with polymers to keep the solids in suspension during the drilling. Drilled shaft foundation concrete should be placed within 6 inches of the shaft base of the slurry-filled excavation immediately after completion of drilling and cleaning. The tremie should remain inserted several feet into the fresh concrete as it displaces the slurry upward and until placement is complete. The slurry should have a sand content no greater than 1% at the time concrete placement commences. The maximum unit weight of the slurry should be established in consultation with Terracon. Due to potential sloughing and raveling, foundation concrete quantities may exceed calculated geometric volumes.

Drilled shaft foundation concrete should be placed immediately after completion of drilling and cleaning. If foundation concrete cannot be placed in dry conditions, a tremie should be used for concrete placement. Due to potential sloughing and raveling, foundation concrete quantities may exceed calculated geometric volumes.

If casing is used for drilled shaft construction, it should be withdrawn in a slow continuous manner maintaining a sufficient head of concrete to prevent infiltration of water or the creation of voids in shaft concrete. Shaft concrete should have a relatively high fluidity when placed in cased shaft holes or through a tremie. Shaft concrete with slump in the range of 6 to 8 inches is recommended.

We recommend that all drilled shaft installations be observed on a full-time basis by an experienced geotechnical engineer in order to evaluate that the soils encountered are consistent with the recommended design parameters. If the subsurface soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required. The Geotechnical Engineer should observe the installation of drilled piers to verify the soil conditions and the diameter and depth of piers. Drilled piers should be constructed true and plumb.

Free-fall concrete placement in drilled piers will only be acceptable if provisions are taken to 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.

Drilled pier end bearing surfaces must be thoroughly cleaned prior to concrete placement. A representative of the Geotechnical Engineer should inspect the bearing surface and foundation pier configuration. If the subsurface soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

Closely spaced piers should be drilled and filled alternately, allowing the concrete to set at least eight hours before drilling the adjacent pier. All excavations should be filled with concrete as soon after drilling as possible. In no event should pier holes be left open overnight. To prevent concrete from striking the walls of the pier and causing caving, the concrete should be placed with appropriate equipment so that the concrete is not allowed to fall freely more than 5 feet. All loose materials should be thoroughly cleaned from the bottom of the pier excavation. This is especially important because end bearing has been considered in determining the provided pier capacities. If casing is necessary and is utilized, then the casing should be withdrawn concurrently with the concrete placement.

# Gravel-Surfaced Drives and Parking

## General Comments

Roadway designs are provided for the traffic conditions and pavement life conditions as noted in the **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Roadway sections noted in this section are contingent upon the site being adequately prepared. Additionally, our recommendations are based on *Chapter 4 Low-Volume Road Design* found in AASHTO 1993.

## Roadway Subgrades

Laboratory testing performed for the near-surface soils at B-3 indicate that the site has an estimate CBR value of 8.

## Design Parameters

We understand unpaved access roads are planned throughout the site. The unpaved road sections for post-construction use have been developed under the following assumptions:

| Aggregate Roadway Design Parameters | | |
|---|---|---|
| **Parameter** | **Design Value** | **Comments** |
| Traffic Loading | 5,000 ESALs [1] | Assumed |
| Design Life | 30 years | Assumed |
| Design CBR | 8 | Obtained from laboratory testing |
| Resilient Modulus | 9,600 psi (all-weather) | Based on CBR of 8 |
| Aggregate Base Elastic Modulus | 36,000 psi | Assumed |
| Allowable Rut Depth | 2.0 inches | Assumed |
| Design Serviceability Loss | 2.5 | Assumed |
| Vehicle Tire Pressure | 80 psi | Assumed |

1. ESAL = 18 kips Equivalent Single Axle Load

## Access Road Sections

As a minimum, we recommend the following options for unpaved access roads:

| Typical Unpaved Road Section – Post Construction Traffic | |
|---|---|
| **Base Course Thickness (inches)** | **Traffic (ESALs)** |
| 4 [1, 2] | 5,000 |

1. Minimum section thickness is anticipated to support fire trucks and pick-up trucks associated with on-going maintenance. Trucks containing heavy equipment may require localized repairs.
2. Base materials shall consist of Class II Base meeting requirements of the Caltrans Standard Specifications.

Roadway section should be constructed over a minimum of 12 inches of scarified, moisture conditioned, and compacted native soils to 95% of the maximum dry density using ASTM D1557. The recommended thicknesses should be measured after full compaction. The width of the roadway should extend a minimum distance of 1 foot on each side of the desired surface width.

Aggregate materials should conform to the specifications of Class II aggregate base in accordance with the requirements and specifications of the State of California Department of Transportation (Caltrans), or other approved local governing specifications.

Positive drainage should be provided during construction and maintained throughout the life of the roadways. Proposed roadway design should maintain the integrity of the road and eliminate ponding.

## Aggregate Surface Roadway Design Recommendations

It is our understanding that aggregate surfaced roads will be utilized during the construction of this project.

Aggregate surface roadway design was conducted in general accordance with the Army Corps of Engineers (ACOE) Technical Manual TM-5-822, Design of Aggregate Surface Roads and Airfields (1990). The design was based on Category III, traffic containing as much as 15% trucks, but with not more than 1% of the total traffic composed of trucks having three or more axles (Group 3 vehicles), and Road Class G (Under 70 vehicles per day). Based on the Category and Road Class, a Design Index of 1 was utilized. Terracon should be contacted if significant changes in traffic loads or in the characteristics described are anticipated.

As a minimum, the aggregate surface course should have a minimum thickness of 4 inches and should be constructed over a minimum of 10 inches of scarified, moisture conditioned, and compacted native soils to 95% of the maximum dry density using ASTM D1557. The recommended thicknesses should be measured after full compaction. The width of the roadway should extend a minimum distance of 1 foot on each side of the desired surface width.

Aggregate materials should conform to the specifications of Class II aggregate base in accordance with the requirements and specifications of the State of California Department of Transportation (Caltrans), or other approved local governing specifications.

## Roadway Design and Construction Considerations

Regardless of the design, un-surfaced roadways will display varying levels of wear and deterioration. We recommend an implementation of a site inspection program at a frequency of at least once per year to verify the adequacy of the roadways. Preventative measures should be applied as needed for erosion control and re-grading. An initial site inspection should be completed approximately three months following construction.

Preventative maintenance should be planned and provided for through an on-going management program to enhance future roadway performance. Preventative maintenance activities are intended to slow the rate of deterioration, and to preserve the roadway investment.

Surfacing materials should not be placed when the surface is wet. Surface drainage should be provided away from the edge of roadways to reduce lateral moisture transmission into the subgrade.

If 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 road when the subgrade is wet 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.

Materials and construction of roadways for the project should be in accordance with the requirements and specifications of the California Department of Transportation or the applicable local governing body.

# General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services 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.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

# Attachments

# Field Exploration Results

**Contents:**

**Site Location Plan**
Perkins Solar ■ Imperial County, CA
January 26, 2024 ■ Terracon Project No. 60235062

## Site Location


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

MAP PROVIDED BY MICROSOFT BING MAPS

**Exploration Plan**
Perkins Solar ■ Imperial County, CA
January 26, 2024 ■ Terracon Project No. 60235062

## Exploration Plan – Boring and Test Pit Locations

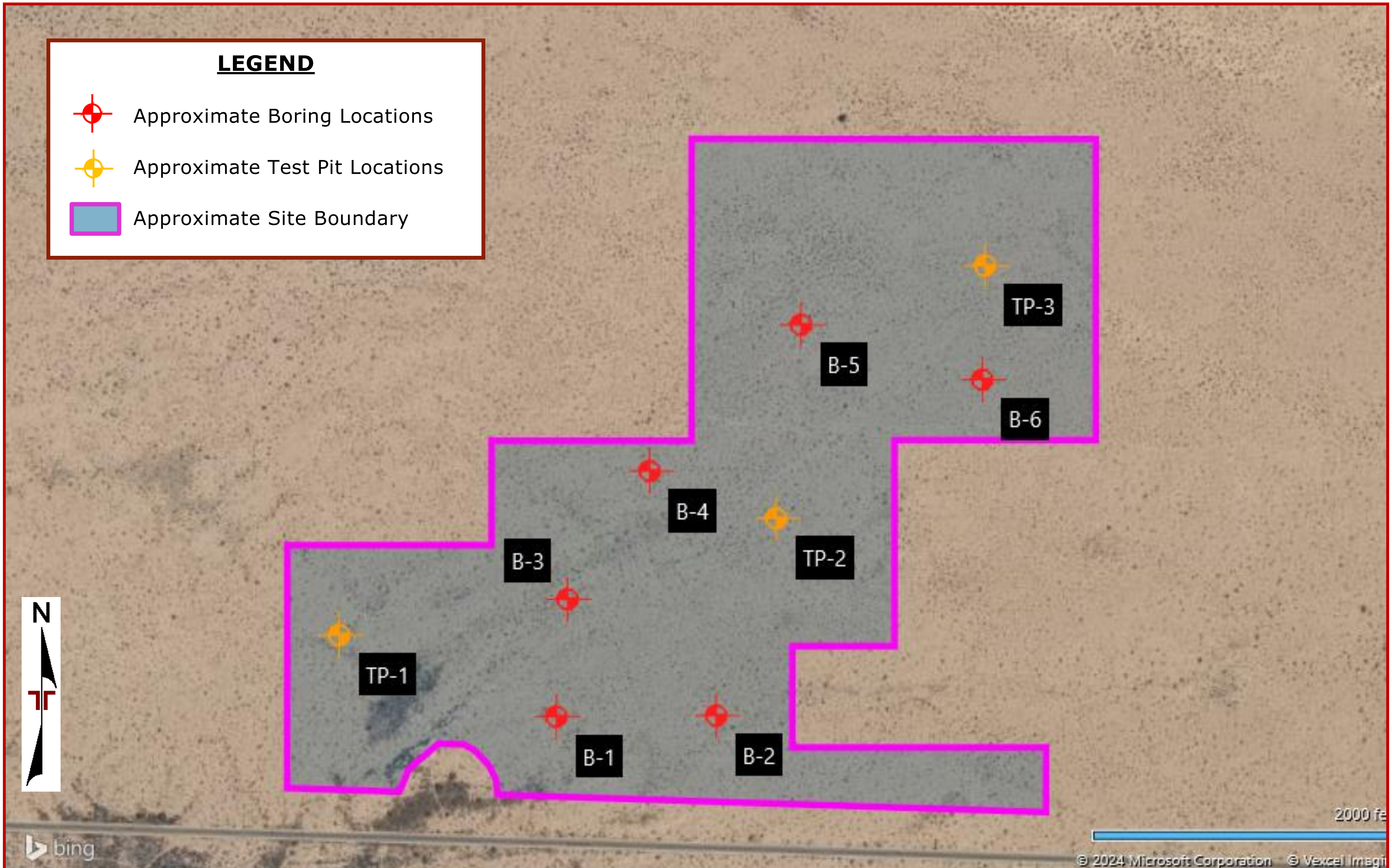



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

# Exploration and Testing Procedures

## Field Exploration

The following table provides a summary of our geotechnical exploration completed at the site.

| | Type of Exploration | Approximate Depth (bgs) | Location |
|---|---|---|---|
| 2 | Boring | 51½ feet | |
| | | 21½ feet | |
| 3 | Test Pit | 10 | |

**Boring Layout and Elevations:** Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. Approximate ground surface elevations were estimated using Google Earth.

**Subsurface Exploration Procedures:** We advanced the borings with a track-mounted drill rig using continuous hollow stem flight. Four samples were obtained in the upper 10 feet of each boring. Test samples were collected during drilling in general accordance with the appropriate ASTM methods using Standard Penetration Testing (SPT) and sampling using standard split-spoon. A sampling spoon was 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 was recorded as the Standard Penetration Test (SPT) resistance value, also referred to as N-values. The N-values are indicated on the boring logs at the test depths. The samples were placed in appropriate containers, taken to our soil laboratory for testing, and classified by a geotechnical engineer.

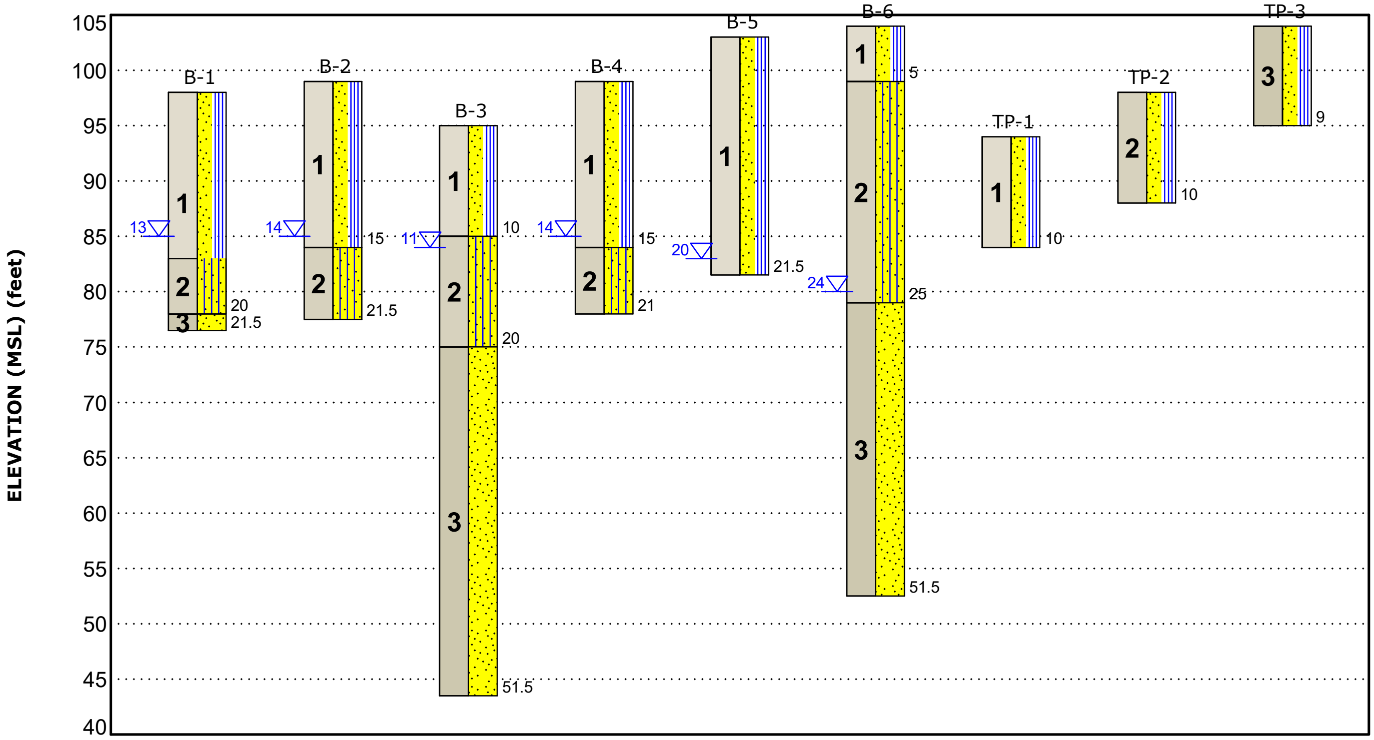
We also observed the boreholes while drilling and at the completion of drilling for the presence of groundwater. Groundwater was observed in borings B-1 to B-6 while drilling at approximate depths of 11 to 24 feet bgs. For safety purposes, all borings and test pits were backfilled with auger cuttings after their completion.

The test pits were excavated with a hydraulically controlled backhoe to a depth of approximately 10 feet. Continuous lithologic logs of each test pit were recorded by our field engineer during the field exploration. Photographs of each testing location, their surroundings and the interior of each test pit is presented in **Test Pits Photo Log**.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs and test pit logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring and test pit logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

23041 Avenida De La Carlota
Ste 350
Laguna Hills, CA

# GeoModel




This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

| Model Layer | Layer Name | General Description |
|---|---|---|
| 1 | Poorly Graded Sand with Silt | loose to medium dense |
| 2 | Silty Sand | medium dense to very dense |
| 3 | Poorly Graded Sand trace silt | loose to very dense |

**Legend**

Poorly-graded Sand with Silt
Silty Sand
Poorly-graded Sand

First Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

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# Boring Log No. B-1

Location: See Exploration Plan

Latitude: 32.7132° Longitude: -115.1720°

| Model Layer | Depth (Ft.) | Description | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | **POORLY GRADED SAND WITH SILT (SP-SM)**, tan | | | | | | | | |
| | | loose | | | | 7-8-8 | 1.8<br>1.5 | 87 | | 10 |
| | | | 5 | | | 2-3-4<br>N=7 | | | NP | |
| | | medium dense | | | | 10-15-18 | 4.3 | 87 | | |
| | | | 10 | | | 21-6-7<br>N=13 | | | | |
| | | | | ▽ | | | | | | |
| | 15.0 | | 15 | | | | | | | |
| 2 | | **SILTY SAND (SM)**, light brown, very dense | | | | 50/6" | | | | |
| | 20.0 | | 20 | | | | | | | |
| 3 | | **POORLY GRADED SAND (SP)**, tan, loose | | | | 5-4-3<br>N=7 | | | | |
| | 21.5 | | | | | | | | | |

***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.

**Notes**

**Water Level Observations**
▽ While drilling

**Advancement Method**
8'' Hollow Stem Auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Logged by**
AC

**Boring Started**
01-03-2024

**Boring Completed**
01-03-2024

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Boring Log No. B-2

Location: See Exploration Plan

Latitude: 32.7132° Longitude: -115.1686°

| Model Layer | Depth (Ft.) | Description | Sample Depth (Ft.) | Water Level Observations | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | **POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, tannish brown | | | | | | | |
| | | loose | 2.5–4 | | 2-4-5 N=9 | | | NP | 6 |
| | | medium dense | 5–6.5 | | 9-15-15 | 2.9 | 97 | | |
| | | tan | 7.5–9 | | 8-10-11 N=21 | | | | |
| | | | 10–11.5 | | 10-23-24 | 15.7 | 87 | | |
| | | | ~13.5 | ▽ | | | | | |
| | 15.0 | | | | | | | | |
| 2 | | **SILTY SAND (SM)**, brown, medium dense | 15–16.5 | | 5-6-7 N=13 | | | | |
| | | very dense | 20–20.5 | | 50/6" | 18.0 | 109 | | |
| | 21.5 | | | | | | | | |
| | | ***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.

**Notes**

**Water Level Observations**
▽ While drilling

**Advancement Method**
8'' Hollow Stem Auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Logged by**
AC

**Boring Started**
01-03-2024

**Boring Completed**
01-03-2024

Perkins Solar
Imperial County, CA
Terracon Project No. 60235062

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Boring Log No. B-3

Location: See Exploration Plan

Latitude: 32.7153° Longitude: -115.1718°

| Model Layer | Depth (Ft.) | Material Description | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.0–10.0 | **POORLY GRADED SAND WITH SILT (SP-SM)**, tan | | | | | | | |
| | | loose | | | 7-8-10 | 1.4 / 0.6 | 100 | | 6 |
| | 5 | medium dense | | | 4-6-9 N=15 | | | | |
| | | | | | 13-18-20 | 1.9 | 83 | | |
| 2 | 10.0–20.0 | **SILTY SAND (SM)**, tannish brown, medium dense | ▽ | | 4-6-7 N=13 | | | | |
| | 15 | | | | 4-6-8 N=14 | | | | |
| 3 | 20.0–30 | **POORLY GRADED SAND (SP)**, trace silt, tan, loose | | | 3-2-2 N=4 | | | NP | |
| | 25 | | | | 2-3-4 N=7 | | | | |

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.

**Water Level Observations**
▽ While drilling

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Logged by**
AC

**Boring Started**
01-04-2024

**Boring Completed**
01-04-2024

**Notes**

**Advancement Method**
8'' Hollow Stem Auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Boring Log No. B-3

Location: See Exploration Plan

Latitude: 32.7153° Longitude: -115.1718°

| Model Layer | Graphic Log | Depth (Ft.) / Description | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | **POORLY GRADED SAND (SP)**, trace silt, tan, loose *(continued)* loose | | | X | 1-2-2 N=4 | | | | 1 |
| | | medium dense | 35 | | X | 5-6-7 N=13 | | | | |
| | | | 40 | | X | 6-8-13 N=21 | | | | |
| | | | 45 | | X | 3-8-13 N=21 | | | | |
| | | loose | 50 | | X | 6-4-5 N=9 | | | | |
| | | 51.5 | | | | | | | | |
| | | ***Boring Terminated at 51.5 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.

**Notes**

**Water Level Observations**
While drilling

**Advancement Method**
8'' Hollow Stem Auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Logged by**
AC

**Boring Started**
01-04-2024

**Boring Completed**
01-04-2024

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Boring Log No. B-4

Location: See Exploration Plan

Latitude: 32.7176° Longitude: -115.1700°

| Model Layer | Graphic Log | Depth (Ft.) / Description | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | **POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, tannish brown | | | | | | | | |
| | | tan, loose | | | | 2-4-4 N=8 | 1.8 | | NP | 8 |
| | | medium dense | 5 | | | 6-12-13 | 0.5 | 95 | | |
| | | | | | | 5-8-10 N=18 | | | | |
| | | | 10 | | | 15-20-23 | 9.0 | 94 | | |
| | | 15.0 | | ▽ | | | | | | |
| 2 | | **SILTY SAND (SM)**, brown, medium dense | 15 | | | 5-7-10 N=17 | | | | |
| | | very dense | 20 | | | 25-50/6" | 24.5 | 77 | | |
| | | 21.0 | | | | | | | | |

***Boring Terminated at 21 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.

**Notes**

**Water Level Observations**
▽ While drilling

**Advancement Method**
8'' Hollow Stem Auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Logged by**
AC

**Boring Started**
01-03-2024

**Boring Completed**
01-03-2024

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Boring Log No. B-5

Location: See Exploration Plan

Latitude: 32.7202° Longitude: -115.1668°

| Model Layer | Graphic Log | Depth (Ft.) / Description | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | **POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, tan | | | | | | | | |
| | | medium dense | | | | 7-10-11 | 0.5 | 96 | | 7 |
| | | | 5 | | | 4-5-6 N=11 | | | | |
| | | | | | | 10-15-17 | 0.7 | 92 | | |
| | | | 10 | | | 6-11-13 N=24 | | | | |
| | | | 15 | | | 12-20-24 | 10.1 | 90 | | |
| | | | 20 | ▽ | | 4-12-13 N=25 | | | | |
| | | 21.5 | | | | | | | | |
| | | ***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.

**Notes**

**Water Level Observations**
▽ While drilling

**Advancement Method**
8'' Hollow Stem Auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Logged by**
AC

**Boring Started**
01-03-2024

**Boring Completed**
01-03-2024

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Boring Log No. B-6

Location: See Exploration Plan

Latitude: 32.7192° Longitude: -115.1630°

| Model Layer | Depth (Ft.) | Material Description | Sample Depth (Ft.) | Water Level Observations | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | **POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, tan | | | | 1.3 | | | |
| | | medium dense | | | 4-6-7 N=13 | | | | |
| | 5.0 | | | | | | | | |
| 2 | | **SILTY SAND (SM)**, trace gravel, grayish brown, medium dense | 5 | | 19-23-24 | 7.0 | 92 | | |
| | | tan | | | 7-11-15 N=26 | | | | |
| | | | 10 | | 13-19-25 | 0.5 | 96 | | |
| | | brownish tan | 15 | | 5-8-13 N=21 | | | | 19 |
| | | | 20 | | 17-23-26 | 11.8 | 107 | | |
| | 25.0 | | | ▽ | | | | | |
| 3 | | **POORLY GRADED SAND (SP)**, trace silt, light brown, medium dense | 25 | | 4-7-12 N=19 | | | NP | |
| | 30.0 | | 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.

**Water Level Observations**
▽ While drilling

**Notes**

**Advancement Method**
8" Hollow Stem Auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Logged by**
AC

**Boring Started**
01-02-2024

**Boring Completed**
01-02-2024

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Boring Log No. B-6

Location: See Exploration Plan

Latitude: 32.7192° Longitude: -115.1630°

| Model Layer | Graphic Log | Depth (Ft.) / Description | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | **POORLY GRADED SAND (SP)**, trace silt, light brown, loose | | | | 4-2-2 N=4 | | | | 2 |
| | | medium dense | 35 | | | 7-10-13 N=23 | | | | |
| | | dense | 40 | | | 8-12-18 N=30 | | | | |
| | | very dense | 45 | | | 10-27-31 N=58 | | | | |
| | | dense | 50 | | | 10-12-21 N=33 | | | | |
| | | 51.5 | | | | | | | | |
| | | ***Boring Terminated at 51.5 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.

**Notes**

**Water Level Observations**
While drilling

**Advancement Method**
8'' Hollow Stem Auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Logged by**
AC

**Boring Started**
01-02-2024

**Boring Completed**
01-02-2024

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Test Pit Log No. TP-1

| Model Layer | Graphic Log | Location: See Exploration Plan<br>Latitude: 32.7147° Longitude: -115.1766°<br>Depth (Ft.) | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | **POORLY GRADED SAND WITH SILT (SP-SM)**, brown<br>white and gray<br>10.0 | 5<br>10 | | Hand | | | | | |
| | | ***Test Pit 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.

**Notes**
Unable to measure depth

**Water Level Observations**
Groundwater not encountered

**Advancement Method**
Bucket

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Excavator**
Excavator

**Operator**
Lourenco

**Logged by**
JB

**Test Pit Started**
01-04-2024

**Test Pit Completed**
01-04-2024

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Test Pit Log No. TP-2

Location: See Exploration Plan

Latitude: 32.7167° Longitude: -115.1673°

| Model Layer | Graphic Log | Depth (Ft.) | Description | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | | **POORLY GRADED SAND WITH SILT (SP-SM)**, brown | | | Grab | | | | NP | 5 |
| | | | gray | | | | | | | | |
| | | | light brown | 5 | | | | | | | |
| | | 10.0 | | 10 | | | | | | | |
| | | | ***Test Pit 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.

**Notes**
Unable to measure depth

**Water Level Observations**
Groundwater not encountered

**Advancement Method**
Bucket

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Excavator**
Excavator

**Operator**
Lourenco

**Logged by**
JB

**Test Pit Started**
01-04-2024

**Test Pit Completed**
01-04-2024

terracon
23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Test Pit Log No. TP-3

| Model Layer | Graphic Log | Location: See Exploration Plan<br>Latitude: 32.7213° Longitude: -115.1629°<br>Depth (Ft.) | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | **POORLY GRADED SAND WITH SILT (SP-SM)**, tan<br>light brown<br>9.0 | 5 | | | | | | | |
| | | ***Test Pit Terminated at 9 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.

**Notes**

**Water Level Observations**
Groundwater not encountered

**Advancement Method**
Bucket

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Excavator**
Excavator

**Operator**
Lourenco

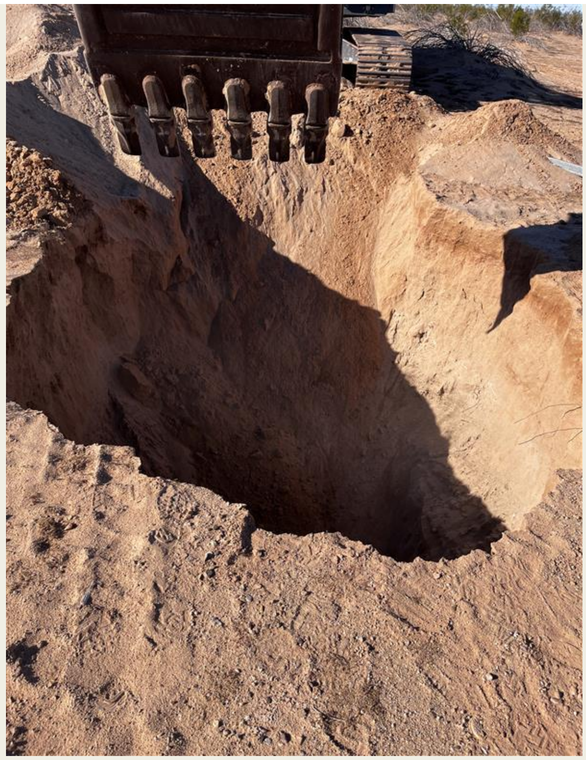
**Logged by**
JB

**Test Pit Started**
01-04-2024

**Test Pit Completed**
01-04-2024

# TEST PITS PHOTO LOG

| Perkins Solar | |
|---|---|
| **Test Pit ID** | |
| TP-1 |  |

| Test Pit ID | |
|---|---|
| TP-2 |  |
| TP-3 |  |

# Laboratory Test Results

**Contents:**

# Laboratory Testing Procedures

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Dry Unit Weight
- Atterberg Limits
- Percent Finer Than No. 200 Sieve
- Modified Proctor Compaction Test
- Direct Shear
- California Bearing Ratio

The laboratory testing program also included review of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

**Thermal Resistivity(pending):** Thermal resistivity tests will be analyzed by Geotherm USA. Terracon collected bulk samples of subsurface materials obtained within the proposed structural areas. Each bulk sample had a Modified Proctor test performed, and each bulk sample was tested for thermal resistivity tests on samples remolded to 85% relative density. The percent compaction is based on comparing to the material's maximum dry density as determined by test method ASTM D1557 (Modified Proctor). Tests included a minimum of 4 readings, including optimum moisture content or as-received moisture (whichever is higher), totally dry condition, and 2 intermediate moisture contents.

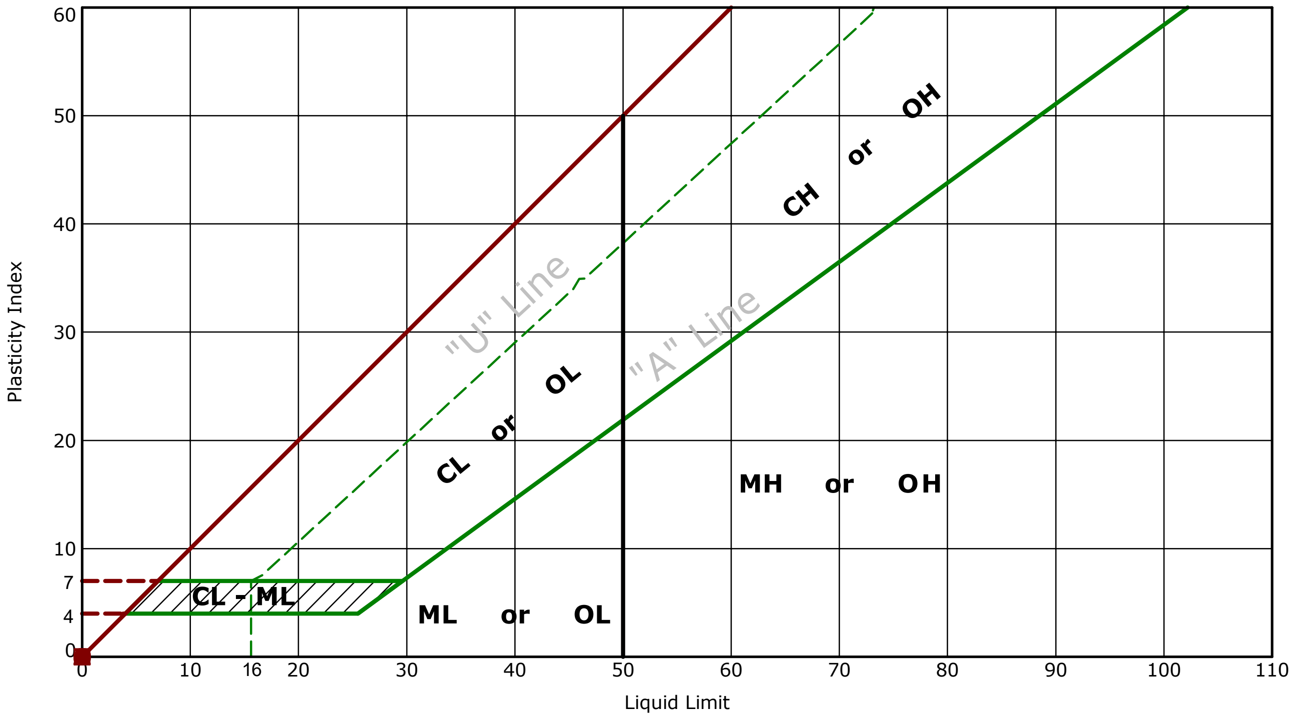
**Corrosivity Testing (pending):** Bulk samples of near surface soils will be tested in the laboratory for the following properties in general accordance with the corresponding standards:

- pH Analysis (ASTM G51)
- Chloride (ASTM D512)
- Sulfate (ASTM C1580)
- Sulfide Content (AWWA 4500-S D)
- Oxidation-Reduction Potential (ASTM G200)
- Electrical Resistivity Testing (ASTM G187)

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Atterberg Limit Results

## ASTM D4318

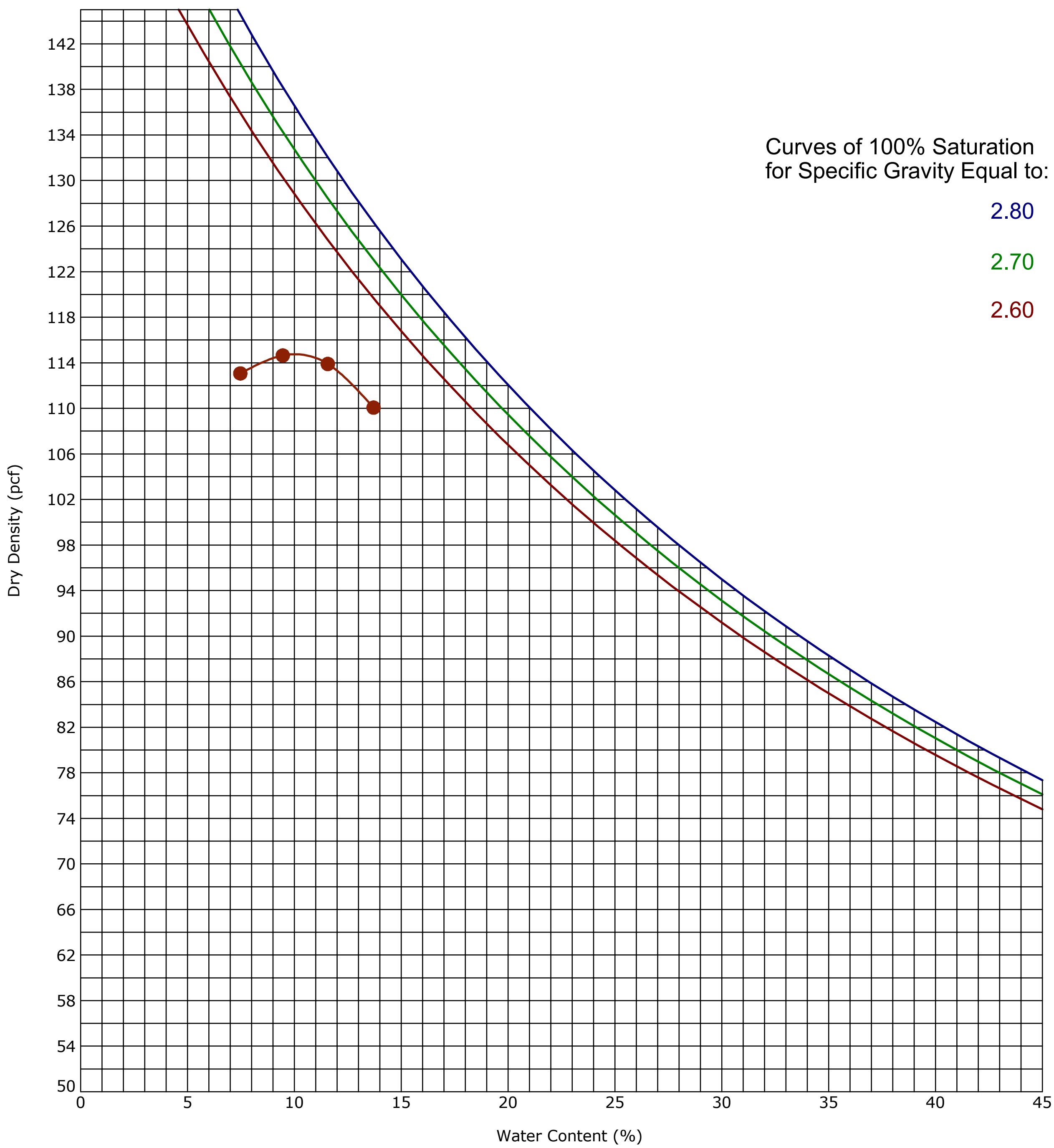



| | Boring ID | Depth (Ft) | LL | PL | PI | Fines | USCS | Description |
|---|---|---|---|---|---|---|---|---|
| ● | B-1 | 5 - 6.5 | NP | NP | NP | | SP-SM | POORLY GRADED SAND WITH SILT |
| ▲ | B-3 | 20 - 21.5 | NP | NP | NP | | SP | POORLY GRADED SAND |
| ★ | B-4 | 0 - 5 | NP | NP | NP | 7.8 | SP-SM | POORLY GRADED SAND WITH SILT |
| ⊙ | B-6 | 25 - 26.5 | NP | NP | NP | | SP | POORLY GRADED SAND |

terracon
23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Moisture-Density Relationship

## ASTM D1557-Method A



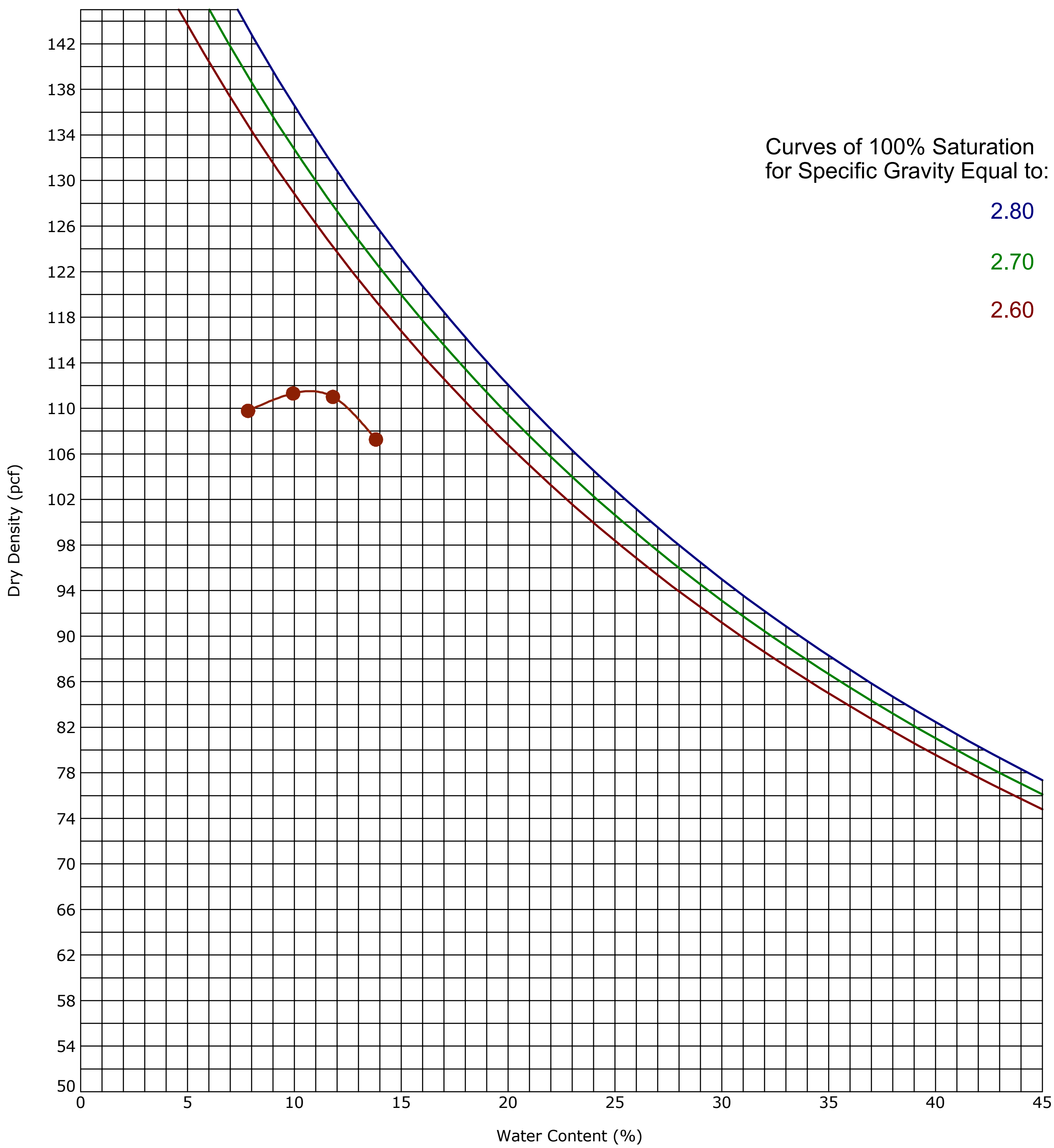

| Boring ID | Depth (Ft) | Description of Materials |
|---|---|---|
| B-1 | 0 - 5 | POORLY GRADED SAND WITH SILT |

| Fines (%) | Fraction > mm size | LL | PL | PI | Test Method | Maximum Dry Density (pcf) | Optimum Water Content (%) |
|---|---|---|---|---|---|---|---|
| 10 | | | | | ASTM D1557-Method A | 114.8 | 10.0 |

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Moisture-Density Relationship

## ASTM D1557-Method C



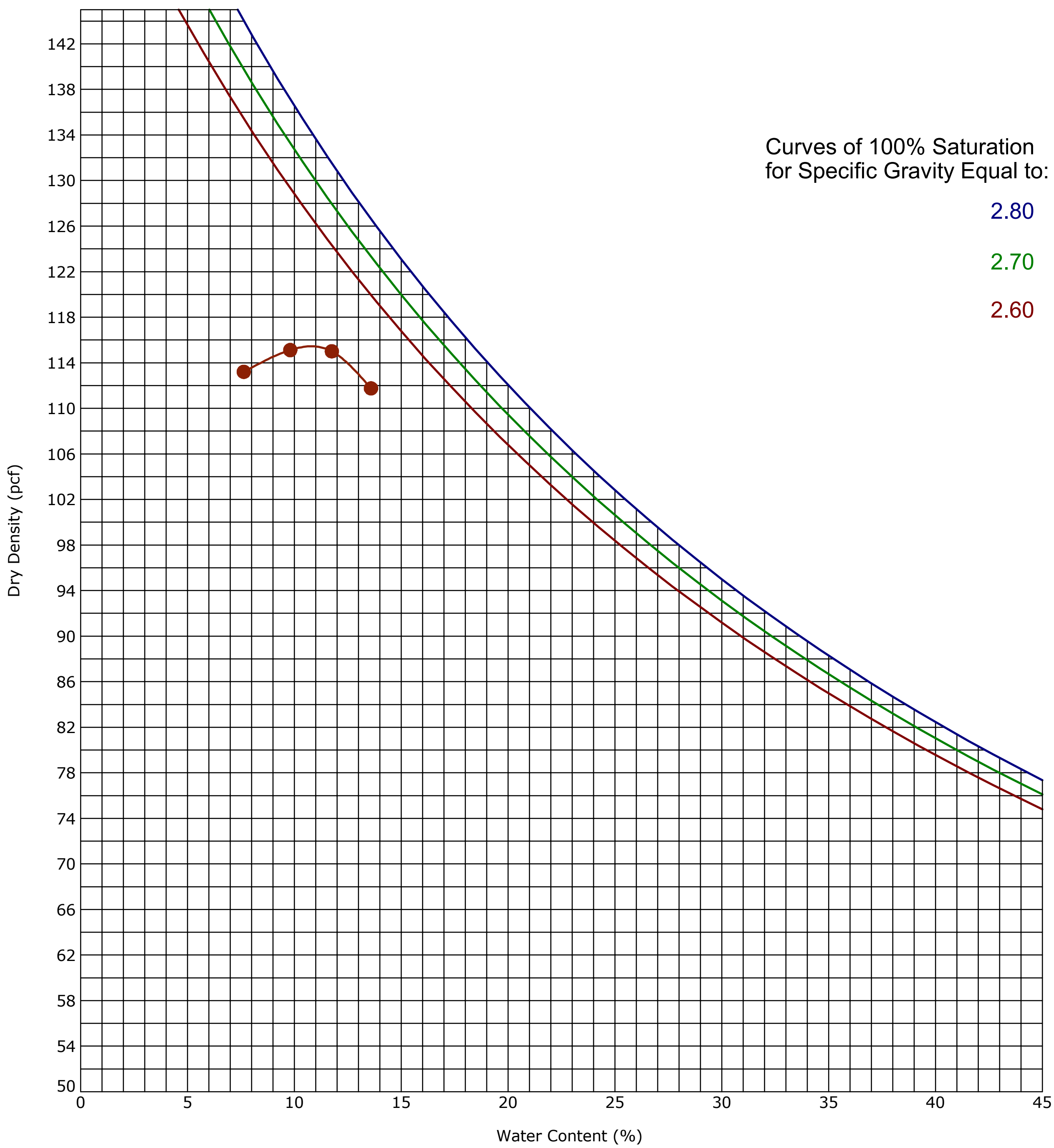

| Boring ID | Depth (Ft) | Description of Materials |
|---|---|---|
| B-3 | 0 - 5 | POORLY GRADED SAND WITH SILT |

| Fines (%) | Fraction > mm size | LL | PL | PI | Test Method | Maximum Dry Density (pcf) | Optimum Water Content (%) |
|---|---|---|---|---|---|---|---|
| 6 | | | | | ASTM D1557-Method C | 111.5 | 10.7 |

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Moisture-Density Relationship

## ASTM D1557-Method A



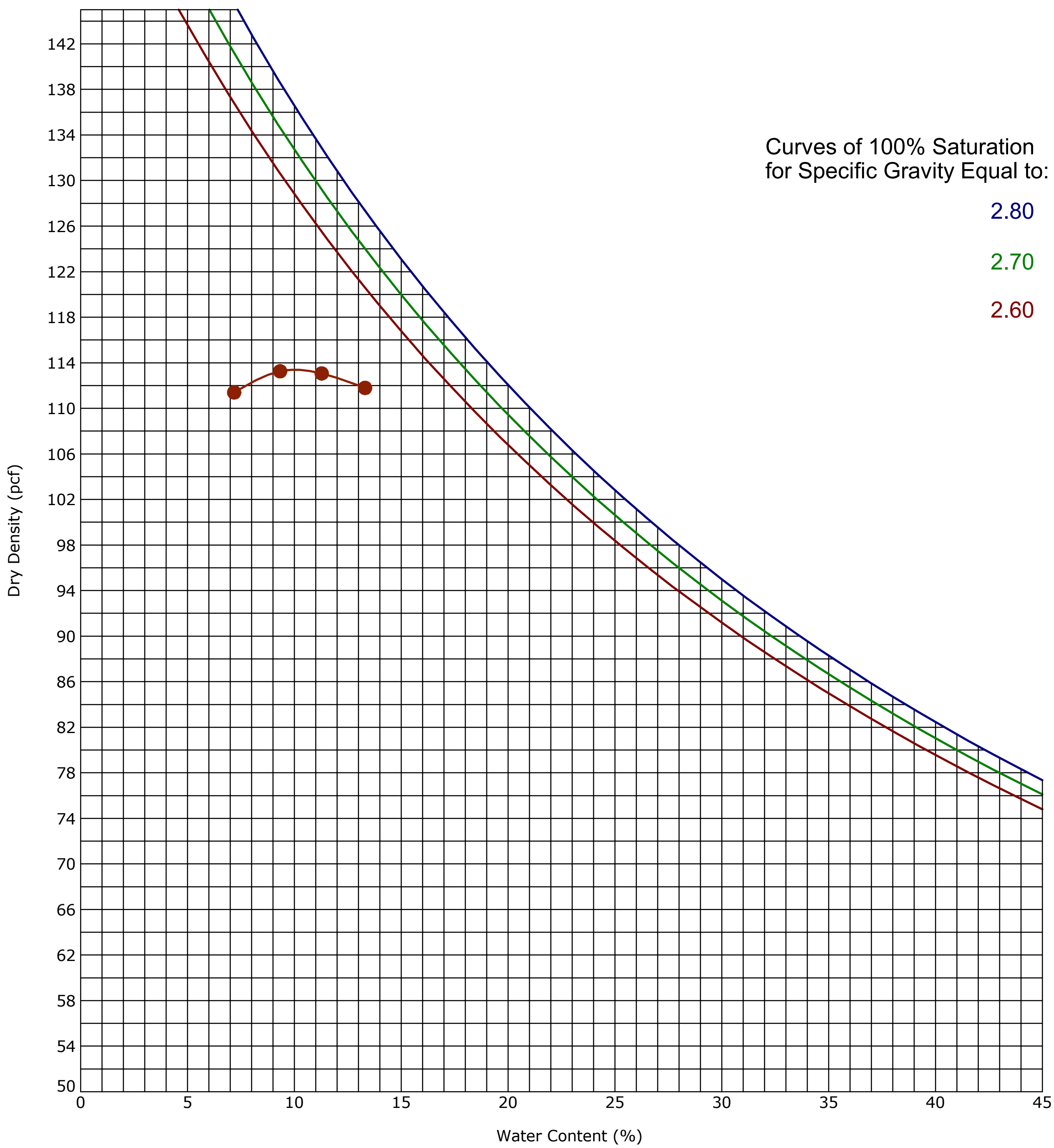

| Boring ID | Depth (Ft) | Description of Materials |
|---|---|---|
| B-4 | 0 - 5 | POORLY GRADED SAND WITH SILT |

| Fines (%) | Fraction > mm size | LL | PL | PI | Test Method | Maximum Dry Density (pcf) | Optimum Water Content (%) |
|---|---|---|---|---|---|---|---|
| 8 | | NP | NP | NP | ASTM D1557-Method A | 115.4 | 10.8 |

23041 Avenida De La Carlota Ste 350
Laguna Hills, CA

# Moisture-Density Relationship

## ASTM D1557-Method A




| Boring ID | Depth (Ft) | Description of Materials |
|---|---|---|
| B-6 | 0 - 4 | POORLY GRADED SAND WITH SILT |

| Fines (%) | Fraction > mm size | LL | PL | PI | Test Method | Maximum Dry Density (pcf) | Optimum Water Content (%) |
|---|---|---|---|---|---|---|---|
| | | | | | ASTM D1557-Method A | 113.4 | 10.0 |

Perkins Solar
Imperial County, CA
Terracon Project No.: 60235062

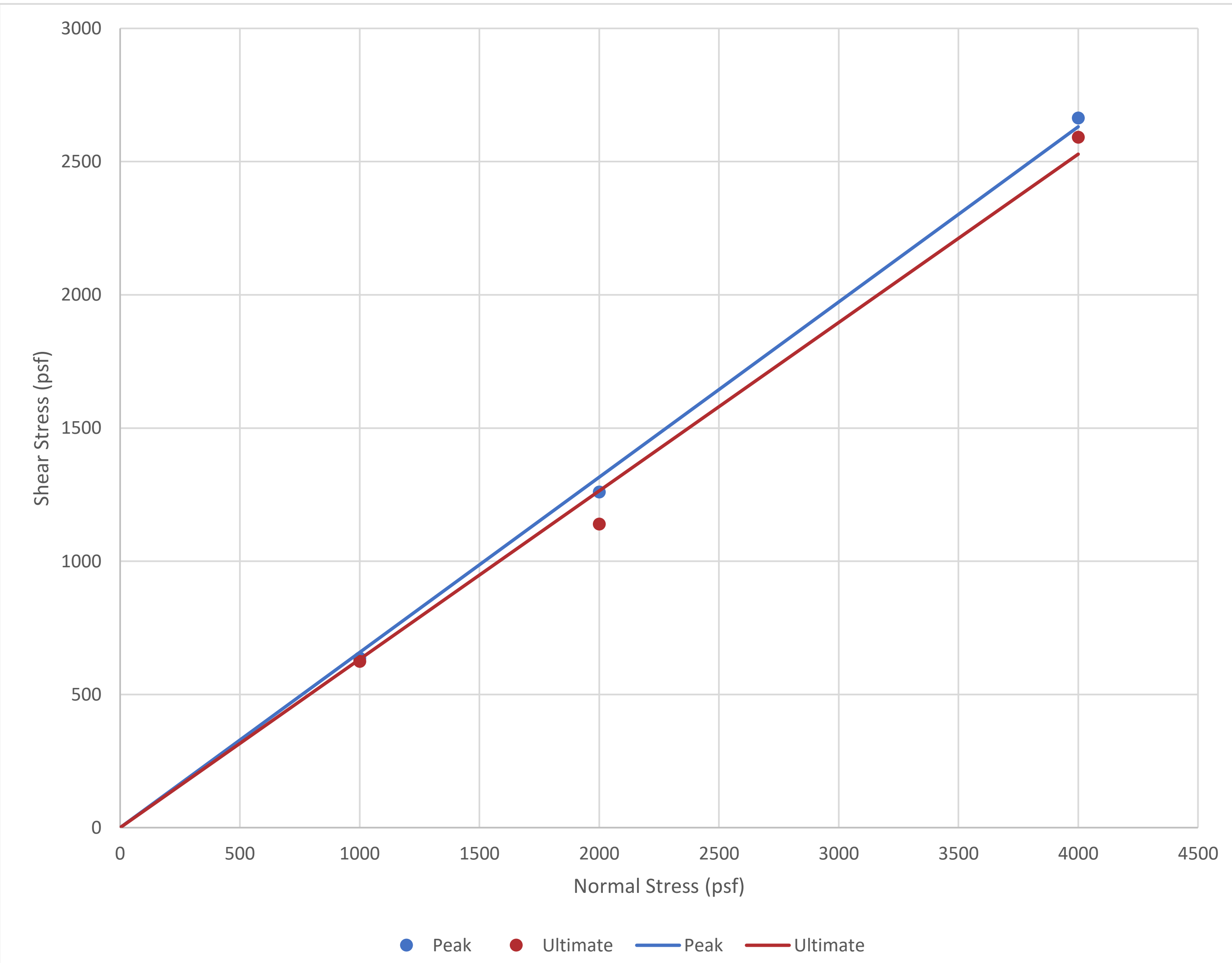
Terracon
145 W Walnut St.
Gardena, CA

# Direct Shear Test

## ASTM D3080

| Boring ID | Depth (ft) | Description | USCS | $\gamma_d$ (pcf) | W(%) |
|---|---|---|---|---|---|
| B-1 | 7.5 | Poorly Graded Sand with Silt | SP-SM | 88 | 4.3 |

| Normal Stress (psf) | Peak Shear Stress (psf) | Ultimate Shear Stress (psf) | Peak | | Ultimate | |
|---|---|---|---|---|---|---|
| | | | φ° | C (psf) | φ° | C (psf) |
| 1000 | 636 | 624 | **34.0** | **0** | **34.0** | **0** |
| 2000 | 1260 | 1140 | | | | |
| 4000 | 2664 | 2592 | | | | |



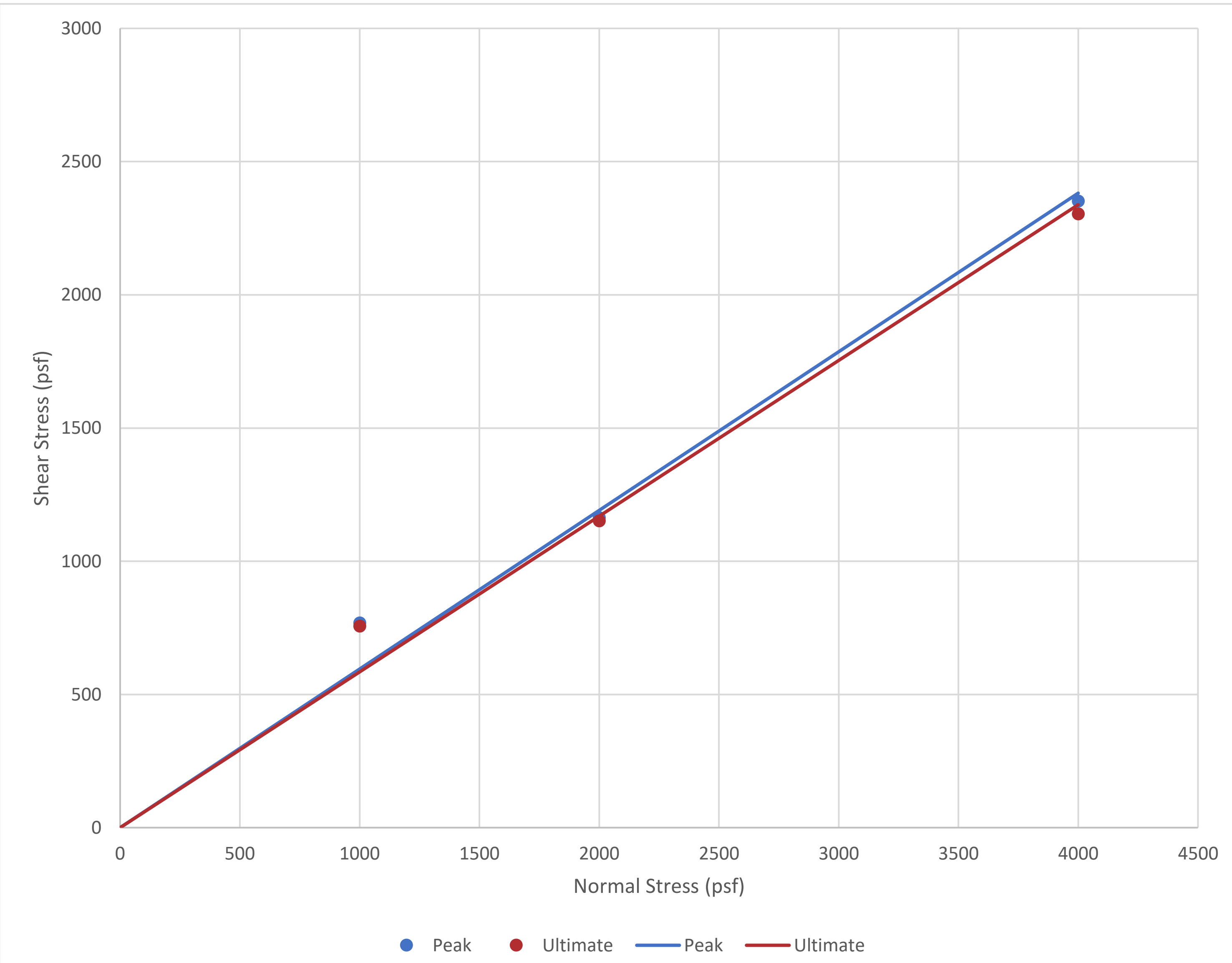
145 W Walnut St.
Gardena, CA

# Direct Shear Test

## ASTM D3080

| Boring ID | Depth (ft) | Description | USCS | $\gamma_d$ (pcf) | W(%) |
|---|---|---|---|---|---|
| B-6 | 5 | Silty Sand | SP-SM | 88 | 4.3 |

| Normal Stress (psf) | Peak Shear Stress (psf) | Ultimate Shear Stress (psf) | Peak | | Ultimate | |
|---|---|---|---|---|---|---|
| | | | φ° | C (psf) | φ° | C (psf) |
| 1000 | 768 | 756 | **28.0** | **170** | **28.0** | **180** |
| 2000 | 1164 | 1152 | | | | |
| 4000 | 2352 | 2304 | | | | |



AP Engineering and Testing, Inc.
DBE|MBE|SBE
2607 Pomona Boulevard | Pomona, CA 91768
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.com

# CALIFORNIA BEARING RATIO (CBR)
# OF LABORATORY-COMPACTED SOIL
ASTM D 1883

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Perkins Solar | Tested By : | SM | Date | 01/15/24 |
| Project No. : | 60235062 | Input By: | JP | Date | 01/17/24 |
| Boring No.: | B-3 | Checked By: | AP | Date | 01/18/24 |
| Sample No.: | - | | | | |
| Depth (ft.) : | 1-4 | | | | |
| Soil Description : | Poorly Graded Sand with Silt | | | | |

SAMPLE DESCRIPTION BEFORE SOAKING

| | |
|---|---|
| Mold Number | G |
| Blows Per Layer | 10 |
| Wt of Wet Soil & Mold (gm) | 11609.5 |
| Weight of Mold (gm) | 7822.5 |
| Weight of Wet Soil (gm) | 3787 |
| Mold Volume (cu.ft) | 0.0750 |
| Container No. | |
| Wet Wt. Soil + Container (gm) | 880.5 |
| Dry Wt. Soil + Container (gm) | 840.12 |
| Wt. Container (gm) | 452.77 |
| Moisture Content (%) | 10.42 |
| Wet Density (pcf) | 111.3 |
| Dry Density (pcf) | 100.8 |

SAMPLE PREPARATION

| | |
|---|---|
| Wt of Hammer (Lbs) | 10 |
| No. of Layers | 5 |
| No. of Blows/Layer | 10 |
| Drop Height (inches) | 18 |
| Surcharge Weight (Lbs) | 10 |
| Max. Dry Density (pcf)* | 111.5 |
| Molded Relative Comp (%) | 90.4 |
| Req'd % Moisture | 10.7 |
| No. of Trials | 1 |
| % Retained 3/4" Sieve | 0.00% |

*Note: Max. dry density provided by Terracon*

DEFORMATION DURING SOAKING PERIOD

Sample Length (inch) 4.584

| DATE | TIME | Mold No.: G Dial Rdgs | Swell (in) |
|---|---|---|---|
| 01/15/24 | 15:35 | 0.0720 | |
| 01/16/24 | 08:10 | 0.0650 | |
| 01/17/24 | 08:10 | 0.0630 | -0.0090 |
| | | | |
| Percent Swell/Collapse (+/-) | | | -0.20 |

AFTER SOAKING

| | |
|---|---|
| Mold Number | G |
| Wt. of Wet Soil + Mold (gm) | 11876 |
| Weight of Mold (gm) | 7823 |
| Weight of Wet Soil (gm) | 4053 |
| Final Sample Volume (cu.ft) | 0.0749 |
| | |
| Container No. | |
| Wet Wt. Soil + Container (gm) | 663.36 |
| Dry Wt. Soil + Container (gm) | 595.67 |
| Wt. Container (gm) | 149.66 |
| Mosture Content (%) | 15.2 |
| | |
| Wet Density (pcf) | 119.4 |
| After Test Dry Density (pcf) | 103.7 |

**TEST LOAD DATA**

Piston Diameter (inches): 1.954

| Penetration (inch) | Mold No.: G LOAD (lb) | Stress (psi) |
|---|---|---|
| 0.000 | 0 | 0.00 |
| 0.025 | 13 | 4.34 |
| 0.050 | 26 | 8.67 |
| 0.075 | 39 | 13.01 |
| 0.100 | 52 | 17.34 |
| 0.125 | 64 | 21.34 |
| 0.150 | 76 | 25.34 |
| 0.175 | 89 | 29.68 |
| 0.200 | 101 | 33.68 |
| 0.225 | 114 | 38.02 |
| 0.250 | 126 | 42.02 |
| 0.275 | 139 | 46.35 |
| 0.300 | 150 | 50.02 |
| 0.325 | 163 | 54.36 |
| 0.350 | 177 | 59.02 |
| 0.375 | 190 | 63.36 |
| 0.400 | 204 | 68.03 |
| 0.425 | 218 | 72.70 |
| 0.450 | 234 | 78.03 |
| 0.475 | 248 | 82.70 |
| 0.500 | 262 | 87.37 |

**TEST RESULTS**

**CBR @ .1":** 2

**CBR @ .2":** 2

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# CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOIL
ASTM D 1883

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Perkins Solar | Tested By : | SM | Date | 01/15/24 |
| Project No. : | 60235062 | Input By: | JP | Date | 01/17/24 |
| Boring No.: | B-3 | Checked By: | AP | Date | 01/18/24 |
| Sample No.: | - | | | | |
| Depth (ft.) : | 1-4 | | | | |
| Soil Description : | Poorly Graded Sand with Silt | | | | |

SAMPLE DESCRIPTION BEFORE SOAKING

| | |
|---|---|
| Mold Number | H |
| Blows Per Layer | 25 |
| Wt of Wet Soil & Mold (gm) | 11844.5 |
| Weight of Mold (gm) | 7836.5 |
| Weight of Wet Soil (gm) | 4008 |
| Mold Volume (cu.ft) | 0.0750 |
| Container No. | |
| Wet Wt. Soil + Container (gm) | 880.5 |
| Dry Wt. Soil + Container (gm) | 840.12 |
| Wt. Container (gm) | 452.77 |
| Moisture Content (%) | 10.42 |
| Wet Density (pcf) | 117.8 |
| Dry Density (pcf) | 106.7 |

SAMPLE PREPARATION

| | |
|---|---|
| Wt of Hammer (Lbs) | 10 |
| No. of Layers | 5 |
| No. of Blows/Layer | 25 |
| Drop Height (inches) | 18 |
| Surcharge Weight (Lbs) | 10 |
| Max. Dry Density (pcf)* | 111.5 |
| Molded Relative Comp (%) | 95.7 |
| Req'd % Moisture | 10.7 |
| No. of Trials | 1 |
| % Retained 3/4" Sieve | 0.00% |

*Note: Max. dry density provided by Terracon*

DEFORMATION DURING SOAKING PERIOD

Sample Length (inch) 4.584

| DATE | TIME | Mold No.: H | |
|---|---|---|---|
| | | Dial Rdgs | Swell (in) |
| 01/15/24 | 15:35 | 0.1020 | |
| 01/16/24 | 08:10 | 0.0960 | |
| 01/17/24 | 08:10 | 0.0950 | -0.0070 |
| | | | |
| Percent Swell/Collapse (+/-) | | | -0.15 |

AFTER SOAKING

| | |
|---|---|
| Mold Number | H |
| Wt. of Wet Soil + Mold (gm) | 12047 |
| Weight of Mold (gm) | 7837 |
| Weight of Wet Soil (gm) | 4211 |
| Final Sample Volume (cu.ft) | 0.0749 |
| | |
| Container No. | |
| Wet Wt. Soil + Container (gm) | 623.19 |
| Dry Wt. Soil + Container (gm) | 559.94 |
| Wt. Container (gm) | 137.18 |
| Mosture Content (%) | 15.0 |
| | |
| Wet Density (pcf) | 124.0 |
| After Test Dry Density (pcf) | 107.8 |

**TEST LOAD DATA**

Piston Diameter (inches): 1.954

| Penetration | Mold No.: H | |
|---|---|---|
| (inch) | LOAD (lb) | Stress (psi) |
| 0.000 | 0 | 0.00 |
| 0.025 | 24 | 8.00 |
| 0.050 | 65 | 21.68 |
| 0.075 | 118 | 39.35 |
| 0.100 | 181 | 60.36 |
| 0.125 | 244 | 81.37 |
| 0.150 | 305 | 101.71 |
| 0.175 | 366 | 122.05 |
| 0.200 | 420 | 140.06 |
| 0.225 | 468 | 156.07 |
| 0.250 | 514 | 171.41 |
| 0.275 | 556 | 185.41 |
| 0.300 | 593 | 197.75 |
| 0.325 | 622 | 207.42 |
| 0.350 | 643 | 214.42 |
| 0.375 | 649 | 216.42 |
| 0.400 | 646 | 215.42 |
| 0.425 | 635 | 211.76 |
| 0.450 | 630 | 210.09 |
| 0.475 | 634 | 211.42 |
| 0.500 | 643 | 214.42 |

**TEST RESULTS**

**CBR @ .1": 8**

**CBR @ .2": 10**

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# CALIFORNIA BEARING RATIO (CBR)
# OF LABORATORY-COMPACTED SOIL
ASTM D 1883

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Perkins Solar | Tested By : | SM | Date | 01/15/24 |
| Project No. : | 60235062 | Input By: | JP | Date | 01/17/24 |
| Boring No.: | B-3 | Checked By: | AP | Date | 01/18/24 |
| Sample No.: | - | | | | |
| Depth (ft.) : | 1-4 | | | | |
| Soil Description : | Poorly Graded Sand with Silt | | | | |

SAMPLE DESCRIPTION BEFORE SOAKING

| | |
|---|---|
| Mold Number | I |
| Blows Per Layer | 56 |
| Wt of Wet Soil & Mold (gm) | 12066.5 |
| Weight of Mold (gm) | 7851 |
| Weight of Wet Soil (gm) | 4216 |
| Mold Volume (cu.ft) | 0.0750 |
| Container No. | |
| Wet Wt. Soil + Container (gm) | 880.5 |
| Dry Wt. Soil + Container (gm) | 840.12 |
| Wt. Container (gm) | 452.77 |
| Moisture Content (%) | 10.42 |
| Wet Density (pcf) | 123.9 |
| Dry Density (pcf) | 112.2 |

SAMPLE PREPARATION

| | |
|---|---|
| Wt of Hammer (Lbs) | 10 |
| No. of Layers | 5 |
| No. of Blows/Layer | 56 |
| Drop Height (inches) | 18 |
| Surcharge Weight (Lbs) | 10 |
| Max. Dry Density (pcf)* | 111.5 |
| Molded Relative Comp (%) | 100.6 |
| Req'd % Moisture | 10.7 |
| No. of Trials | 1 |
| % Retained 3/4" Sieve | 0.00% |

*Note: Max. dry density provided by Terracon*

DEFORMATION DURING SOAKING PERIOD

Sample Length (inch) 4.584

| DATE | TIME | Mold No.: I | |
|---|---|---|---|
| | | Dial Rdgs | Swell (in) |
| 01/15/24 | 15:35 | 0.1300 | |
| 01/16/24 | 08:10 | 0.1300 | |
| 01/17/24 | 08:10 | 0.1300 | 0.0000 |
| | | | |
| Percent Swell/Collapse (+/-) | | | 0.00 |

AFTER SOAKING

| | |
|---|---|
| Mold Number | I |
| Wt. of Wet Soil + Mold (gm) | 12199 |
| Weight of Mold (gm) | 7851 |
| Weight of Wet Soil (gm) | 4348 |
| Final Sample Volume (cu.ft) | 0.0750 |
| | |
| Container No. | |
| Wet Wt. Soil + Container (gm) | 685.29 |
| Dry Wt. Soil + Container (gm) | 621.32 |
| Wt. Container (gm) | 142.62 |
| Mosture Content (%) | 13.4 |
| | |
| Wet Density (pcf) | 127.8 |
| After Test Dry Density (pcf) | 112.7 |

**TEST LOAD DATA**

Piston Diameter (inches): 1.954

| Penetration (inch) | Mold No.: I LOAD (lb) | Stress (psi) |
|---|---|---|
| 0.000 | 0 | 0.00 |
| 0.025 | 48 | 16.01 |
| 0.050 | 192 | 64.03 |
| 0.075 | 362 | 120.72 |
| 0.100 | 555 | 185.08 |
| 0.125 | 758 | 252.77 |
| 0.150 | 956 | 318.80 |
| 0.175 | 1135 | 378.49 |
| 0.200 | 1273 | 424.51 |
| 0.225 | 1368 | 456.19 |
| 0.250 | 1413 | 471.20 |
| 0.275 | 1389 | 463.19 |
| 0.300 | 1268 | 422.84 |
| 0.325 | 1145 | 381.83 |
| 0.350 | 1017 | 339.14 |
| 0.375 | 910 | 303.46 |
| 0.400 | 792 | 264.11 |
| 0.425 | 739 | 246.44 |
| 0.450 | 712 | 237.43 |
| 0.475 | 705 | 235.10 |
| 0.500 | 706 | 235.43 |

**TEST RESULTS**

| | |
|---|---|
| **CBR @ .1":** | **27** |
| **CBR @ .2":** | **31** |

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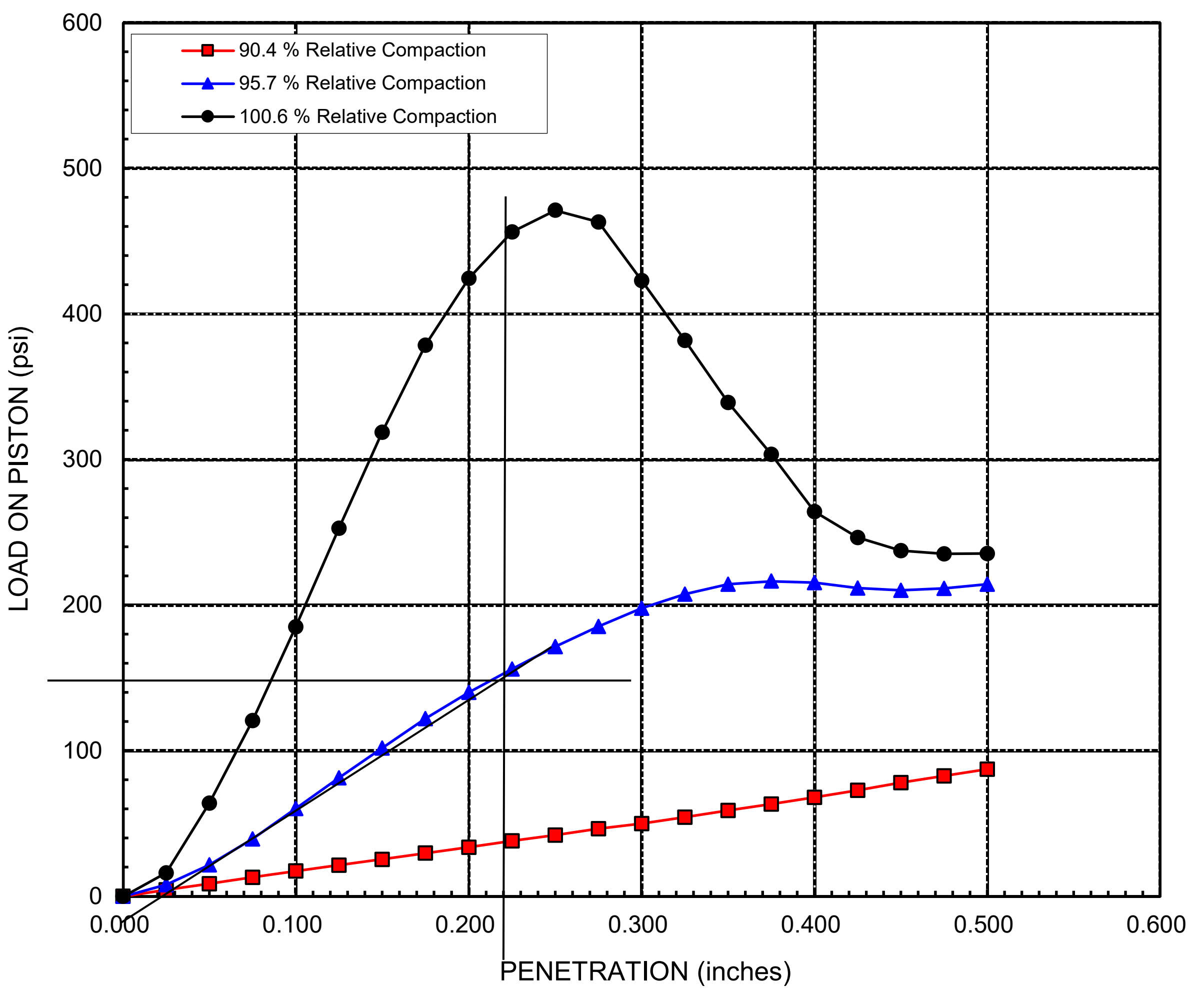
# CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOIL
## ASTM D 1883

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Perkins Solar | Tested By : | SM | Date: | 01/15/24 |
| Project No. : | 60235062 | Data Input By: | JP | Date: | 01/17/24 |
| Boring No.: | B-3 | Checked By: | AP | Date: | 01/18/24 |
| Sample No.: | - | | | | |
| Depth (ft.) : | 1-4 | | | | |
| Soil Description : | Poorly Graded Sand with Silt | | | | |



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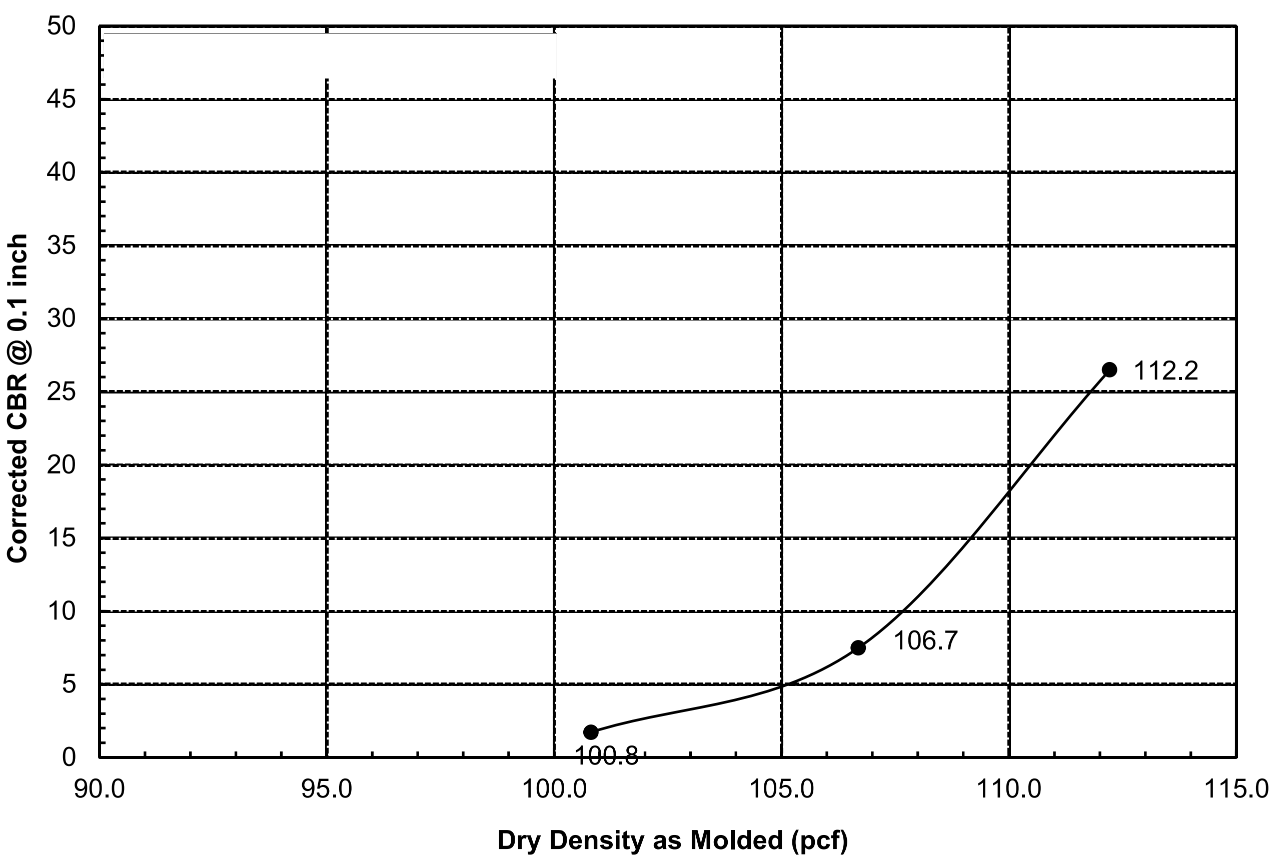
# CALIFORNIA BEARING RATIO (CBR)
# OF LABORATORY-COMPACTED SOIL
# ASTM D 1883

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Perkins Solar | Tested By : | SM | Date: | 01/15/24 |
| Project No. : | 60235062 | Data Input By: | JP | Date: | 01/17/24 |
| Boring No.: | B-3 | Checked By: | AP | Date: | 01/18/24 |
| Sample No.: | - | | | | |
| Depth (ft.) : | 1-4 | | | | |
| Soil Description : | Poorly Graded Sand with Silt | | | | |

## TEST RESULTS

| Dry Density (pcf) | Maximum Dry Density by ASTM D 1557 (pcf) | Relative Compaction (%) | Blow Per Layer | CBR @0.1" | CBR @0.2" |
|---|---|---|---|---|---|
| 100.8 | 111.5 | 90.4 | 10 | 2 | 2 |
| 106.7 | 111.5 | 95.7 | 25 | 8 | 10 |
| 112.2 | 111.5 | 100.6 | 56 | 27 | 31 |

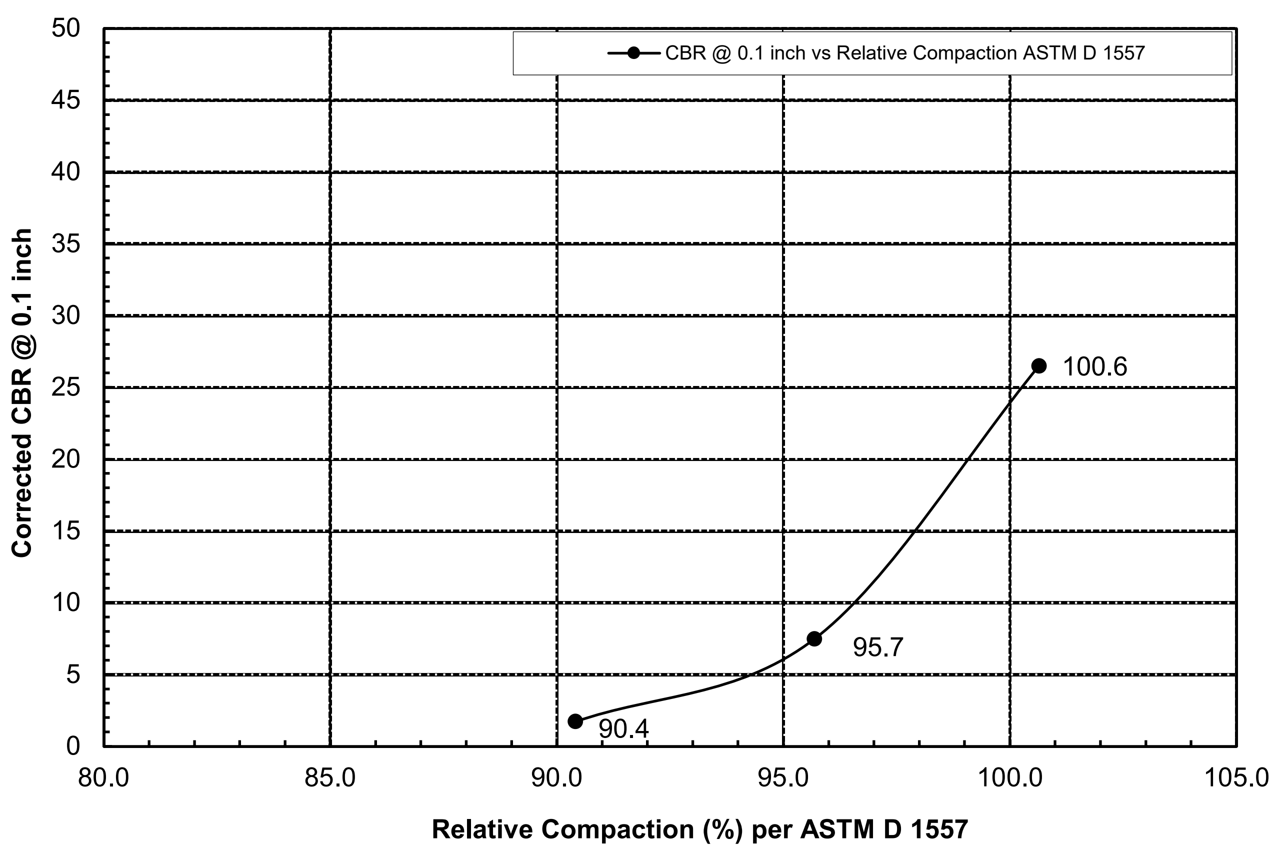


# CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOIL ASTM D 1883

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Perkins Solar | Tested By : | SM | Date: | 01/15/24 |
| Project No. : | 60235062 | Data Input By: | JP | Date: | 01/17/24 |
| Boring No.: | B-3 | Checked By: | AP | Date: | 01/18/24 |
| Sample No.: | - | | | | |
| Depth (ft.) : | 1-4 | | | | |
| Soil Description : | Poorly Graded Sand with Silt | | | | |

## TEST RESULTS

| Dry Density (pcf) | Maximum Dry Density by ASTM D 1557 (pcf) | Relative Compaction (%) | Blow Per Layer | CBR @0.1" | CBR @0.2" |
|---|---|---|---|---|---|
| 100.8 | 111.5 | 90.4 | 10 | 2 | 2 |
| 106.7 | 111.5 | 95.7 | 25 | 8 | 10 |
| 112.2 | 111.5 | 100.6 | 56 | 27 | 31 |



# Field Soil Electrical Resistivity Test Results

**Contents:**

## Field Electrical Resistivity Test Procedures

**Electrical Resistivity Testing**: Soil electrical resistivity data was be obtained in accordance with ASTM G57 Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method. At the test location, two near perpendicular lines was tested. Electrode “a” spacings are summarized in the following table. Electrode spacing was adjusted to conform to site conditions.

| No. of Test Locations | Electrode “a” Spacing (feet) | Location |
|---|---|---|
| 6 | 0.5, 1, 2, 5, 10 and 15 feet | Array Areas |

## Exploration Plan – Electrical Resistivity Locations

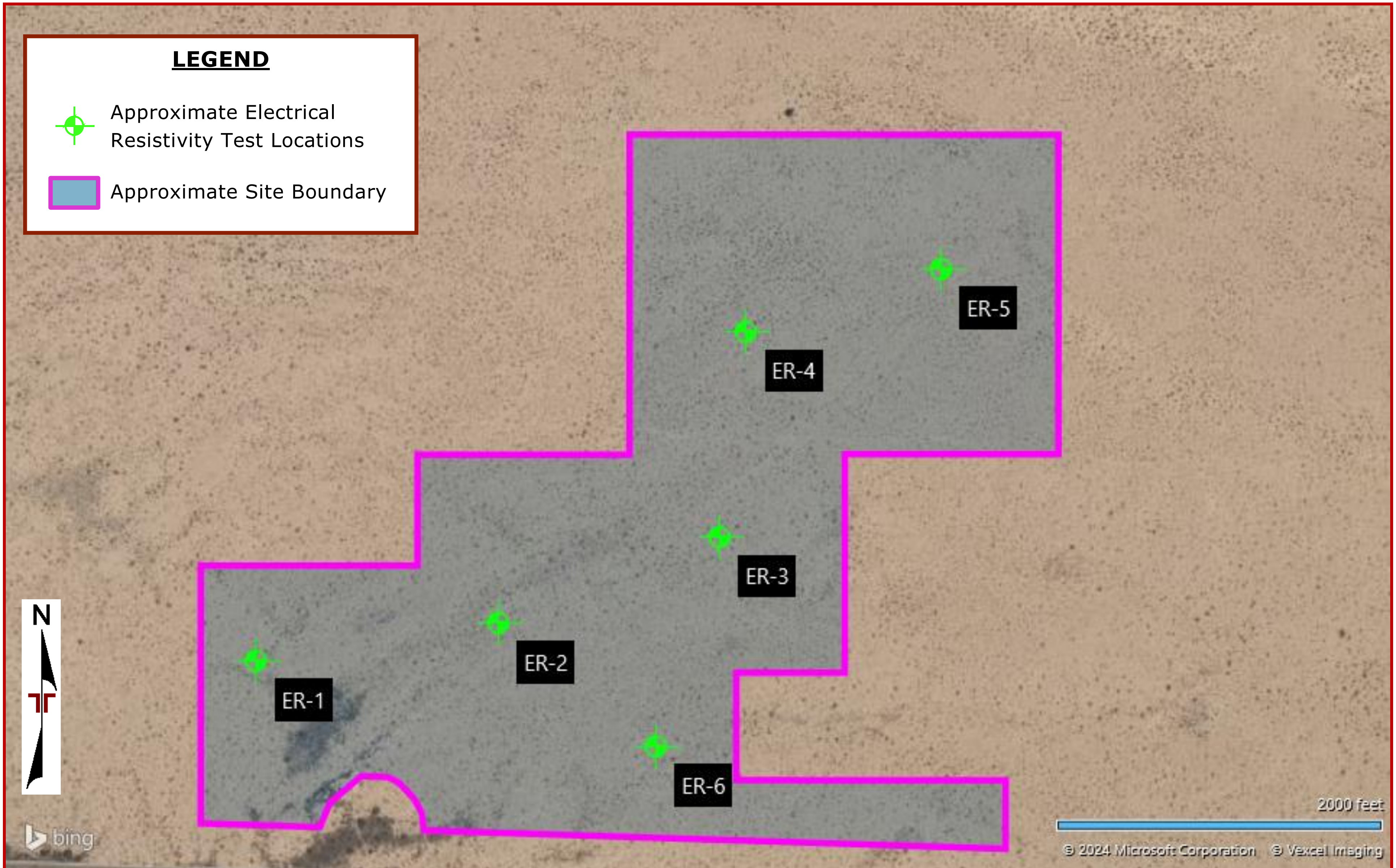



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

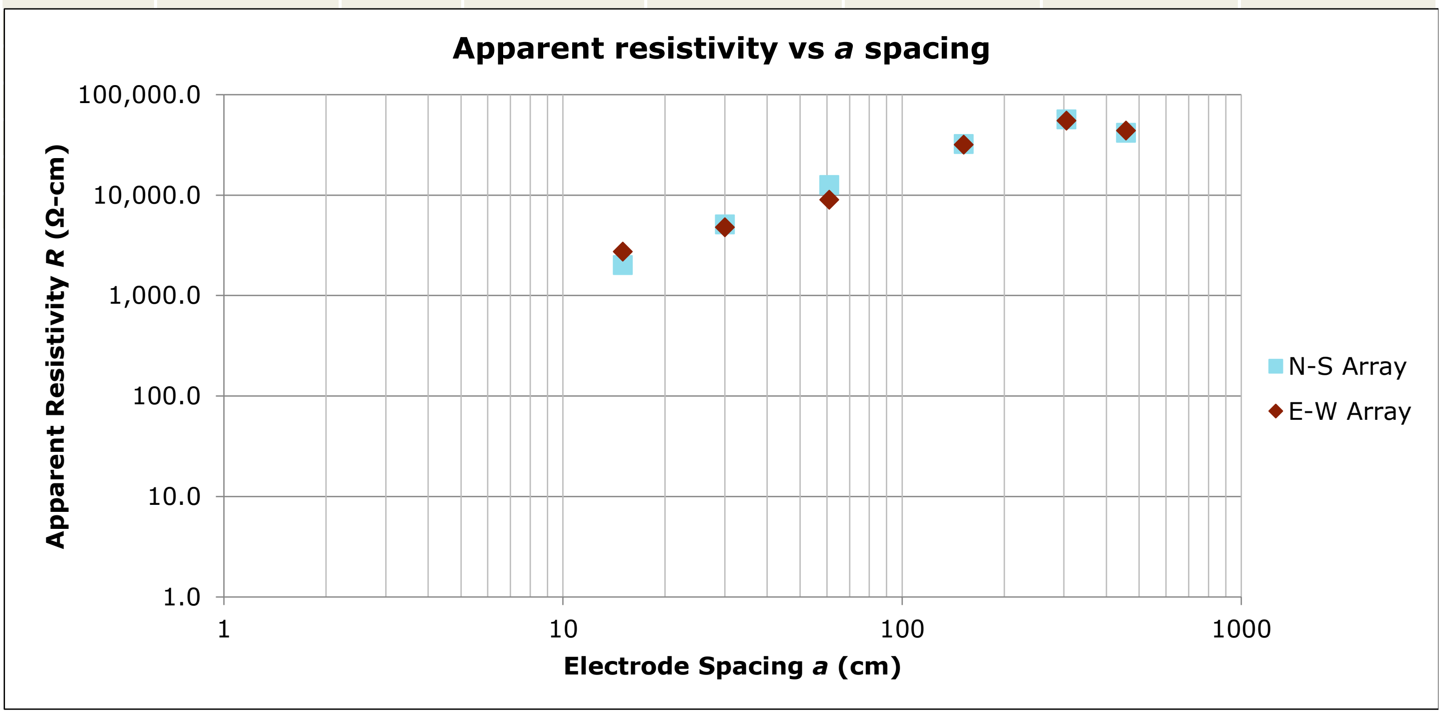
MAP PROVIDED BY MICROSOFT BING MAPS

**FIELD ELECTRICAL RESISTIVITY TEST DATA**
Perkins Solar | Imperial County, California
Terracon Project No. 60235062

| | | | |
|---|---|---|---|
| **Array Loc.** | ER-1 (32.714658, -115.176620) | | |
| **Instrument** | MiniSting | **Weather** | Sunny |
| **Serial #** | SZ107129 | **Ground Cond.** | Exposed Soils |
| **Cal. Check** | | **Tested By** | AT |
| **Test Date** | January 3, 2024 | **Method** | Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012) |
| **Notes & Conflicts** | | | |

Apparent resistivity $\rho$ is calculated as : $$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$

| Electrode Spacing *a* | | Electrode Depth *b* | | N-S Test | | E-W Test | |
|---|---|---|---|---|---|---|---|
| (feet) | (centimeters) | (inches) | (centimeters) | Measured Resistance *R* Ω | Apparent Resistivity *ρ* (Ω-cm) | Measured Resistance *R* Ω | Apparent Resistivity *ρ* (Ω-cm) |
| 0.5 | 15 | 2 | 5 | 18.4 | 2020 | 25.0 | 2750 |
| 1 | 30 | 2 | 5 | 25.9 | 5110 | 24.3 | 4800 |
| 2 | 61 | 2 | 5 | 32.4 | 12580 | 23.2 | 9010 |
| 5 | 152 | 2 | 5 | 33.7 | 32250 | 33.3 | 31820 |
| 10 | 305 | 2 | 5 | 29.6 | 56830 | 28.9 | 55370 |
| 15 | 457 | 2 | 5 | 14.5 | 41700 | 15.4 | 44090 |
| | | | | | | | |



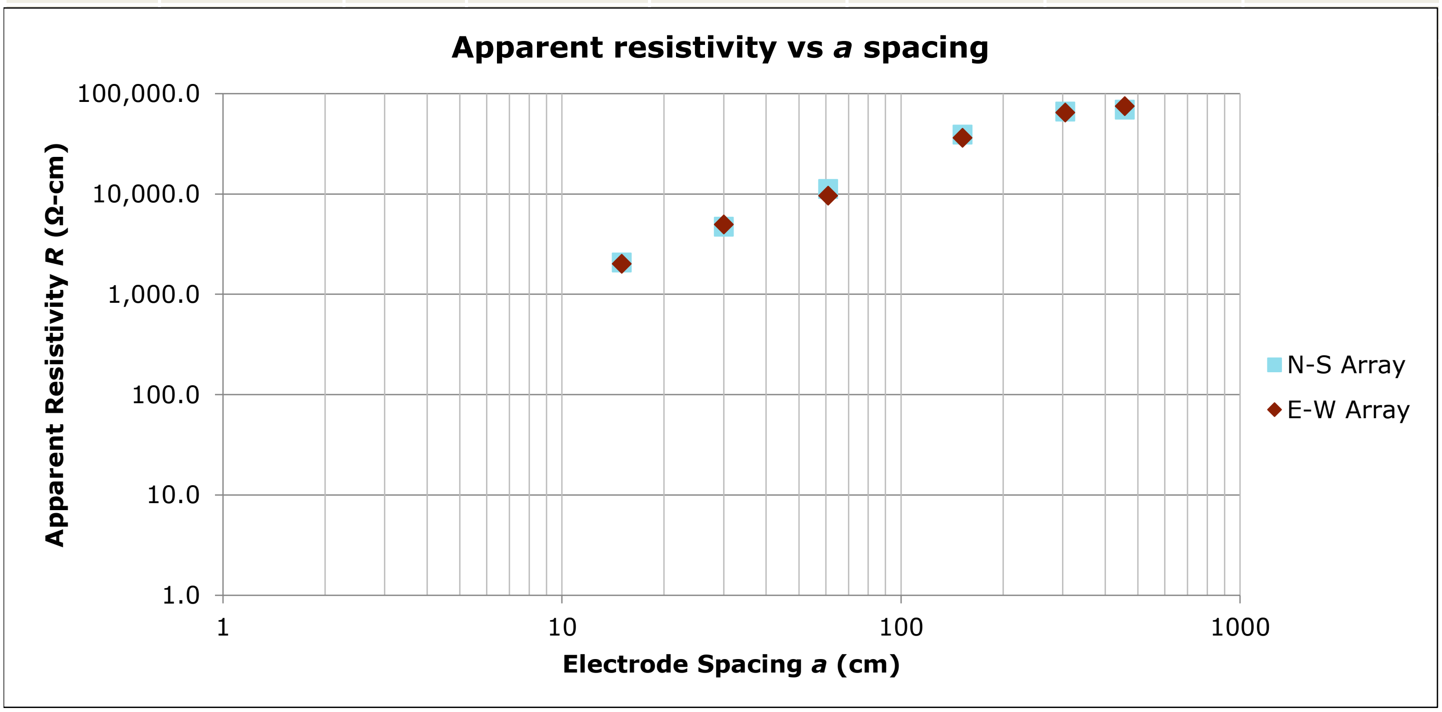
**FIELD ELECTRICAL RESISTIVITY TEST DATA**
Perkins Solar | Imperial County, California
Terracon Project No. 60235062

| | | | |
|---|---|---|---|
| **Array Loc.** | ER-2 (32.715295, -115.171770) | | |
| **Instrument** | MiniSting | **Weather** | Sunny |
| **Serial #** | SZ107129 | **Ground Cond.** | Exposed Soils |
| **Cal. Check** | | **Tested By** | TA |
| **Test Date** | January 3, 2024 | **Method** | Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012) |
| **Notes & Conflicts** | | | |

Apparent resistivity $\rho$ is calculated as :

$$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$

| **Electrode Spacing *a*** | | **Electrode Depth *b*** | | **N-S Test** | | **E-W Test** | |
|---|---|---|---|---|---|---|---|
| (feet) | (centimeters) | (inches) | (centimeters) | Measured Resistance *R* Ω | Apparent Resistivity $\rho$ (Ω-cm) | Measured Resistance *R* Ω | Apparent Resistivity $\rho$ (Ω-cm) |
| 0.5 | 15 | 2 | 5 | 18.9 | 2070 | 18.3 | 2010 |
| 1 | 30 | 2 | 5 | 23.9 | 4710 | 25.2 | 4970 |
| 2 | 61 | 2 | 5 | 29.0 | 11240 | 24.7 | 9580 |
| 5 | 152 | 2 | 5 | 40.8 | 39040 | 37.8 | 36160 |
| 10 | 305 | 2 | 5 | 34.5 | 66180 | 33.8 | 64710 |
| 15 | 457 | 2 | 5 | 24.1 | 69100 | 26.1 | 74960 |
| | | | | | | | |



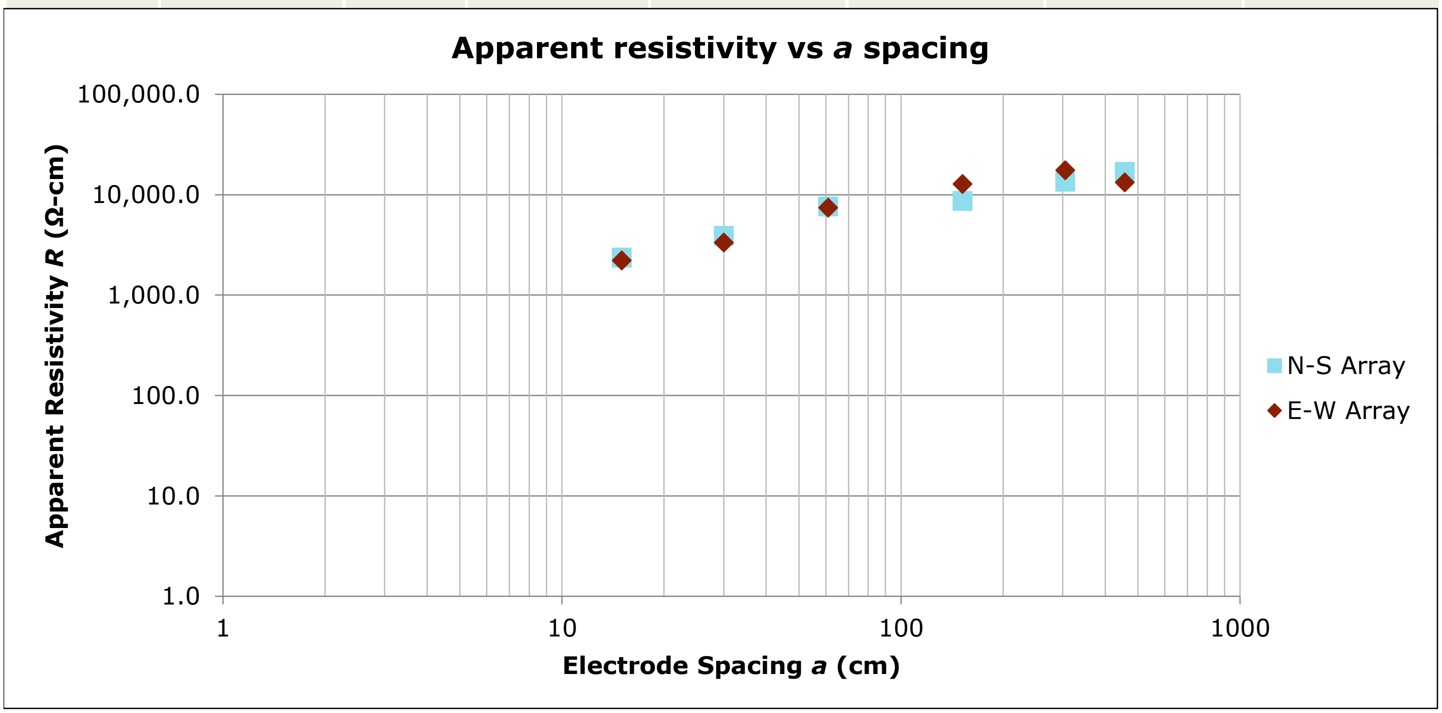
**FIELD ELECTRICAL RESISTIVITY TEST DATA**
Perkins Solar | Imperial County, California
Terracon Project No. 60235062

| | | | |
|---|---|---|---|
| **Array Loc.** | ER-3 (32.716741, -115.167341) | | |
| **Instrument** | MiniSting | **Weather** | Sunny |
| **Serial #** | SZ107129 | **Ground Cond.** | Exposed Soils |
| **Cal. Check** | | **Tested By** | TA |
| **Test Date** | January 3, 2024 | **Method** | Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012) |
| **Notes & Conflicts** | | | |

Apparent resistivity $\rho$ is calculated as :

$$\rho = \frac{4\pi aR}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$

| **Electrode Spacing *a*** | | **Electrode Depth *b*** | | **N-S Test** | | **E-W Test** | |
|---|---|---|---|---|---|---|---|
| (feet) | (centimeters) | (inches) | (centimeters) | Measured Resistance *R* | Apparent Resistivity $\rho$ | Measured Resistance *R* | Apparent Resistivity $\rho$ |
| | | | | Ω | (Ω-cm) | Ω | (Ω-cm) |
| 0.5 | 15 | 2 | 5 | 21.6 | 2370 | 20.2 | 2220 |
| 1 | 30 | 2 | 5 | 19.7 | 3890 | 16.9 | 3330 |
| 2 | 61 | 2 | 5 | 19.8 | 7660 | 19.2 | 7440 |
| 5 | 152 | 2 | 5 | 9.1 | 8690 | 13.3 | 12760 |
| 10 | 305 | 2 | 5 | 7.0 | 13430 | 9.1 | 17490 |
| 15 | 457 | 2 | 5 | 5.9 | 16870 | 4.6 | 13320 |
| | | | | | | | |



**FIELD ELECTRICAL RESISTIVITY TEST DATA**
Perkins Solar | Imperial County, California
Terracon Project No. 60235062

| | |
|---|---|
| **Array Loc.** | ER-4 (32.720198, -115.166817) |

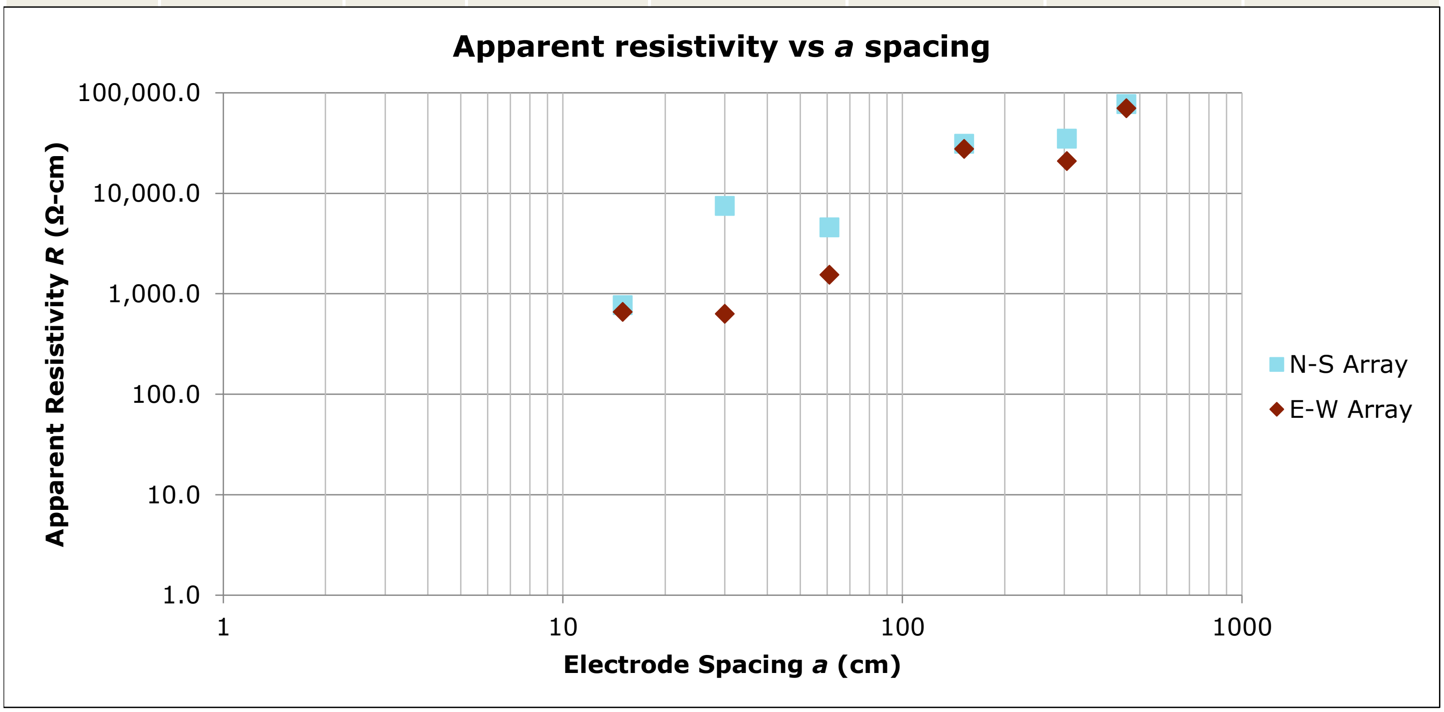
| | | | |
|---|---|---|---|
| **Instrument** | MiniSting | **Weather** | Sunny |
| **Serial #** | SZ107129 | **Ground Cond.** | Exposed Soils |
| **Cal. Check** | | **Tested By** | AT |
| **Test Date** | January 3, 2024 | **Method** | Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012) |

**Notes & Conflicts**

Apparent resistivity $\rho$ is calculated as :

$$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$

| **Electrode Spacing *a*** | | **Electrode Depth *b*** | | **N-S Test** | | **E-W Test** | |
|---|---|---|---|---|---|---|---|
| (feet) | (centimeters) | (inches) | (centimeters) | Measured Resistance *R* Ω | Apparent Resistivity *ρ* (Ω-cm) | Measured Resistance *R* Ω | Apparent Resistivity *ρ* (Ω-cm) |
| 0.5 | 15 | 2 | 5 | 7.0 | 770 | 6.0 | 660 |
| 1 | 30 | 2 | 5 | 38.1 | 7510 | 3.2 | 630 |
| 2 | 61 | 2 | 5 | 11.8 | 4580 | 4.0 | 1550 |
| 5 | 152 | 2 | 5 | 32.5 | 31060 | 29.0 | 27700 |
| 10 | 305 | 2 | 5 | 18.2 | 34910 | 11.0 | 20990 |
| 15 | 457 | 2 | 5 | 26.9 | 77310 | 24.5 | 70390 |

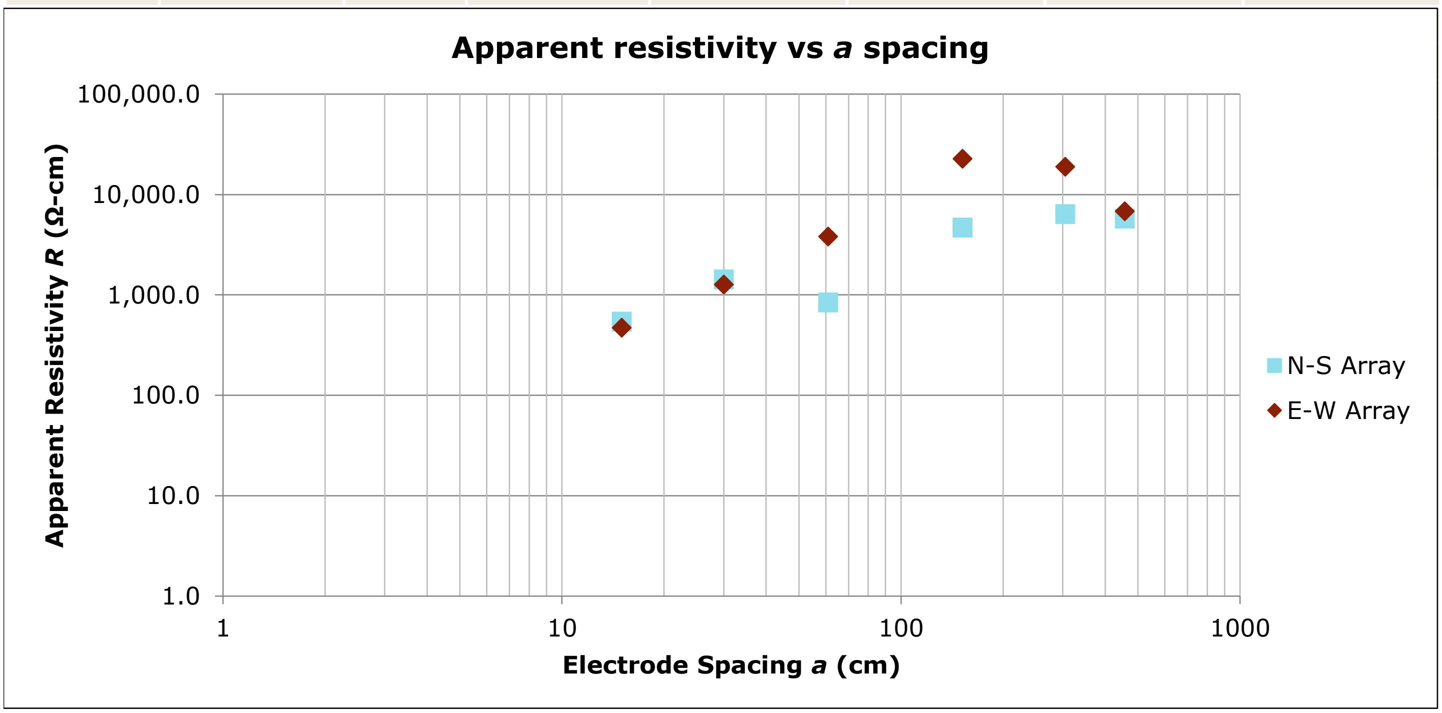


**FIELD ELECTRICAL RESISTIVITY TEST DATA**
Perkins Solar | Imperial County, California
Terracon Project No. 60235062

| | | | |
|---|---|---|---|
| **Array Loc.** | ER-5 (32.721252, -115.162912) | | |
| **Instrument** | MiniSting | **Weather** | Sunny |
| **Serial #** | SZ107129 | **Ground Cond.** | Exposed Soils |
| **Cal. Check** | | **Tested By** | AT |
| **Test Date** | January 3, 2024 | **Method** | Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012) |
| **Notes & Conflicts** | | | |

Apparent resistivity $\rho$ is calculated as :
$$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$

| **Electrode Spacing *a*** | | **Electrode Depth *b*** | | **N-S Test** | | **E-W Test** | |
|---|---|---|---|---|---|---|---|
| (feet) | (centimeters) | (inches) | (centimeters) | Measured Resistance *R* Ω | Apparent Resistivity $\rho$ (Ω-cm) | Measured Resistance *R* Ω | Apparent Resistivity $\rho$ (Ω-cm) |
| 0.5 | 15 | 2 | 5 | 4.9 | 540 | 4.3 | 470 |
| 1 | 30 | 2 | 5 | 7.2 | 1430 | 6.4 | 1270 |
| 2 | 61 | 2 | 5 | 2.2 | 840 | 9.8 | 3820 |
| 5 | 152 | 2 | 5 | 4.9 | 4670 | 23.7 | 22700 |
| 10 | 305 | 2 | 5 | 3.3 | 6380 | 9.8 | 18860 |
| 15 | 457 | 2 | 5 | 2.0 | 5770 | 2.4 | 6820 |
| | | | | | | | |

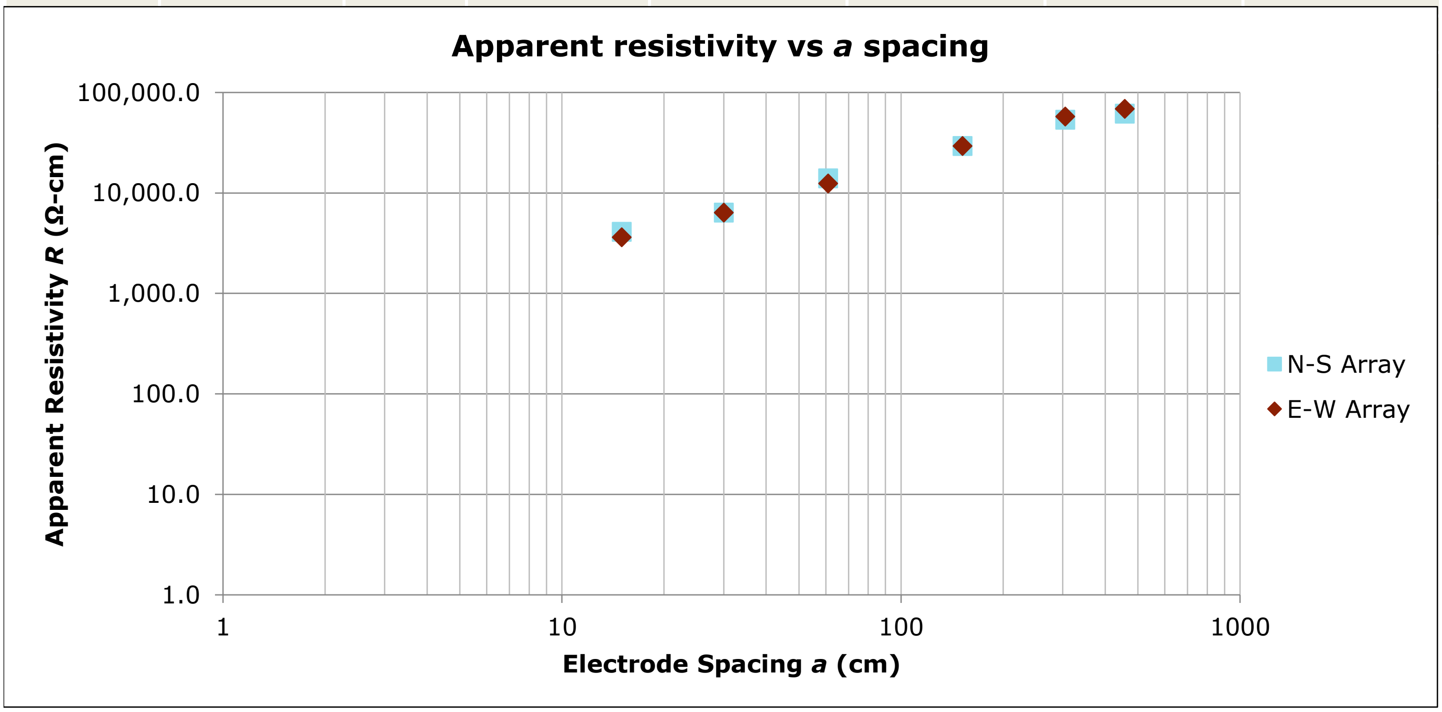


**FIELD ELECTRICAL RESISTIVITY TEST DATA**
Perkins Solar | Imperial County, California
Terracon Project No. 60235062

| | | | |
|---|---|---|---|
| **Array Loc.** | ER-6 (32.713217, -115.168616) | | |
| **Instrument** | MiniSting | **Weather** | Sunny |
| **Serial #** | SZ107129 | **Ground Cond.** | Exposed Soils |
| **Cal. Check** | | **Tested By** | AT |
| **Test Date** | January 3, 2024 | **Method** | Wenner 4-pin (ASTM G57-06 (2012); IEEE 81-2012) |
| **Notes & Conflicts** | | | |

Apparent resistivity $\rho$ is calculated as :
$$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2 + 4b^2}} - \frac{a}{\sqrt{a^2 + b^2}}}$$

| **Electrode Spacing *a*** | | **Electrode Depth *b*** | | **N-S Test** | | **E-W Test** | |
|---|---|---|---|---|---|---|---|
| (feet) | (centimeters) | (inches) | (centimeters) | Measured Resistance *R* Ω | Apparent Resistivity $\rho$ (Ω-cm) | Measured Resistance *R* Ω | Apparent Resistivity $\rho$ (Ω-cm) |
| 0.5 | 15 | 2 | 5 | 37.3 | 4100 | 33.0 | 3620 |
| 1 | 30 | 2 | 5 | 32.4 | 6390 | 32.3 | 6370 |
| 2 | 61 | 2 | 5 | 36.0 | 13940 | 32.0 | 12390 |
| 5 | 152 | 2 | 5 | 30.6 | 29270 | 30.6 | 29250 |
| 10 | 305 | 2 | 5 | 28.0 | 53610 | 30.0 | 57540 |
| 15 | 457 | 2 | 5 | 21.5 | 61780 | 24.0 | 68870 |



# Test Pile Driving Data

**Contents:**

# Pile Testing Procedures

Our PLT program included supplying 18 total piles between 8-ft to 13-ft long W6x9 steel piles, pile installation, vertical (compression and tension) load testing, lateral testing, and extraction. The pile summary provided by Terracon are summarized in the table below. This program included 2 test piles for tension and lateral testing and 1 test pile for compression testing at 6 locations across the site.

| Pile Load Test Areas | Pile Load Test Locations | Proposed Embedment Depth (feet) |
|---|---|---|
| Array Areas | 6 (Compression Test) | Ranging from 5 to 7 |
| | 6 (Tension Test) | Ranging from 5 to 10 |
| | 6 (Lateral Test) | |

The test locations were established in the field by using a hand-held GPS (accurate to about 10 feet) and existing site features as reference points. The mapped test locations should be considered accurate only to the degree implied by the means and methods used to define them.

**Exploration Plan**
Perkins Solar ■ Imperial County, CA
January 26, 2024 ■ Terracon Project No. 60235062

## Anticipated Exploration Plan – Pile Testing Locations

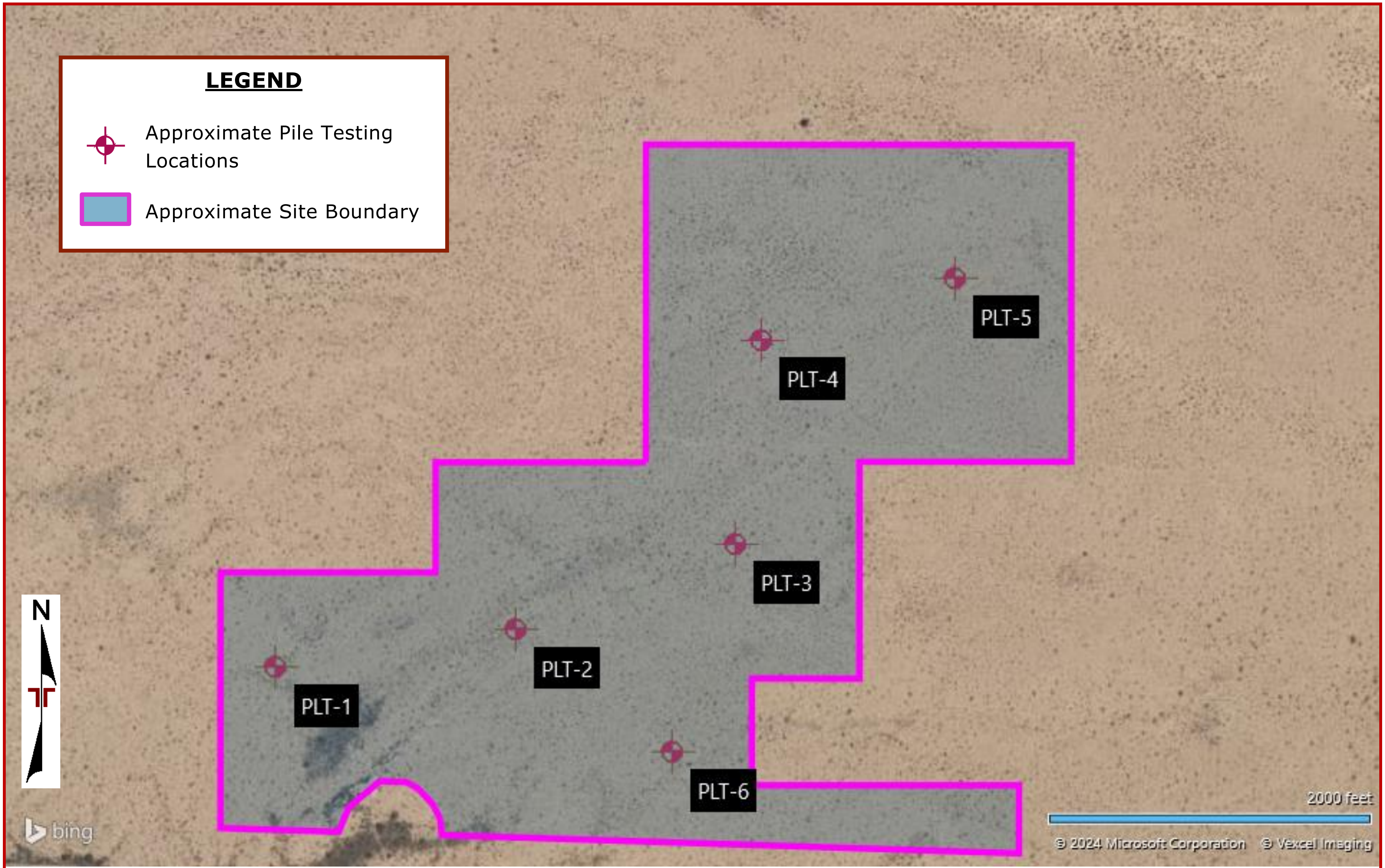



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

## Pile Embedment Drive Time: Perkins Solar - 60235062

| Pile Location | Pile Size | Pile ID | Pile Length (ft) | Embed Depth (ft) | Total Drive Time (s) | Incremental Drive Time per Foot of Depth (seconds) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| PLT-1 | W6x9 | A | 8 | 5 | 11 | 1 | 1 | 2 | 3 | 4 | | | | | |
| | W6x9 | B | 11 | 8 | 42 | 1 | 1 | 2 | 5 | 4 | 6 | 10 | 13 | | |
| | W6x9 | C | 7 | 5 | 13 | 2 | 1 | 2 | 3 | 5 | | | | | |
| PLT-2 | W6x9 | A | 9 | 6 | 12 | 1 | 1 | 2 | 3 | 4 | 1 | | | | |
| | W6x9 | B | 12 | 9 | 28 | 0 | 1 | 1 | 3 | 3 | 5 | 6 | 8 | 1 | |
| | W6x9 | C | 9 | 7 | 21 | 1 | 2 | 2 | 3 | 5 | 7 | 1 | | | |
| PLT-3 | W6x9 | A | 10 | 7 | 19 | 1 | 2 | 2 | 3 | 4 | 6 | 1 | | | |
| | W6x9 | B | 13 | 10 | 31 | 1 | 1 | 1 | 1 | 2 | 3 | 10 | 5 | 6 | 1 |
| | W6x9 | C | 9 | 7 | 11 | 1 | 0 | 1 | 1 | 2 | 2 | 3 | 1 | | |
| PLT-4 | W6x9 | A | 8 | 5 | 7 | 1 | 1 | 2 | 1 | 2 | | | | | |
| | W6x9 | B | 11 | 8 | 15 | 1 | 1 | 1 | 1 | 2 | 4 | 5 | | | |
| | W6x9 | C | 9 | 7 | 16 | 1 | 1 | 2 | 2 | 4 | 5 | 1 | | | |
| PLT-5 | W6x9 | A | 9 | 6 | 8 | 2 | 1 | 1 | 2 | 1 | 1 | | | | |
| | W6x9 | B | 12 | 9 | 17 | 1 | 2 | 1 | 1 | 2 | 2 | 3 | 4 | 1 | |
| | W6x9 | C | 8 | 6 | 13 | 2 | 3 | 1 | 2 | 4 | 1 | | | | |
| PLT-6 | W6x9 | A | 10 | 7 | 17 | 1 | 1 | 2 | 3 | 3 | 4 | 3 | | | |
| | W6x9 | B | 13 | 10 | 55 | 1 | 1 | 2 | 2 | 2 | 3 | 6 | 9 | 12 | 17 |
| | W6x9 | C | 9 | 7 | 22 | 1 | 2 | 2 | 2 | 3 | 5 | 7 | | | |

# Pile Load Test Results

**Contents:**

## Axial Tension Test Results

Terracon

| Axial Tension | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pile No. | | Pile Type | Embedment Depth, ft | Pile Drive Time, sec | Yield Deflection, in[1] | Load, lb | Ultimate Deflection[2] | Load, lb |
| PLT-1 | A | W6x9 | 5 | 11 | 0.25** | 4,750 | 0.76 | 7,500 |
| | B | W6x9 | 8 | 42 | 0.08* | 10,000 | -- | -- |
| PLT-2 | A | W6x9 | 6 | 12 | 0.24 | 5,000 | 0.78 | 7,500 |
| | B | W6x9 | 9 | 28 | 0.20* | 10,000 | -- | -- |
| PLT-3 | A | W6x9 | 7 | 19 | 0.25 | 6,500 | 0.84 | 9,500 |
| | B | W6x9 | 10 | 31 | 0.11* | 10,000 | -- | -- |
| PLT-4 | A | W6x9 | 5 | 7 | 0.25** | 1,750 | 0.79 | 3,000 |
| | B | W6x9 | 8 | 15 | 0.25** | 4,200 | 0.78 | 7,000 |
| PLT-5 | A | W6x9 | 6 | 8 | 0.25 | 3,500 | 0.78 | 7,000 |
| | B | W6x9 | 9 | 17 | 0.26 | 8,500 | 0.35 | 10,000 |
| PLT-6 | A | W6x9 | 7 | 17 | 0.25** | 6,600 | 0.71 | 10,000 |
| | B | W6x9 | 10 | 55 | 0.09* | 10,000 | -- | -- |

[1] Yield deflection is defined near ¼"

[2] Ultimate deflection is defined as the final deflection reading prior to unloading

* Maximum load reached prior to deflection criteria

**Load interpolated from graph.

# Tension Load Test Result for PLT-1A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

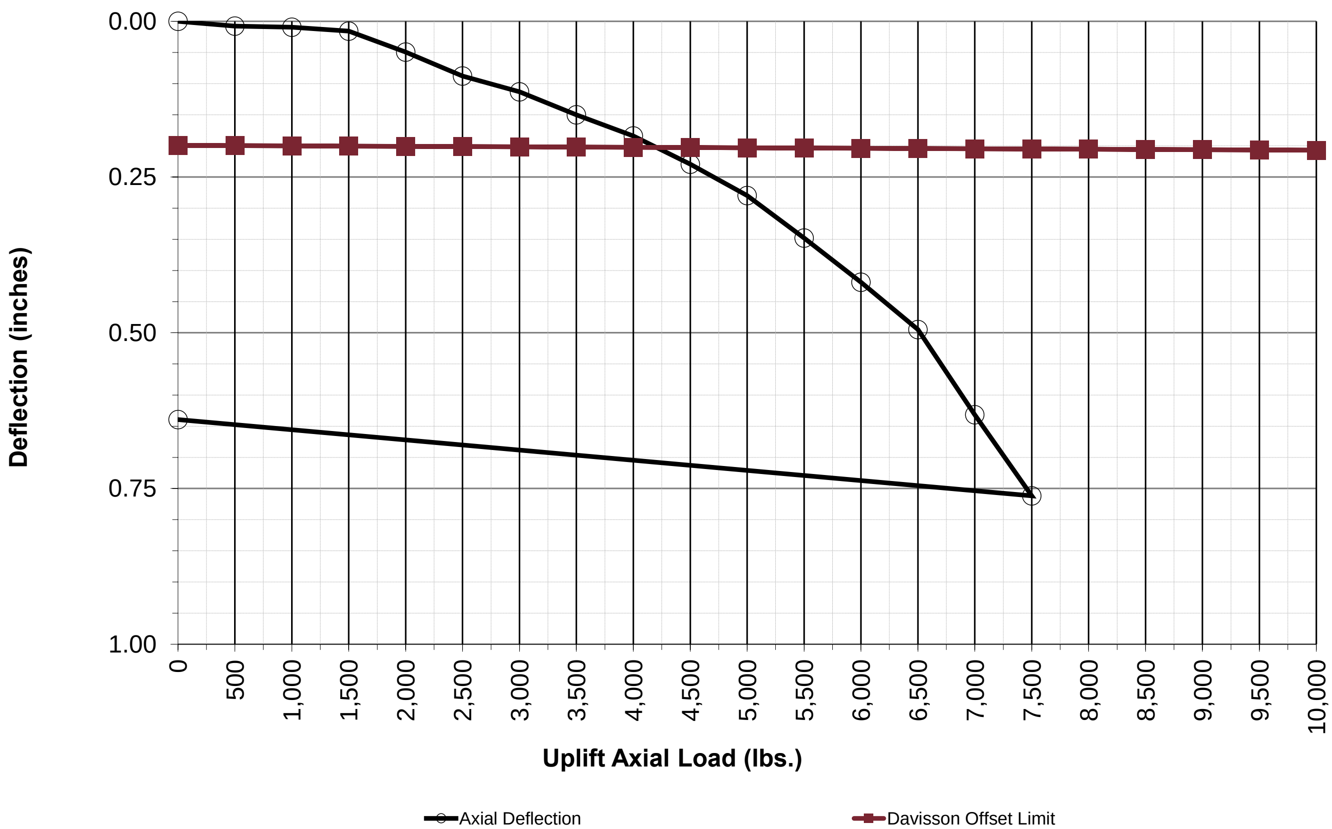
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/3/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-1A |
| Group Latitude [deg.]: | 36.132683° |
| Group Longitude[deg.]: | -119.4096 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 60 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 11 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(PL/AE)) | Comments |
| 0% | 0 | 0.000 | 0.000 | 0.199 | |
| 5% | 500 | 0.008 | 0.000 | 0.200 | |
| 10% | 1000 | 0.010 | 0.001 | 0.200 | |
| 15% | 1500 | 0.016 | 0.001 | 0.200 | |
| 20% | 2000 | 0.049 | 0.002 | 0.201 | |
| 25% | 2500 | 0.088 | 0.002 | 0.201 | |
| 30% | 3000 | 0.113 | 0.002 | 0.201 | |
| 35% | 3500 | 0.150 | 0.003 | 0.202 | |
| 40% | 4000 | 0.184 | 0.003 | 0.202 | |
| 45% | 4500 | 0.229 | 0.003 | 0.203 | |
| 50% | 5000 | 0.280 | 0.004 | 0.203 | |
| 55% | 5500 | 0.348 | 0.004 | 0.203 | |
| 60% | 6000 | 0.419 | 0.005 | 0.204 | |
| 65% | 6500 | 0.495 | 0.005 | 0.204 | |
| 70% | 7000 | 0.632 | 0.005 | 0.205 | |
| 75% | 7500 | 0.762 | 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 | 0.639 | 0.000 | 0.199 | |



# Tension Load Test Result for PLT-1B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

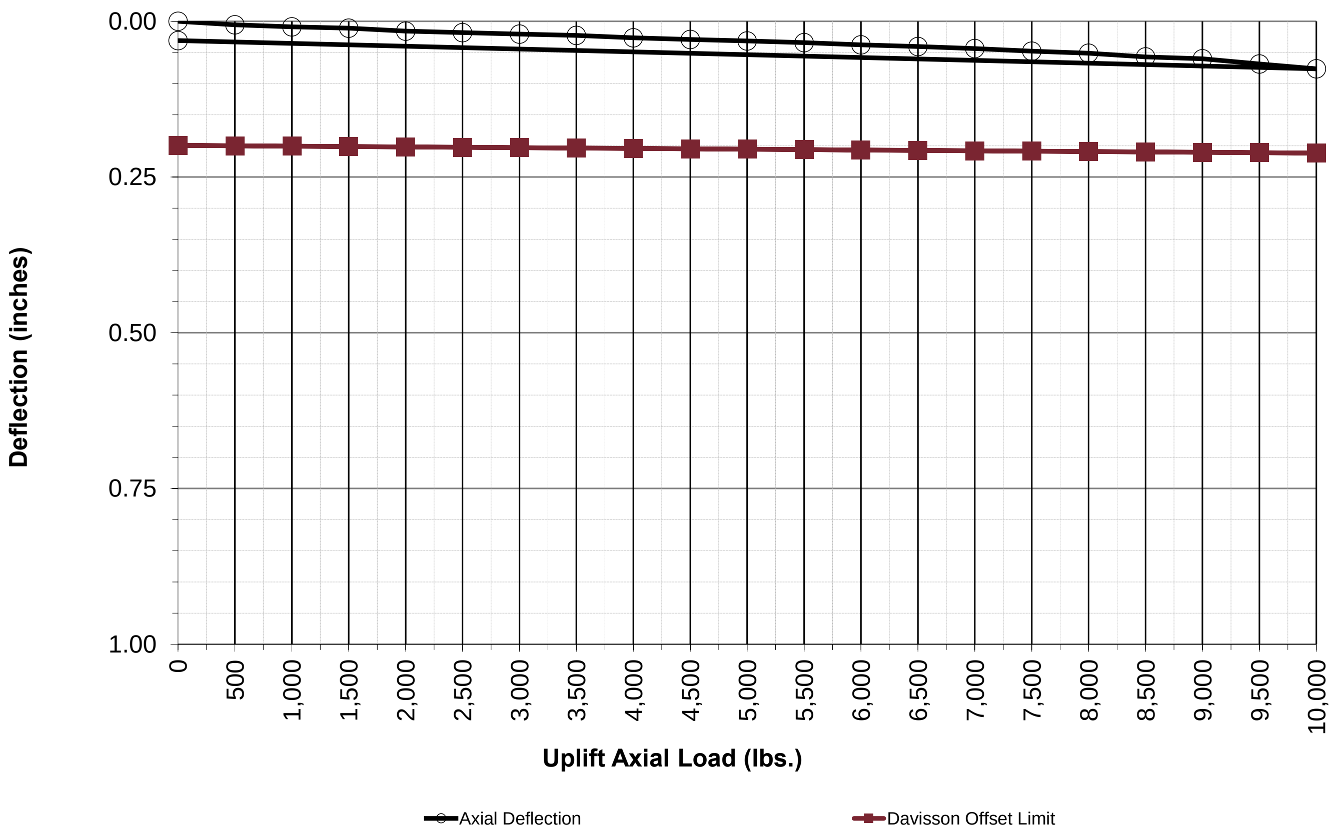
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/3/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-1B |
| Group Latitude [deg.]: | 36.132683° |
| Group Longitude[deg.]: | -119.4096 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 96 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 42 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(PL/AE)) | Comments |
| 0% | 0 | 0.000 | 0.000 | 0.199 | |
| 5% | 500 | 0.006 | 0.001 | 0.200 | |
| 10% | 1000 | 0.009 | 0.001 | 0.200 | |
| 15% | 1500 | 0.011 | 0.002 | 0.201 | |
| 20% | 2000 | 0.016 | 0.002 | 0.202 | |
| 25% | 2500 | 0.018 | 0.003 | 0.202 | |
| 30% | 3000 | 0.021 | 0.004 | 0.203 | |
| 35% | 3500 | 0.023 | 0.004 | 0.203 | |
| 40% | 4000 | 0.027 | 0.005 | 0.204 | |
| 45% | 4500 | 0.029 | 0.006 | 0.205 | |
| 50% | 5000 | 0.032 | 0.006 | 0.205 | |
| 55% | 5500 | 0.034 | 0.007 | 0.206 | |
| 60% | 6000 | 0.038 | 0.007 | 0.207 | |
| 65% | 6500 | 0.041 | 0.008 | 0.207 | |
| 70% | 7000 | 0.044 | 0.009 | 0.208 | |
| 75% | 7500 | 0.048 | 0.009 | 0.208 | |
| 80% | 8000 | 0.051 | 0.010 | 0.209 | |
| 85% | 8500 | 0.057 | 0.010 | 0.210 | |
| 90% | 9000 | 0.060 | 0.011 | 0.210 | |
| 95% | 9500 | 0.069 | 0.012 | 0.211 | |
| 100% | 10000 | 0.076 | 0.012 | 0.212 | |
| 0% | 0 | 0.031 | 0.000 | 0.199 | |



# Tension Load Test Result for PLT-2A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

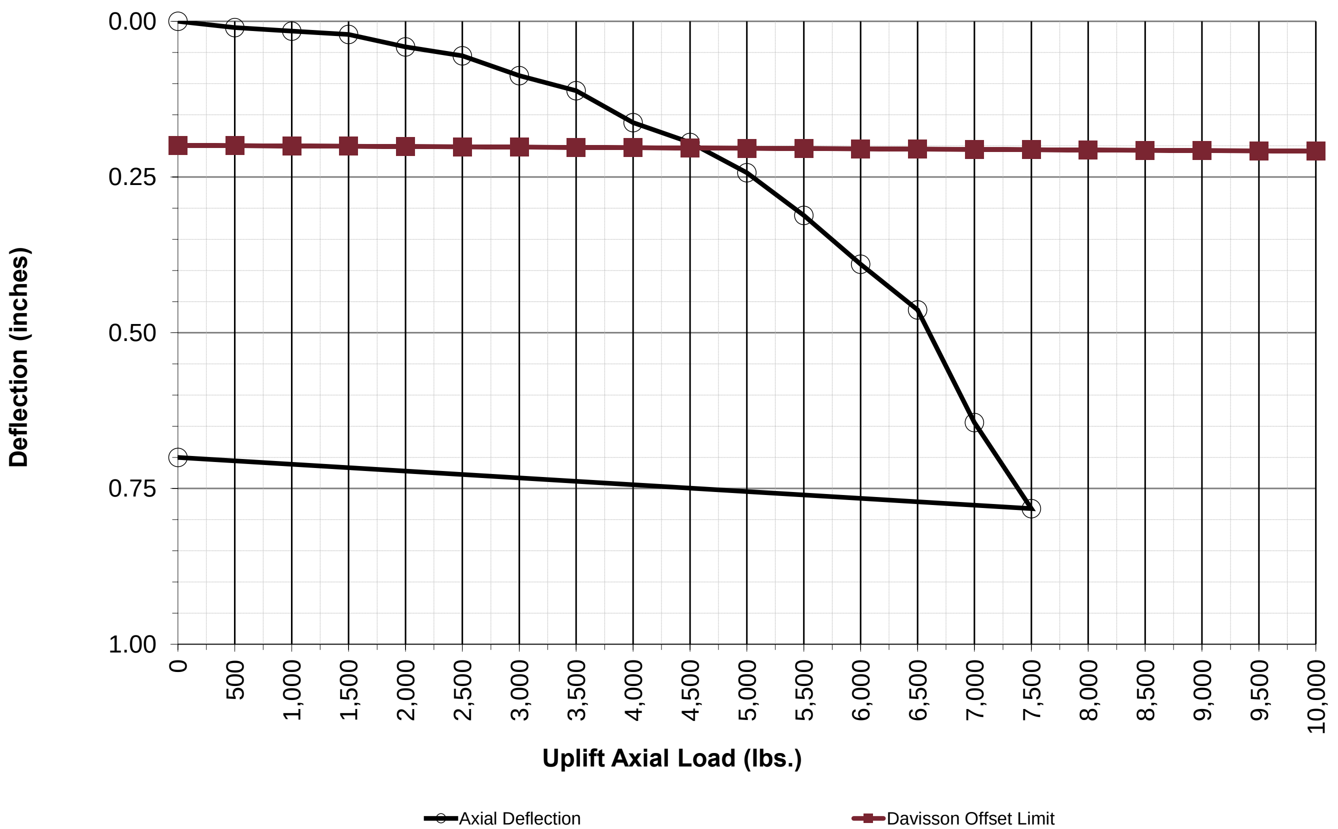
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/3/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-2A |
| Group Latitude [deg.]: | 36.131832° |
| Group Longitude[deg.]: | -119.396316° |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 72 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 12 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(PL/AE)) | Comments |
| 0% | 0 | 0.000 | 0.000 | 0.199 | |
| 5% | 500 | 0.010 | 0.000 | 0.200 | |
| 10% | 1000 | 0.016 | 0.001 | 0.200 | |
| 15% | 1500 | 0.021 | 0.001 | 0.201 | |
| 20% | 2000 | 0.041 | 0.002 | 0.201 | |
| 25% | 2500 | 0.055 | 0.002 | 0.201 | |
| 30% | 3000 | 0.087 | 0.003 | 0.202 | |
| 35% | 3500 | 0.111 | 0.003 | 0.202 | |
| 40% | 4000 | 0.163 | 0.004 | 0.203 | |
| 45% | 4500 | 0.195 | 0.004 | 0.203 | |
| 50% | 5000 | 0.243 | 0.005 | 0.204 | |
| 55% | 5500 | 0.312 | 0.005 | 0.204 | |
| 60% | 6000 | 0.390 | 0.006 | 0.205 | |
| 65% | 6500 | 0.463 | 0.006 | 0.205 | |
| 70% | 7000 | 0.644 | 0.006 | 0.206 | |
| 75% | 7500 | 0.782 | 0.007 | 0.206 | |
| 80% | 8000 | | 0.007 | 0.207 | |
| 85% | 8500 | | 0.008 | 0.207 | |
| 90% | 9000 | | 0.008 | 0.208 | |
| 95% | 9500 | | 0.009 | 0.208 | |
| 100% | 10000 | | 0.009 | 0.208 | |
| 0% | 0 | 0.700 | 0.000 | 0.199 | |



# Tension Load Test Result for PLT-2B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

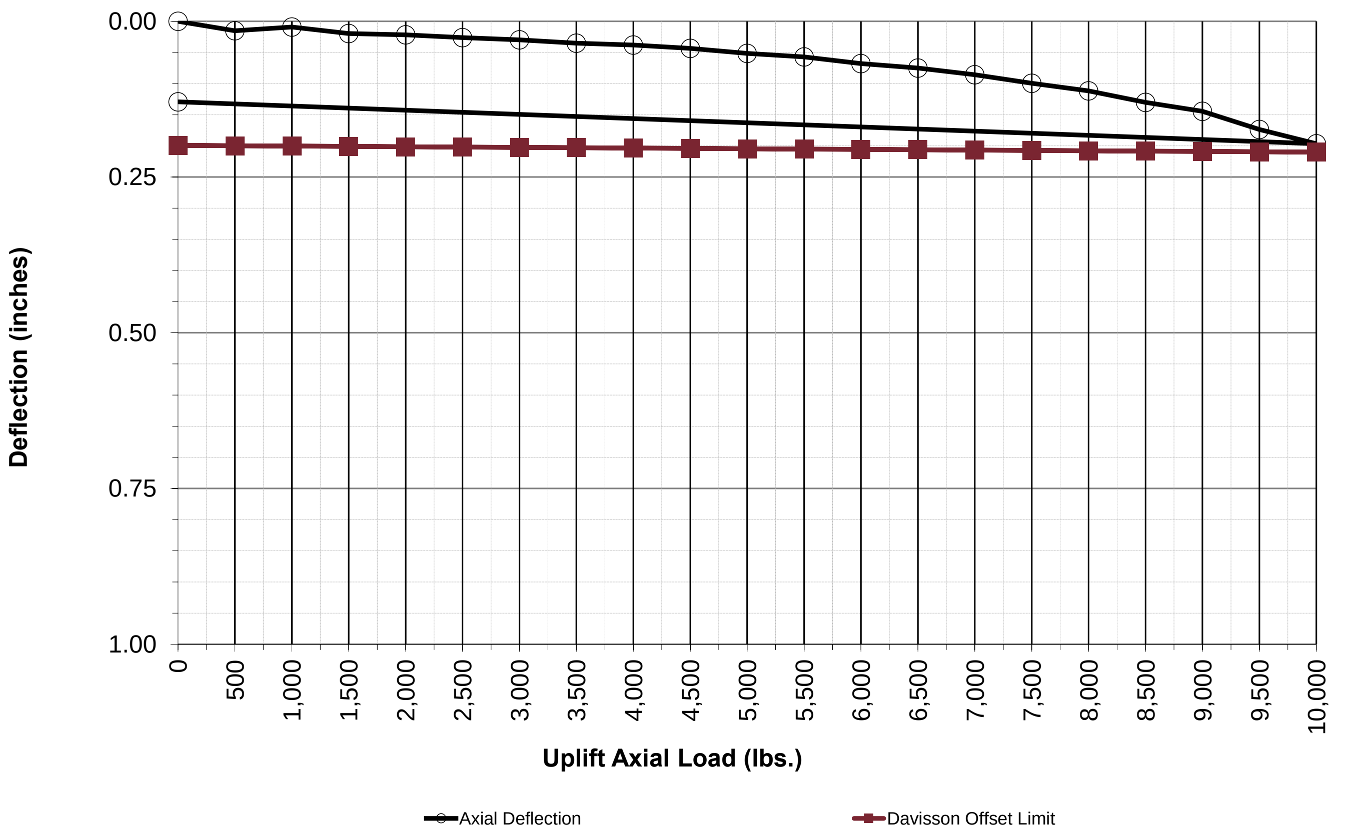
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/3/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-2B |
| Group Latitude [deg.]: | 36.131832° |
| Group Longitude[deg.]: | -119.396316° |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 84 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 28 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(PL/AE)) | Comments |
| 0% | 0 | 0.000 | 0.000 | 0.199 | |
| 5% | 500 | 0.015 | 0.001 | 0.200 | |
| 10% | 1000 | 0.009 | 0.001 | 0.200 | |
| 15% | 1500 | 0.020 | 0.002 | 0.201 | |
| 20% | 2000 | 0.022 | 0.002 | 0.201 | |
| 25% | 2500 | 0.026 | 0.003 | 0.202 | |
| 30% | 3000 | 0.030 | 0.003 | 0.202 | |
| 35% | 3500 | 0.035 | 0.004 | 0.203 | |
| 40% | 4000 | 0.038 | 0.004 | 0.203 | |
| 45% | 4500 | 0.043 | 0.005 | 0.204 | |
| 50% | 5000 | 0.052 | 0.005 | 0.205 | |
| 55% | 5500 | 0.057 | 0.006 | 0.205 | |
| 60% | 6000 | 0.068 | 0.006 | 0.206 | |
| 65% | 6500 | 0.075 | 0.007 | 0.206 | |
| 70% | 7000 | 0.086 | 0.008 | 0.207 | |
| 75% | 7500 | 0.100 | 0.008 | 0.207 | |
| 80% | 8000 | 0.112 | 0.009 | 0.208 | |
| 85% | 8500 | 0.130 | 0.009 | 0.208 | |
| 90% | 9000 | 0.145 | 0.010 | 0.209 | |
| 95% | 9500 | 0.174 | 0.010 | 0.209 | |
| 100% | 10000 | 0.197 | 0.011 | 0.210 | |
| 0% | 0 | 0.129 | 0.000 | 0.199 | |



# Tension Load Test Result for PLT-3A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

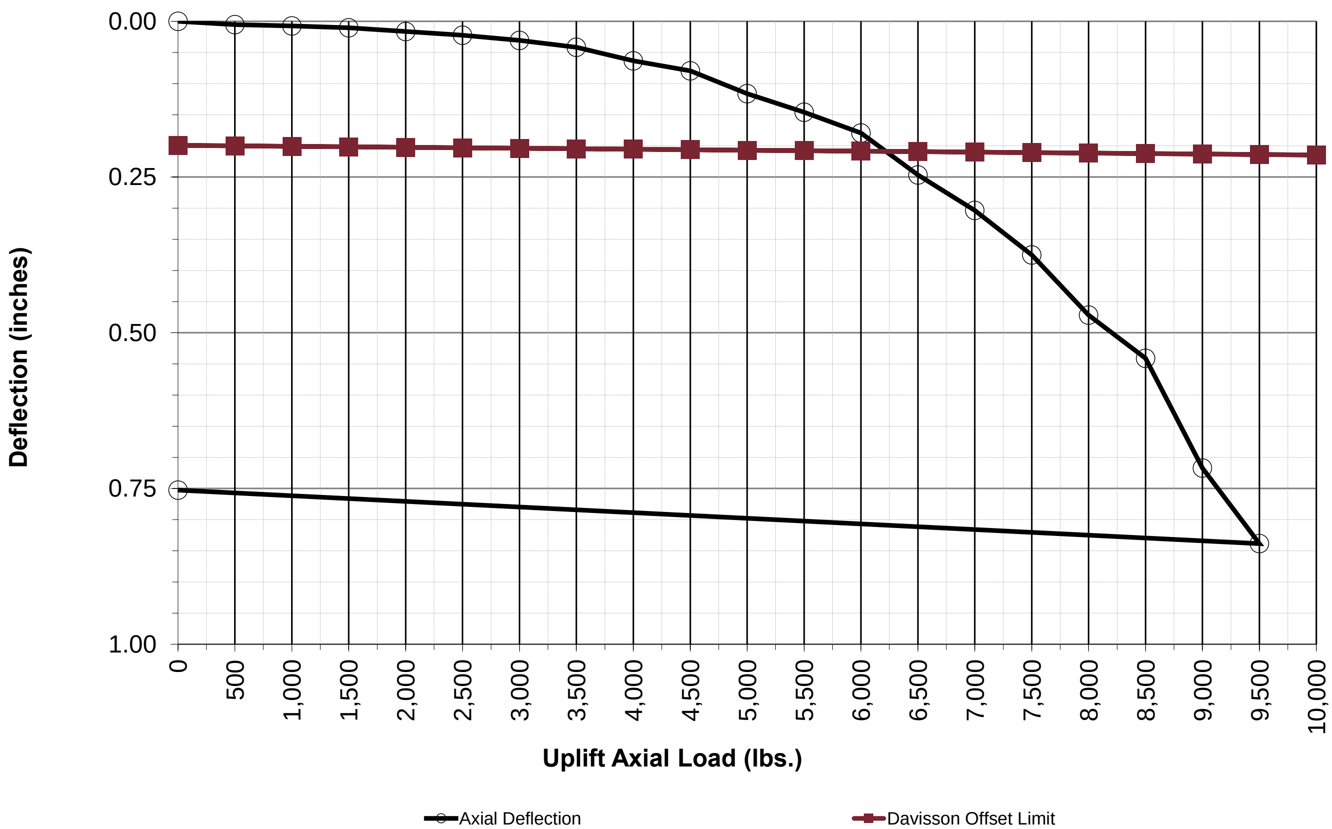
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-3A |
| Group Latitude [deg.]: | 36.1276 |
| Group Longitude[deg.]: | -119.4037 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 120 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 19 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(PL/AE)) | Comments |
| 0% | 0 | 0.000 | 0.000 | 0.199 | |
| 5% | 500 | 0.005 | 0.001 | 0.200 | |
| 10% | 1000 | 0.007 | 0.002 | 0.201 | |
| 15% | 1500 | 0.010 | 0.002 | 0.201 | |
| 20% | 2000 | 0.016 | 0.003 | 0.202 | |
| 25% | 2500 | 0.022 | 0.004 | 0.203 | |
| 30% | 3000 | 0.031 | 0.005 | 0.204 | |
| 35% | 3500 | 0.042 | 0.005 | 0.205 | |
| 40% | 4000 | 0.063 | 0.006 | 0.205 | |
| 45% | 4500 | 0.080 | 0.007 | 0.206 | |
| 50% | 5000 | 0.116 | 0.008 | 0.207 | |
| 55% | 5500 | 0.146 | 0.008 | 0.208 | |
| 60% | 6000 | 0.179 | 0.009 | 0.208 | |
| 65% | 6500 | 0.247 | 0.010 | 0.209 | |
| 70% | 7000 | 0.304 | 0.011 | 0.210 | |
| 75% | 7500 | 0.375 | 0.012 | 0.211 | |
| 80% | 8000 | 0.472 | 0.012 | 0.212 | |
| 85% | 8500 | 0.541 | 0.013 | 0.212 | |
| 90% | 9000 | 0.717 | 0.014 | 0.213 | |
| 95% | 9500 | 0.839 | 0.015 | 0.214 | |
| 100% | 10000 | | 0.015 | 0.215 | |
| 0% | 0 | 0.753 | 0.000 | 0.199 | |



# Tension Load Test Result for PLT-3B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

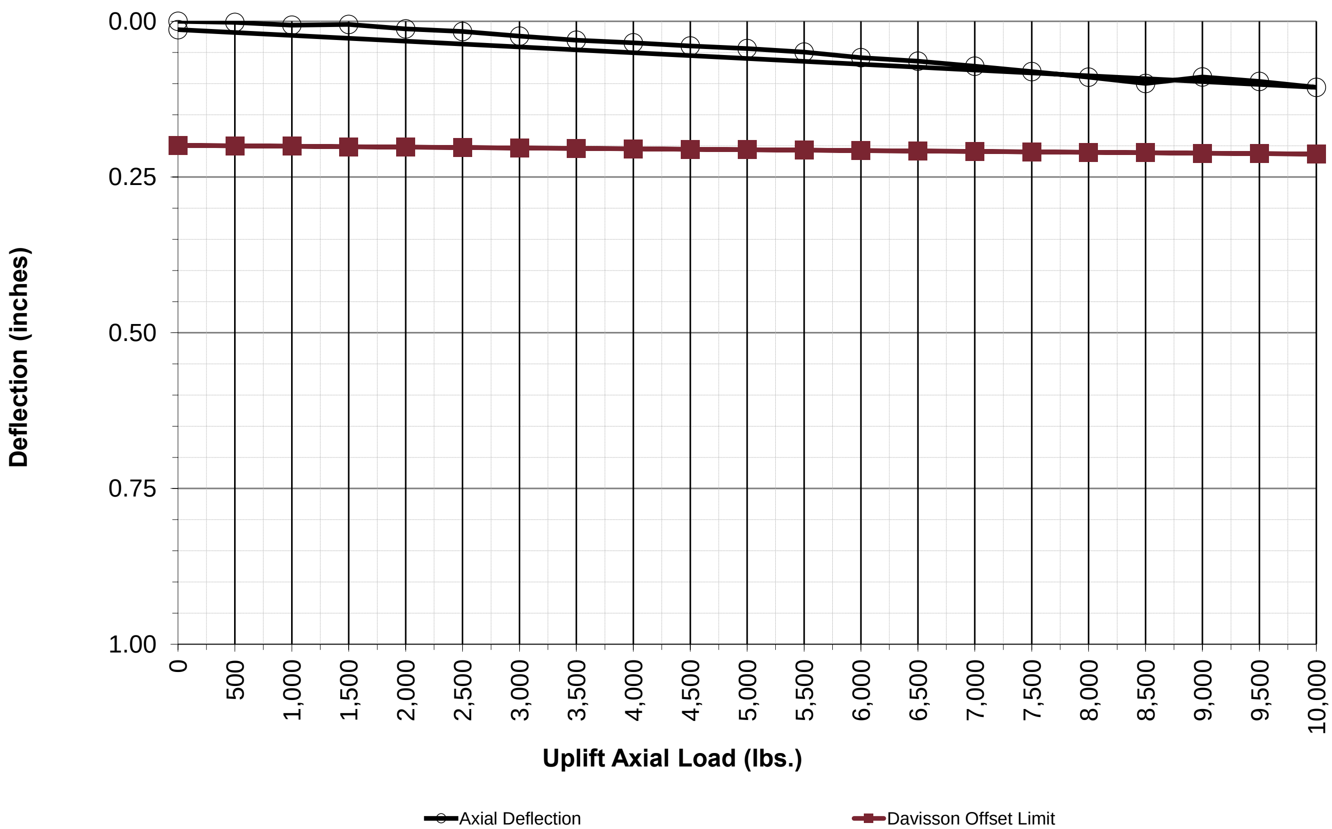
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-3B |
| Group Latitude [deg.]: | 36.1276 |
| Group Longitude[deg.]: | -119.4037 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 108 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 31 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(PL/AE)) | Comments |
| 0% | 0 | 0.000 | 0.000 | 0.199 | |
| 5% | 500 | 0.002 | 0.001 | 0.200 | |
| 10% | 1000 | 0.006 | 0.001 | 0.201 | |
| 15% | 1500 | 0.005 | 0.002 | 0.201 | |
| 20% | 2000 | 0.012 | 0.003 | 0.202 | |
| 25% | 2500 | 0.016 | 0.003 | 0.203 | |
| 30% | 3000 | 0.024 | 0.004 | 0.203 | |
| 35% | 3500 | 0.030 | 0.005 | 0.204 | |
| 40% | 4000 | 0.035 | 0.006 | 0.205 | |
| 45% | 4500 | 0.040 | 0.006 | 0.205 | |
| 50% | 5000 | 0.044 | 0.007 | 0.206 | |
| 55% | 5500 | 0.050 | 0.008 | 0.207 | |
| 60% | 6000 | 0.058 | 0.008 | 0.208 | |
| 65% | 6500 | 0.064 | 0.009 | 0.208 | |
| 70% | 7000 | 0.072 | 0.010 | 0.209 | |
| 75% | 7500 | 0.081 | 0.010 | 0.210 | |
| 80% | 8000 | 0.090 | 0.011 | 0.210 | |
| 85% | 8500 | 0.100 | 0.012 | 0.211 | |
| 90% | 9000 | 0.089 | 0.013 | 0.212 | |
| 95% | 9500 | 0.097 | 0.013 | 0.212 | |
| 100% | 10000 | 0.106 | 0.014 | 0.213 | |
| 0% | 0 | 0.013 | 0.000 | 0.199 | |



# Tension Load Test Result for PLT-4A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

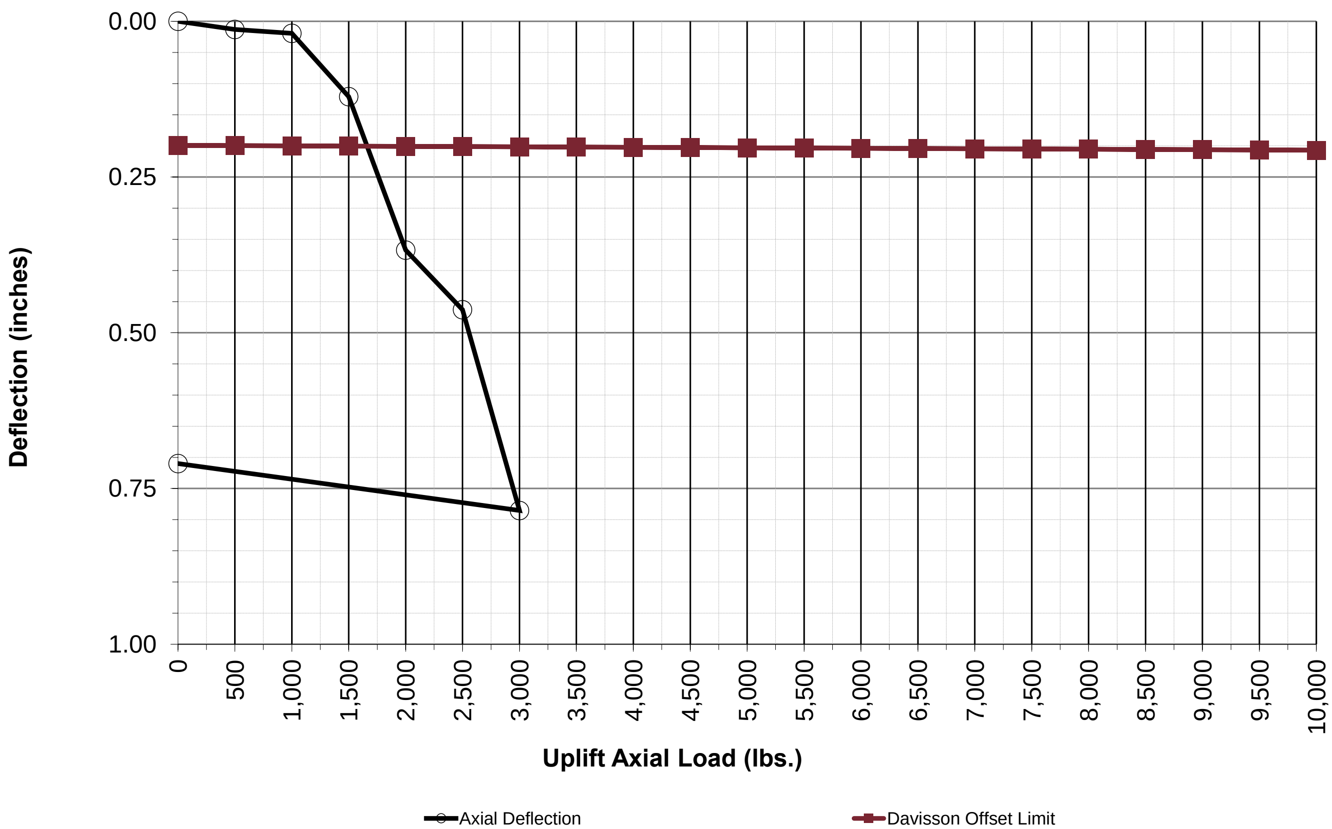
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-4A |
| Group Latitude [deg.]: | 36.1282 |
| Group Longitude[deg.]: | -119.3952 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 60 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 7 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(PL/AE)) | Comments |
| 0% | 0 | 0.000 | 0.000 | 0.199 | |
| 5% | 500 | 0.013 | 0.000 | 0.200 | |
| 10% | 1000 | 0.019 | 0.001 | 0.200 | |
| 15% | 1500 | 0.121 | 0.001 | 0.200 | |
| 20% | 2000 | 0.367 | 0.002 | 0.201 | |
| 25% | 2500 | 0.463 | 0.002 | 0.201 | |
| 30% | 3000 | 0.785 | 0.002 | 0.201 | |
| 35% | 3500 | | 0.003 | 0.202 | |
| 40% | 4000 | | 0.003 | 0.202 | |
| 45% | 4500 | | 0.003 | 0.203 | |
| 50% | 5000 | | 0.004 | 0.203 | |
| 55% | 5500 | | 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 | 0.710 | 0.000 | 0.199 | |



# Tension Load Test Result for PLT-4B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

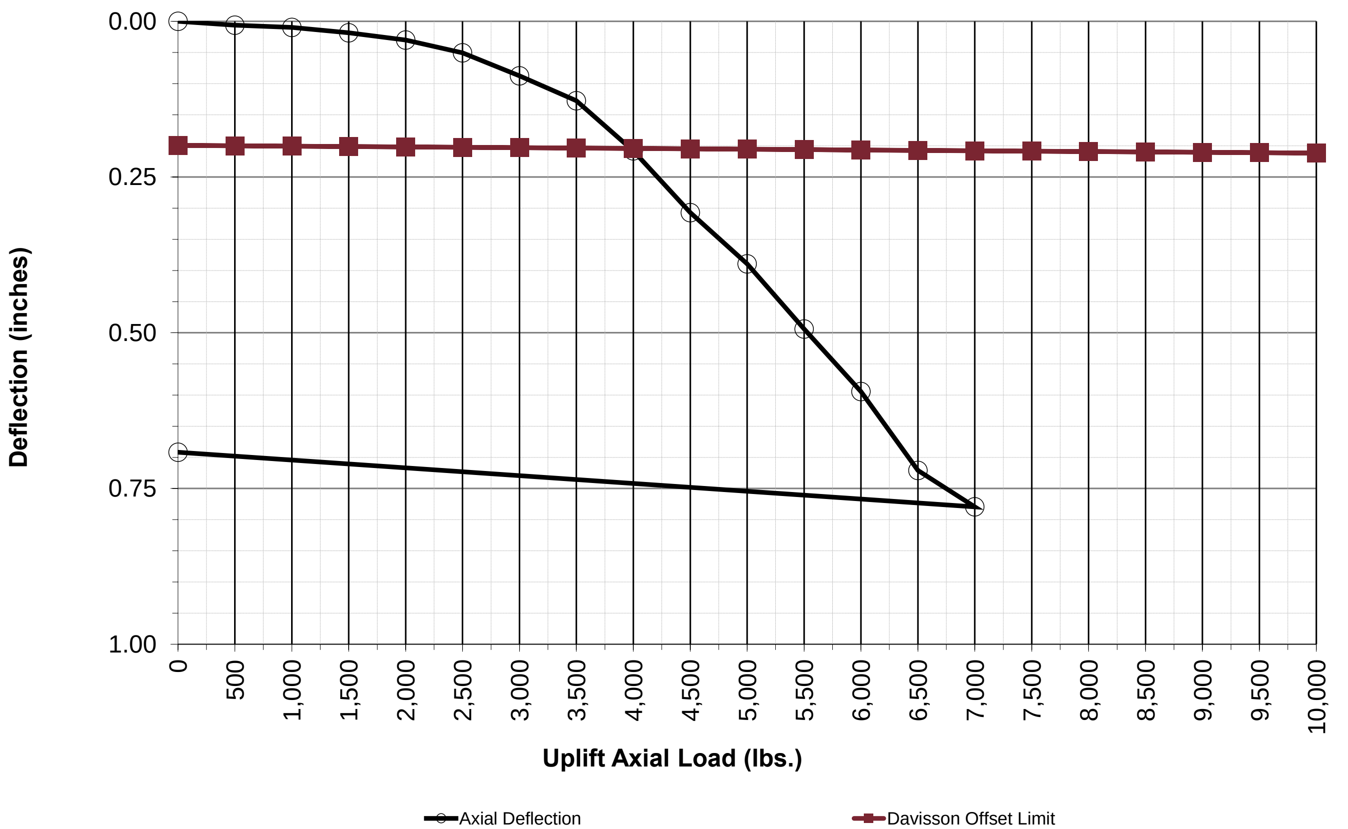
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-4B |
| Group Latitude [deg.]: | 36.1282 |
| Group Longitude[deg.]: | -119.3952 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 96 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 24 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 15 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(PL/AE)) | Comments |
| 0% | 0 | 0.000 | 0.000 | 0.199 | |
| 5% | 500 | 0.006 | 0.001 | 0.200 | |
| 10% | 1000 | 0.010 | 0.001 | 0.200 | |
| 15% | 1500 | 0.019 | 0.002 | 0.201 | |
| 20% | 2000 | 0.030 | 0.002 | 0.202 | |
| 25% | 2500 | 0.051 | 0.003 | 0.202 | |
| 30% | 3000 | 0.088 | 0.004 | 0.203 | |
| 35% | 3500 | 0.128 | 0.004 | 0.203 | |
| 40% | 4000 | 0.208 | 0.005 | 0.204 | |
| 45% | 4500 | 0.307 | 0.006 | 0.205 | |
| 50% | 5000 | 0.389 | 0.006 | 0.205 | |
| 55% | 5500 | 0.494 | 0.007 | 0.206 | |
| 60% | 6000 | 0.594 | 0.007 | 0.207 | |
| 65% | 6500 | 0.721 | 0.008 | 0.207 | |
| 70% | 7000 | 0.780 | 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 | 0.692 | 0.000 | 0.199 | |



# Tension Load Test Result for PLT-5A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT -5A |
| Group Latitude [deg.]: | 36.1249 |
| Group Longitude[deg.]: | -119.4081 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 60 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 8 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(PL/AE)) | Comments |
| 0% | 0 | 0.000 | 0.000 | 0.199 | |
| 5% | 500 | 0.010 | 0.000 | 0.200 | |
| 10% | 1000 | 0.022 | 0.001 | 0.200 | |
| 15% | 1500 | 0.036 | 0.001 | 0.200 | |
| 20% | 2000 | 0.076 | 0.002 | 0.201 | |
| 25% | 2500 | 0.115 | 0.002 | 0.201 | |
| 30% | 3000 | 0.172 | 0.002 | 0.201 | |
| 35% | 3500 | 0.252 | 0.003 | 0.202 | |
| 40% | 4000 | 0.307 | 0.003 | 0.202 | |
| 45% | 4500 | 0.380 | 0.003 | 0.203 | |
| 50% | 5000 | 0.448 | 0.004 | 0.203 | |
| 55% | 5500 | 0.503 | 0.004 | 0.203 | |
| 60% | 6000 | 0.559 | 0.005 | 0.204 | |
| 65% | 6500 | 0.688 | 0.005 | 0.204 | |
| 70% | 7000 | 0.778 | 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 | 0.685 | 0.000 | 0.199 | |

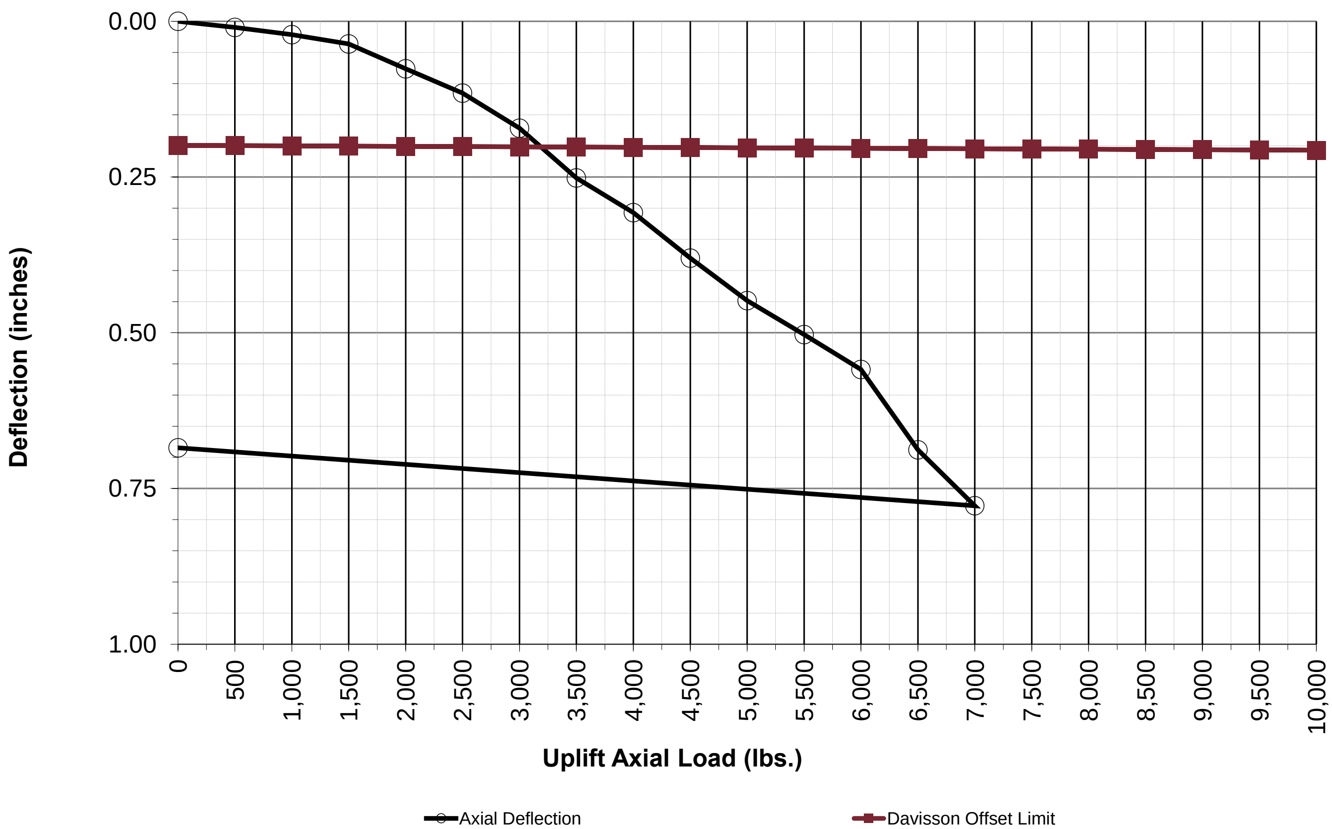



Exhibit C-9

# Tension Load Test Result for PLT-5B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

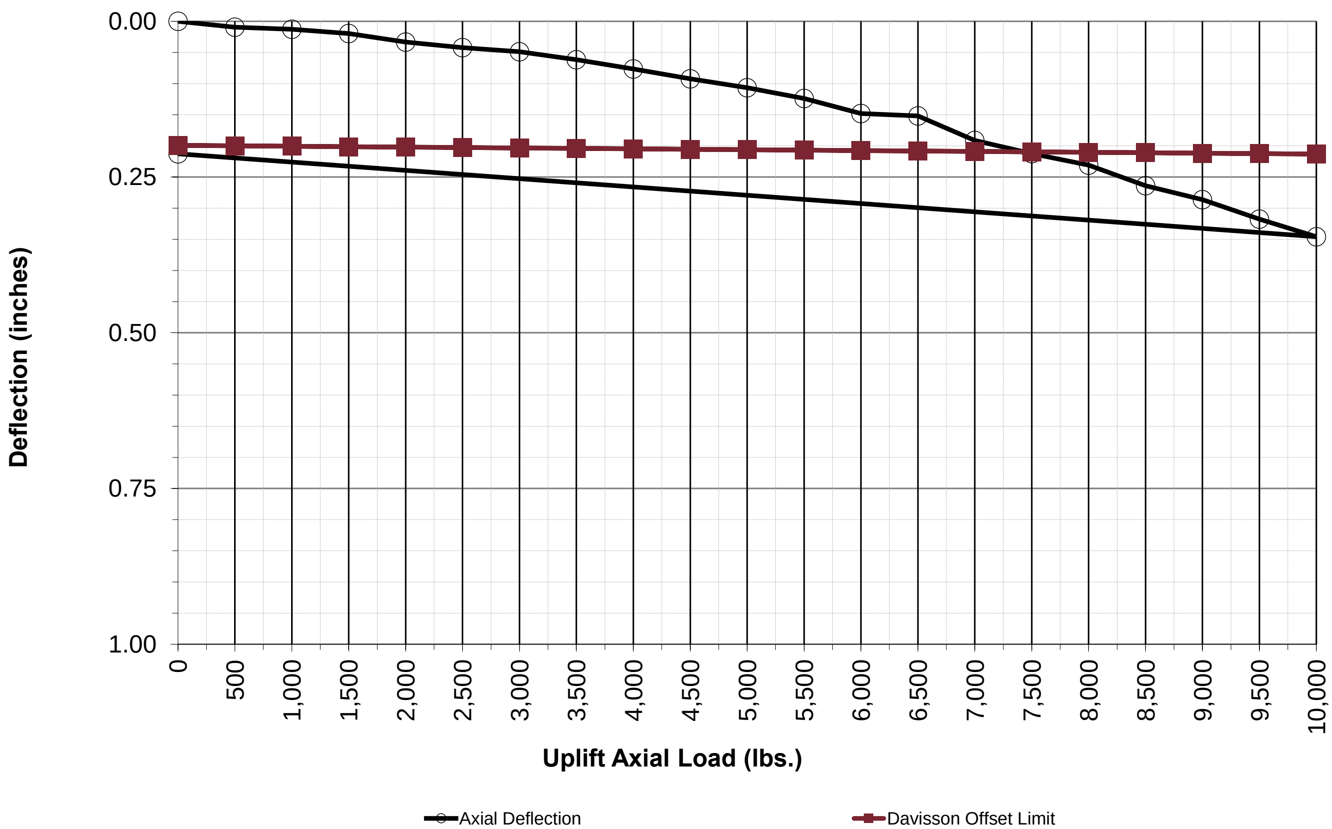
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-5B |
| Group Latitude [deg.]: | 36.1249 |
| Group Longitude[deg.]: | -119.4081 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 108 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 17 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(PL/AE)) | Comments |
| 0% | 0 | 0.000 | 0.000 | 0.199 | |
| 5% | 500 | 0.010 | 0.001 | 0.200 | |
| 10% | 1000 | 0.013 | 0.001 | 0.201 | |
| 15% | 1500 | 0.020 | 0.002 | 0.201 | |
| 20% | 2000 | 0.033 | 0.003 | 0.202 | |
| 25% | 2500 | 0.042 | 0.003 | 0.203 | |
| 30% | 3000 | 0.049 | 0.004 | 0.203 | |
| 35% | 3500 | 0.062 | 0.005 | 0.204 | |
| 40% | 4000 | 0.077 | 0.006 | 0.205 | |
| 45% | 4500 | 0.092 | 0.006 | 0.205 | |
| 50% | 5000 | 0.107 | 0.007 | 0.206 | |
| 55% | 5500 | 0.124 | 0.008 | 0.207 | |
| 60% | 6000 | 0.148 | 0.008 | 0.208 | |
| 65% | 6500 | 0.152 | 0.009 | 0.208 | |
| 70% | 7000 | 0.191 | 0.010 | 0.209 | |
| 75% | 7500 | 0.212 | 0.010 | 0.210 | |
| 80% | 8000 | 0.231 | 0.011 | 0.210 | |
| 85% | 8500 | 0.264 | 0.012 | 0.211 | |
| 90% | 9000 | 0.286 | 0.013 | 0.212 | |
| 95% | 9500 | 0.318 | 0.013 | 0.212 | |
| 100% | 10000 | 0.346 | 0.014 | 0.213 | |
| 0% | 0 | 0.213 | 0.000 | 0.199 | |



# Tension Load Test Result for PLT-6A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

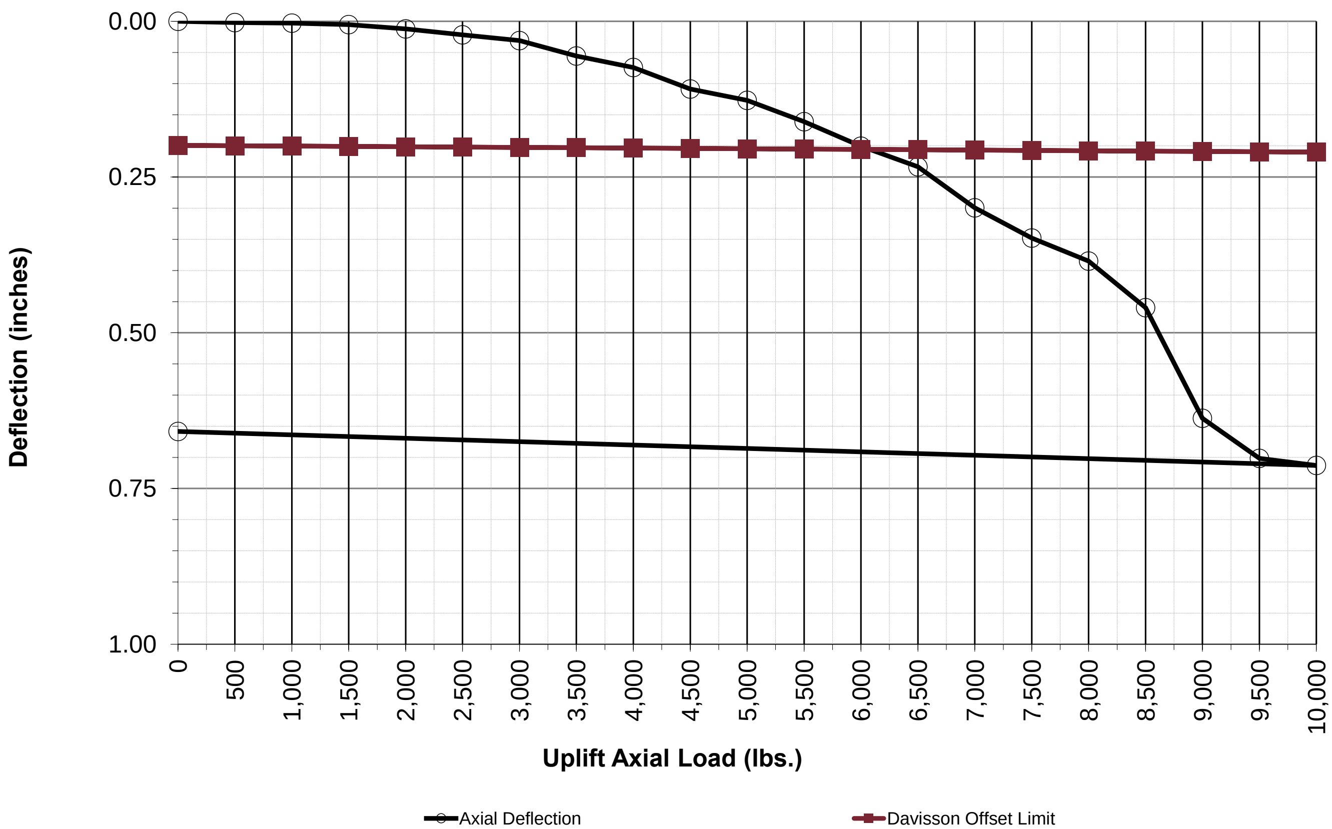
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-6A |
| Group Latitude [deg.]: | 36.1265 |
| Group Longitude[deg.]: | -119.3955 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 84 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 17 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(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 | 0.005 | 0.002 | 0.201 | |
| 20% | 2000 | 0.012 | 0.002 | 0.201 | |
| 25% | 2500 | 0.022 | 0.003 | 0.202 | |
| 30% | 3000 | 0.031 | 0.003 | 0.202 | |
| 35% | 3500 | 0.056 | 0.004 | 0.203 | |
| 40% | 4000 | 0.074 | 0.004 | 0.203 | |
| 45% | 4500 | 0.109 | 0.005 | 0.204 | |
| 50% | 5000 | 0.127 | 0.005 | 0.205 | |
| 55% | 5500 | 0.161 | 0.006 | 0.205 | |
| 60% | 6000 | 0.201 | 0.006 | 0.206 | |
| 65% | 6500 | 0.234 | 0.007 | 0.206 | |
| 70% | 7000 | 0.300 | 0.008 | 0.207 | |
| 75% | 7500 | 0.348 | 0.008 | 0.207 | |
| 80% | 8000 | 0.385 | 0.009 | 0.208 | |
| 85% | 8500 | 0.460 | 0.009 | 0.208 | |
| 90% | 9000 | 0.637 | 0.010 | 0.209 | |
| 95% | 9500 | 0.702 | 0.010 | 0.209 | |
| 100% | 10000 | 0.713 | 0.011 | 0.210 | |
| 0% | 0 | 0.659 | 0.000 | 0.199 | |



# Tension Load Test Result for PLT-6B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in.]: | 6 |
| Load Cell: | DILLON ED |

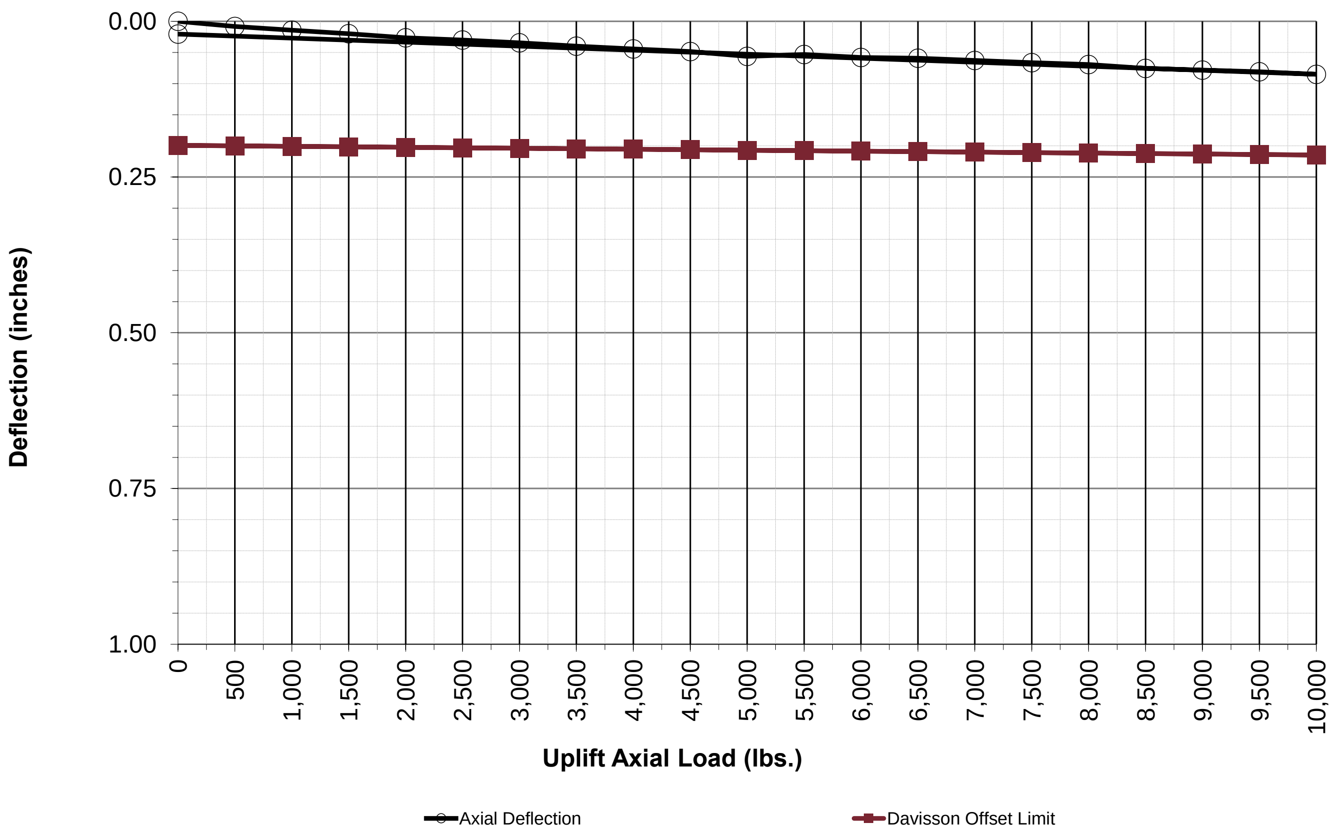
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT6-B |
| Group Latitude [deg.]: | 36.1265 |
| Group Longitude[deg.]: | -119.3955 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 120 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Target Load [lbs.]: | 10,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 55 |

| Tension Test Results | | | | Davisson Offset Limit Lines | |
|---|---|---|---|---|---|
| % of Target Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Elastic Data (in.) (PL/AE) | Davisson Offset Limit (in.) (0.15+(PL/AE)) | Comments |
| 0% | 0 | 0.000 | 0.000 | 0.199 | |
| 5% | 500 | 0.008 | 0.001 | 0.200 | |
| 10% | 1000 | 0.014 | 0.002 | 0.201 | |
| 15% | 1500 | 0.020 | 0.002 | 0.201 | |
| 20% | 2000 | 0.027 | 0.003 | 0.202 | |
| 25% | 2500 | 0.030 | 0.004 | 0.203 | |
| 30% | 3000 | 0.035 | 0.005 | 0.204 | |
| 35% | 3500 | 0.040 | 0.005 | 0.205 | |
| 40% | 4000 | 0.044 | 0.006 | 0.205 | |
| 45% | 4500 | 0.049 | 0.007 | 0.206 | |
| 50% | 5000 | 0.056 | 0.008 | 0.207 | |
| 55% | 5500 | 0.053 | 0.008 | 0.208 | |
| 60% | 6000 | 0.058 | 0.009 | 0.208 | |
| 65% | 6500 | 0.059 | 0.010 | 0.209 | |
| 70% | 7000 | 0.063 | 0.011 | 0.210 | |
| 75% | 7500 | 0.066 | 0.012 | 0.211 | |
| 80% | 8000 | 0.069 | 0.012 | 0.212 | |
| 85% | 8500 | 0.076 | 0.013 | 0.212 | |
| 90% | 9000 | 0.078 | 0.014 | 0.213 | |
| 95% | 9500 | 0.081 | 0.015 | 0.214 | |
| 100% | 10000 | 0.085 | 0.015 | 0.215 | |
| 0% | 0 | 0.021 | 0.000 | 0.199 | |



## Lateral Test Results

# Lateral Load

| Pile No. | | Pile Type | Embedment Depth, ft | Pile Drive Time, sec | Yield Deflection, in[1] | Load Application Height, in above grade | Load, lb |
|---|---|---|---|---|---|---|---|
| PLT-1 | A | W6x9 | 5 | 11 | 0.52 | 30 | 2,500 |
| | B | W6x9 | 8 | 42 | 0.52 | 30 | 4,000 |
| PLT-2 | A | W6x9 | 6 | 12 | 0.52 | 30 | 2,500 |
| | B | W6x9 | 9 | 28 | 0.50** | 30 | 3,250 |
| PLT-3 | A | W6x9 | 7 | 19 | 0.50** | 30 | 2,250 |
| | B | W6x9 | 10 | 31 | 0.5** | 30 | 2,400 |
| PLT-4 | A | W6x9 | 5 | 7 | 0.50 | 30 | 2,000 |
| | B | W6x9 | 8 | 15 | 0.50 | 30 | 3,000 |
| PLT-5 | A | W6x9 | 6 | 8 | 0.50** | 30 | 2,800 |
| | B | W6x9 | 9 | 17 | 0.50 | 30 | 3,000 |
| PLT-6 | A | W6x9 | 7 | 17 | 0.48 | 30 | 3,000 |
| | B | W6x9 | 10 | 55 | 0.45 | 30 | 3,000 |

[1] Yield deflection is defined near 1/2"

* Maximum load reached prior to deflection criteria

**Load interpolated from graph.

# Lateral Load Test Result for PLT-1A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

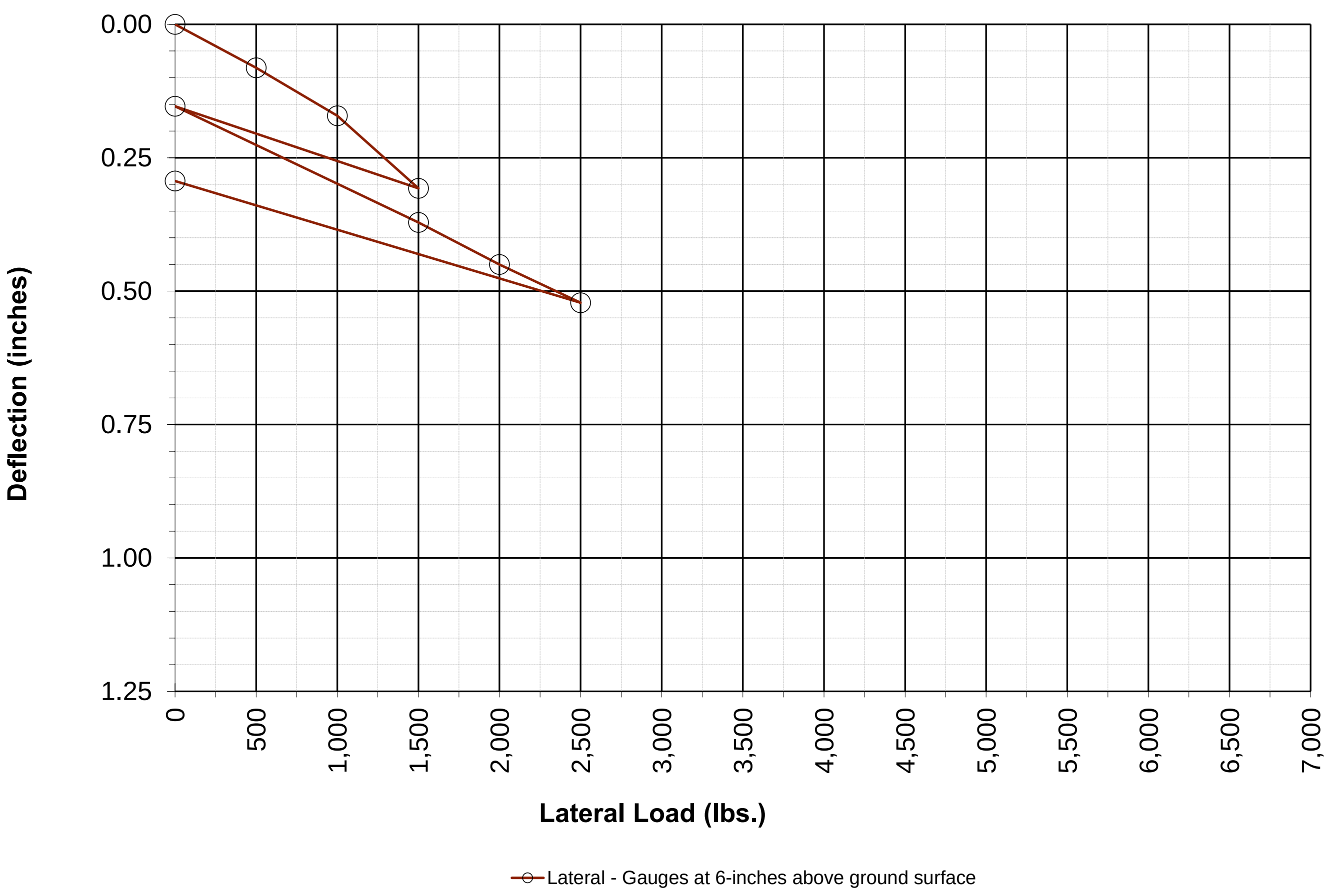
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/3/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-1A |
| Group Latitude [deg.]: | 36.132683° |
| Group Longitude [deg.]: | -119.4096 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 60 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 11 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.082 | |
| 14% | 1,000 | 0.172 | |
| 21% | 1,500 | 0.308 | |
| 0% | 0 | 0.154 | |
| 21% | 1,500 | 0.371 | |
| 29% | 2,000 | 0.450 | |
| 36% | 2,500 | 0.522 | |
| 43% | 3,000 | | |
| 0% | 0 | | |
| 43% | 3,000 | | |
| 50% | 3,500 | | |
| 57% | 4,000 | | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.294 | |



# Lateral Load Test Result for PLT-1B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

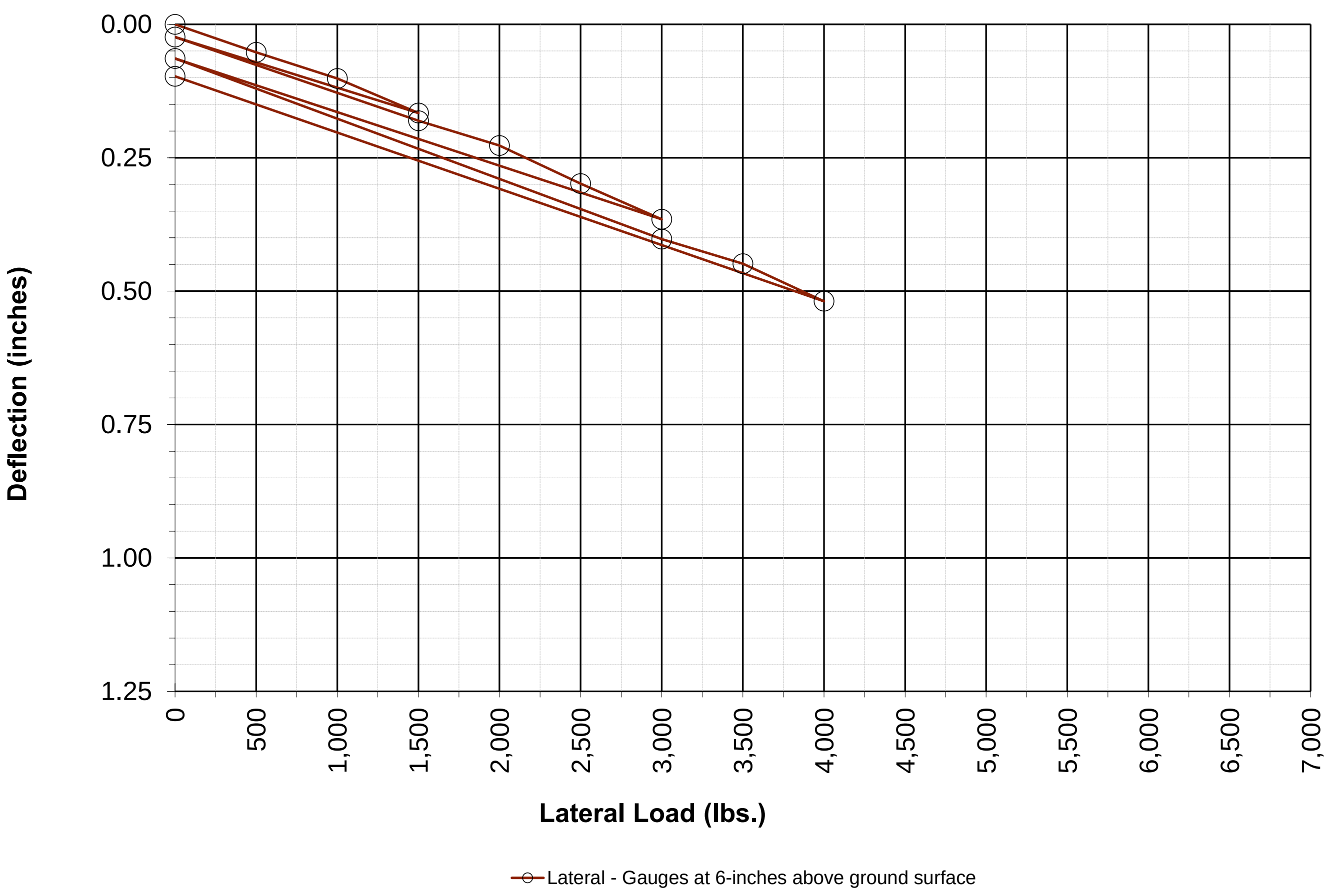
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/3/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-1B |
| Group Latitude [deg.]: | 36.132683° |
| Group Longitude [deg.]: | -119.4096 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 96 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 42 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.053 | |
| 14% | 1,000 | 0.102 | |
| 21% | 1,500 | 0.166 | |
| 0% | 0 | 0.024 | |
| 21% | 1,500 | 0.181 | |
| 29% | 2,000 | 0.227 | |
| 36% | 2,500 | 0.299 | |
| 43% | 3,000 | 0.366 | |
| 0% | 0 | 0.064 | |
| 43% | 3,000 | 0.403 | |
| 50% | 3,500 | 0.449 | |
| 57% | 4,000 | 0.519 | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.097 | |



# Lateral Load Test Result for PLT-2A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

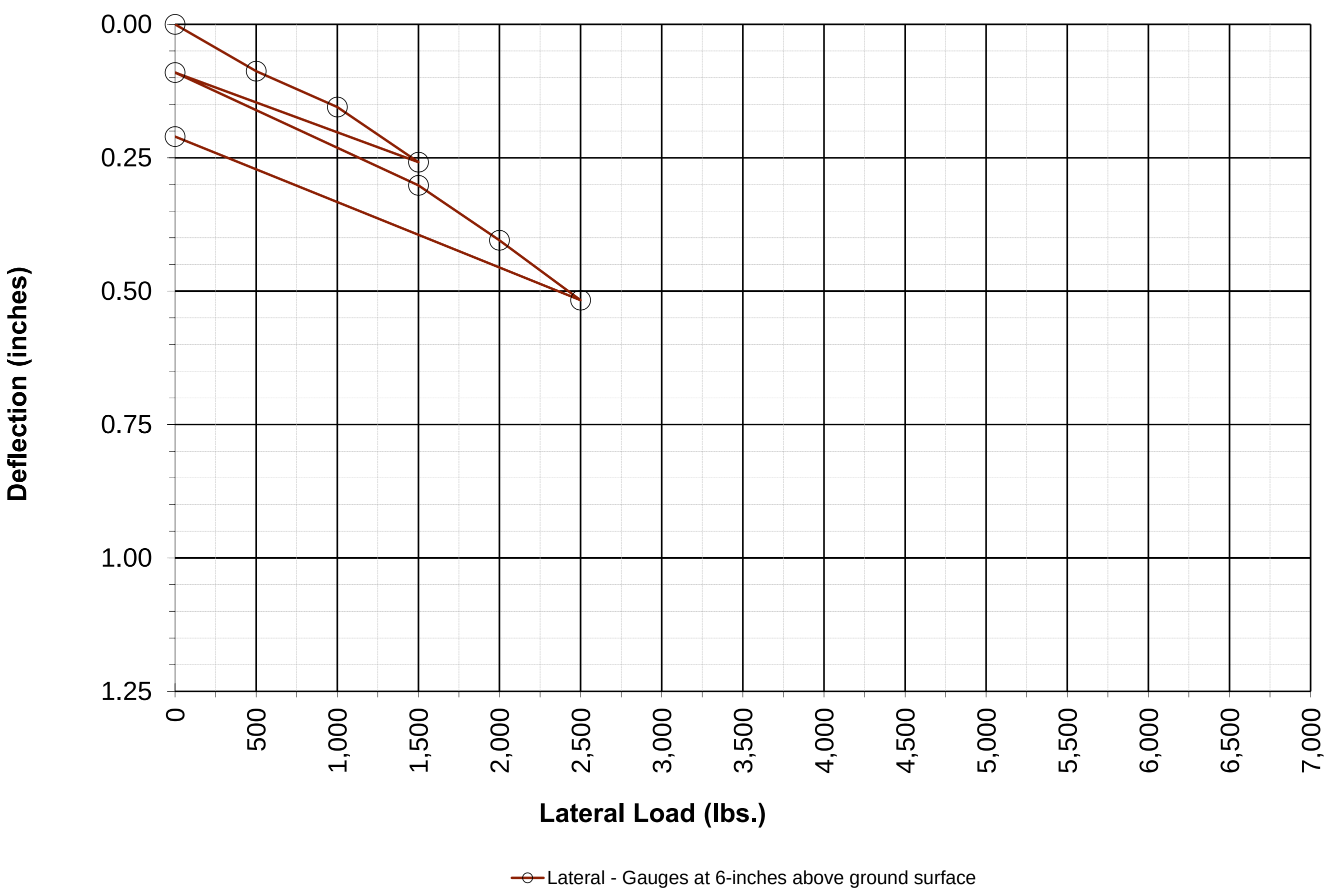
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/3/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-2A |
| Group Latitude [deg.]: | 36.131832° |
| Group Longitude [deg.]: | -119.396316° |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 72 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 12 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.088 | |
| 14% | 1,000 | 0.155 | |
| 21% | 1,500 | 0.259 | |
| 0% | 0 | 0.091 | |
| 21% | 1,500 | 0.302 | |
| 29% | 2,000 | 0.405 | |
| 36% | 2,500 | 0.517 | |
| 43% | 3,000 | | |
| 0% | 0 | | |
| 43% | 3,000 | | |
| 50% | 3,500 | | |
| 57% | 4,000 | | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.211 | |



# Lateral Load Test Result for PLT-2B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

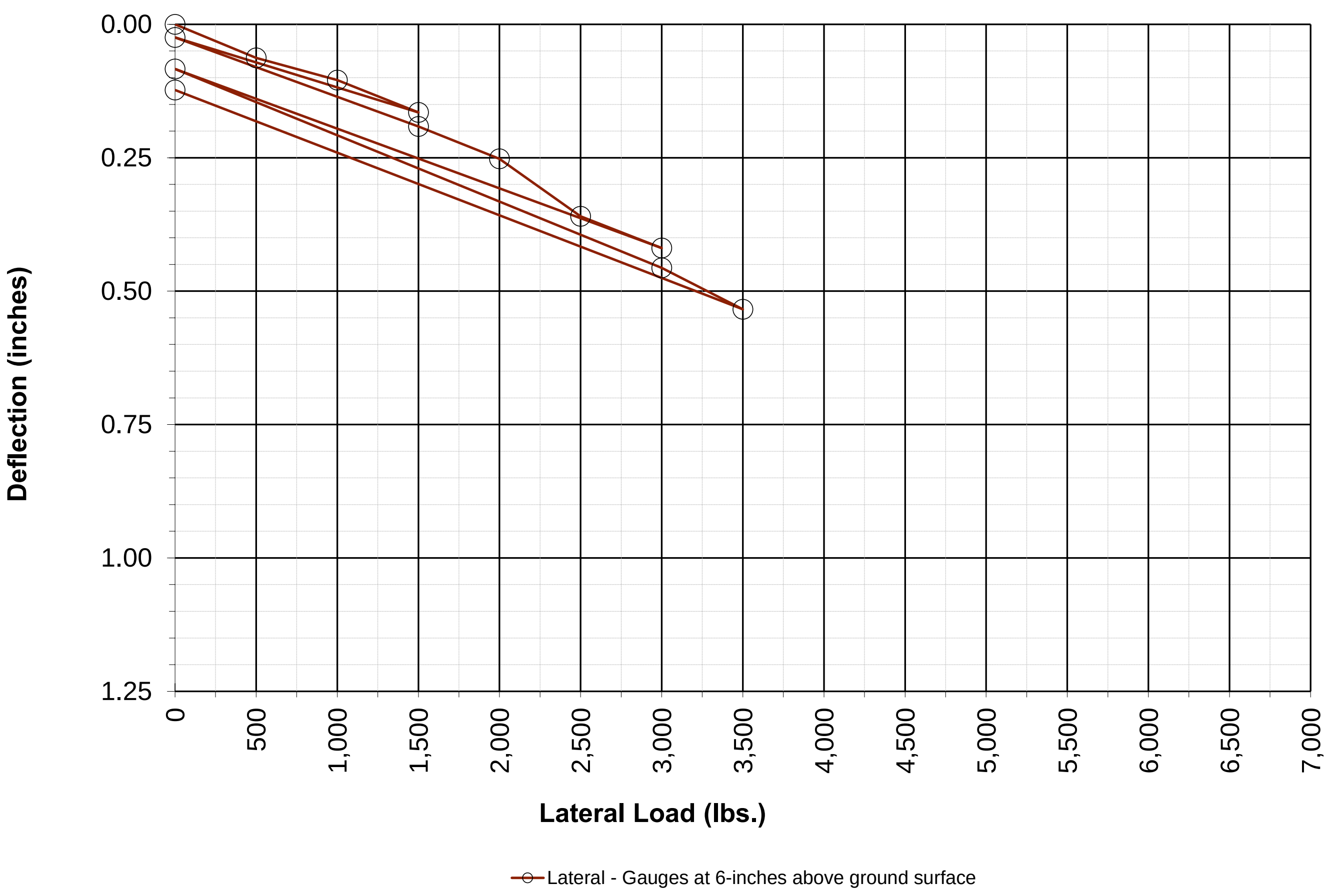
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/3/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-2B |
| Group Latitude [deg.]: | 36.131832° |
| Group Longitude [deg.]: | -119.396316° |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 84 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 28 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.063 | |
| 14% | 1,000 | 0.105 | |
| 21% | 1,500 | 0.165 | |
| 0% | 0 | 0.025 | |
| 21% | 1,500 | 0.191 | |
| 29% | 2,000 | 0.252 | |
| 36% | 2,500 | 0.360 | |
| 43% | 3,000 | 0.419 | |
| 0% | 0 | 0.084 | |
| 43% | 3,000 | 0.456 | |
| 50% | 3,500 | 0.534 | |
| 57% | 4,000 | | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.123 | |



# Lateral Load Test Result for PLT-3A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

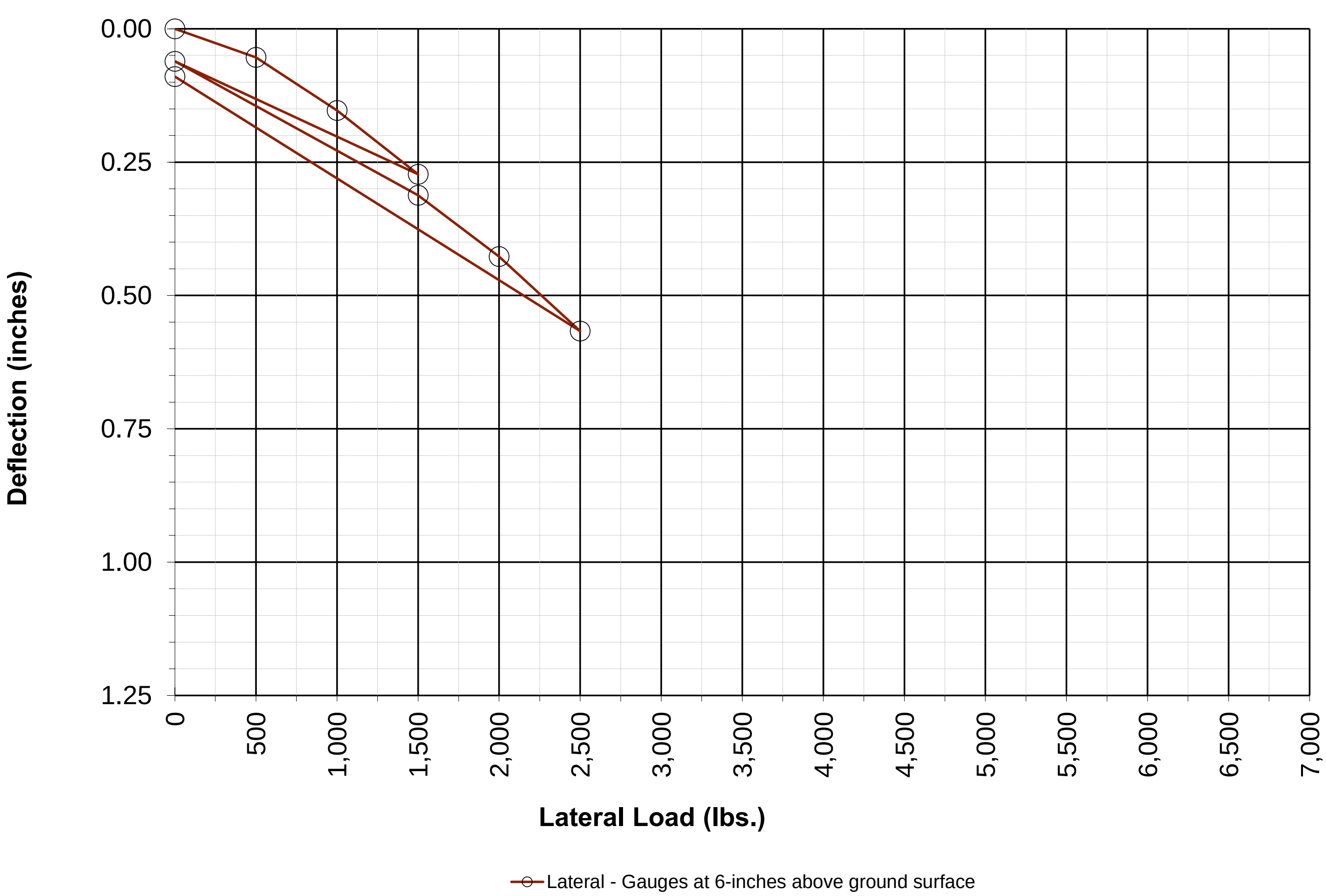
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-3A |
| Group Latitude [deg.]: | 36.1276 |
| Group Longitude [deg.]: | -119.4037 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 120 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 19 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.054 | |
| 14% | 1,000 | 0.153 | |
| 21% | 1,500 | 0.273 | |
| 0% | 0 | 0.061 | |
| 21% | 1,500 | 0.312 | |
| 29% | 2,000 | 0.427 | |
| 36% | 2,500 | 0.567 | |
| 43% | 3,000 | | |
| 0% | 0 | | |
| 43% | 3,000 | | |
| 50% | 3,500 | | |
| 57% | 4,000 | | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.090 | |



# Lateral Load Test Result for PLT-3B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

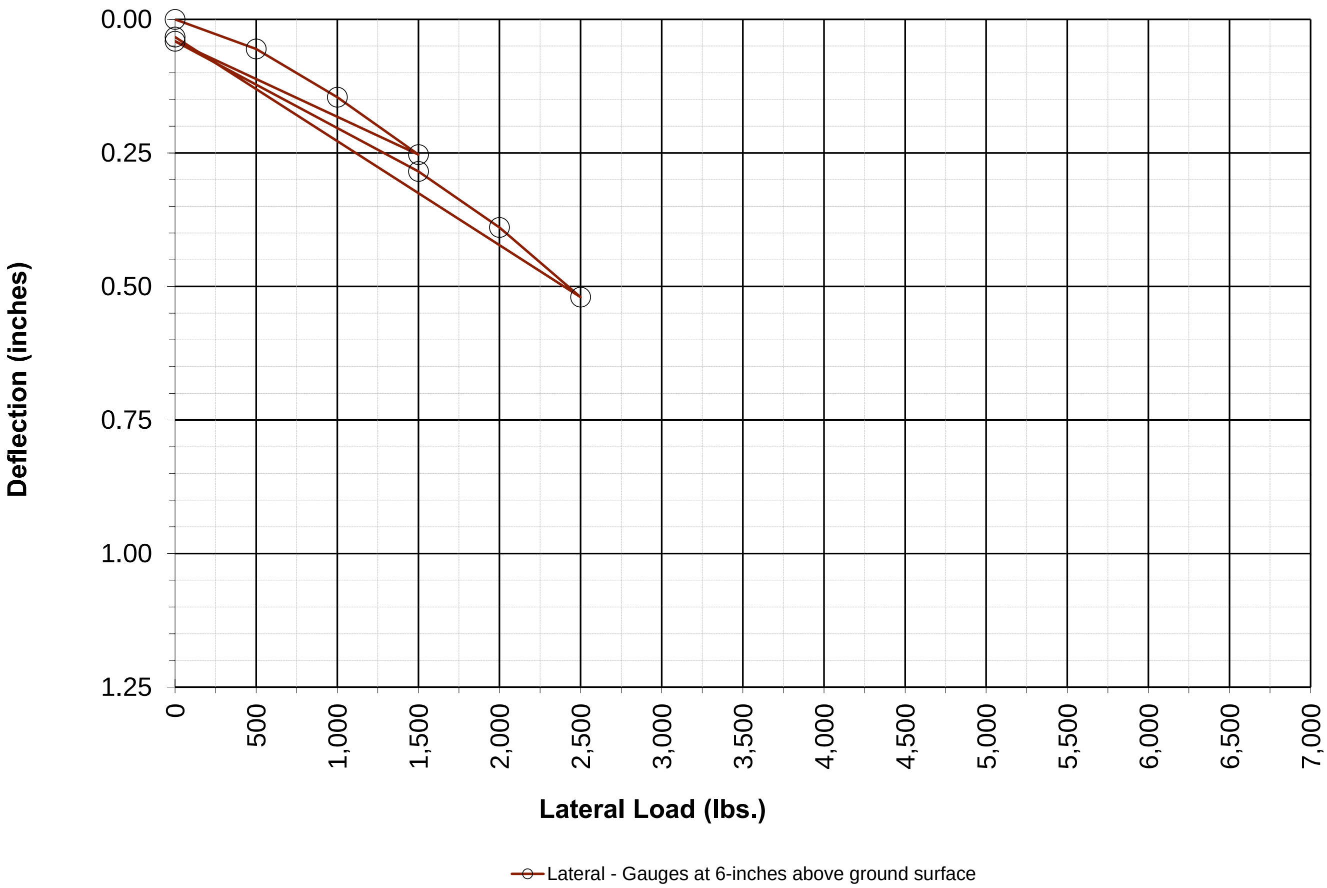
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-3B |
| Group Latitude [deg.]: | 36.1276 |
| Group Longitude [deg.]: | -119.4037 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 108 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 31 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.055 | |
| 14% | 1,000 | 0.146 | |
| 21% | 1,500 | 0.253 | |
| 0% | 0 | 0.041 | |
| 21% | 1,500 | 0.285 | |
| 29% | 2,000 | 0.390 | |
| 36% | 2,500 | 0.520 | |
| 43% | 3,000 | | |
| 0% | 0 | | |
| 43% | 3,000 | | |
| 50% | 3,500 | | |
| 57% | 4,000 | | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.033 | |



# Lateral Load Test Result for PLT-4A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

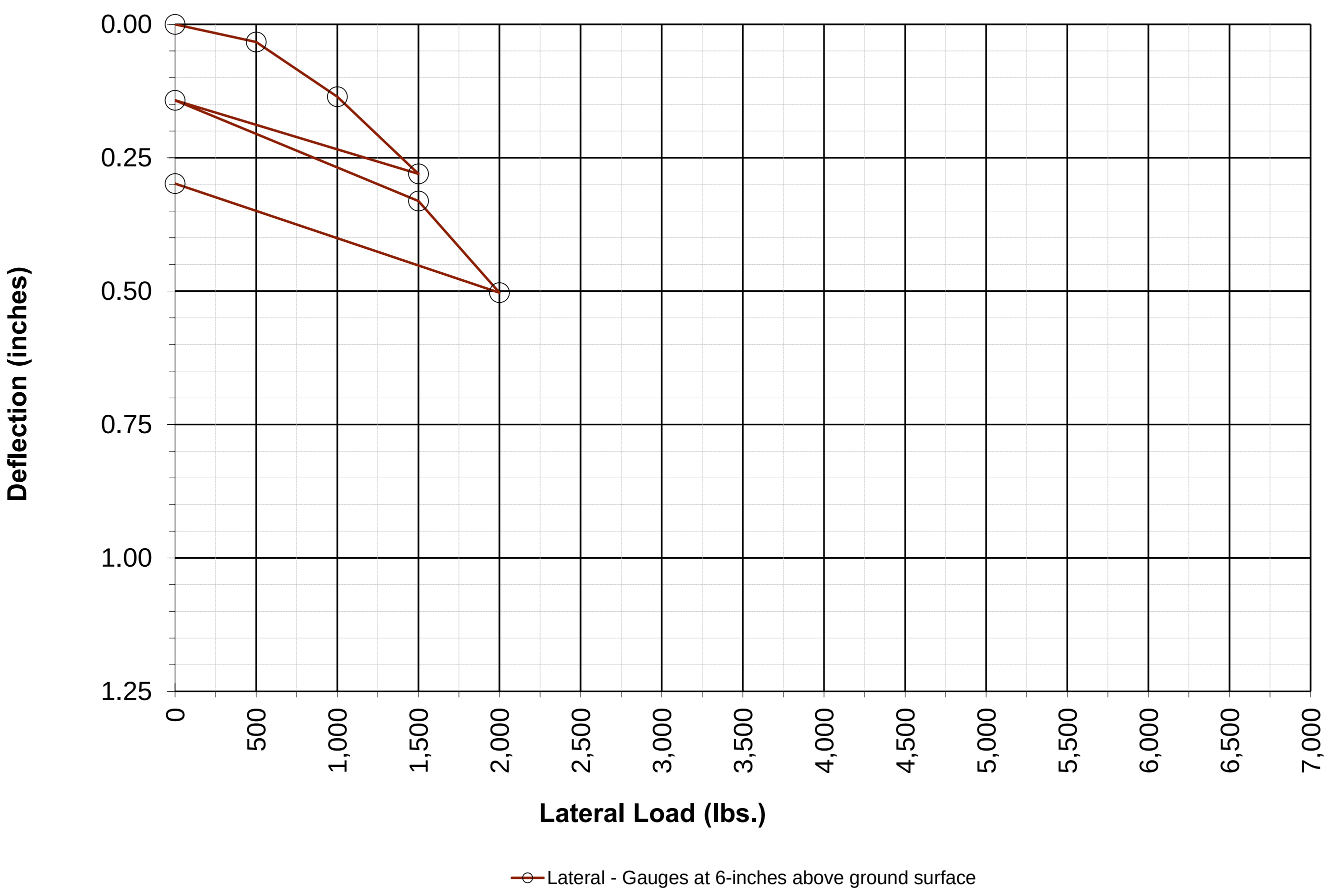
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-4A |
| Group Latitude [deg.]: | 36.1282 |
| Group Longitude [deg.]: | -119.3952 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 60 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 7 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.033 | |
| 14% | 1,000 | 0.136 | |
| 21% | 1,500 | 0.280 | |
| 0% | 0 | 0.142 | |
| 21% | 1,500 | 0.331 | |
| 29% | 2,000 | 0.503 | |
| 36% | 2,500 | | |
| 43% | 3,000 | | |
| 0% | 0 | | |
| 43% | 3,000 | | |
| 50% | 3,500 | | |
| 57% | 4,000 | | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.299 | |



# Lateral Load Test Result for PLT-4B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

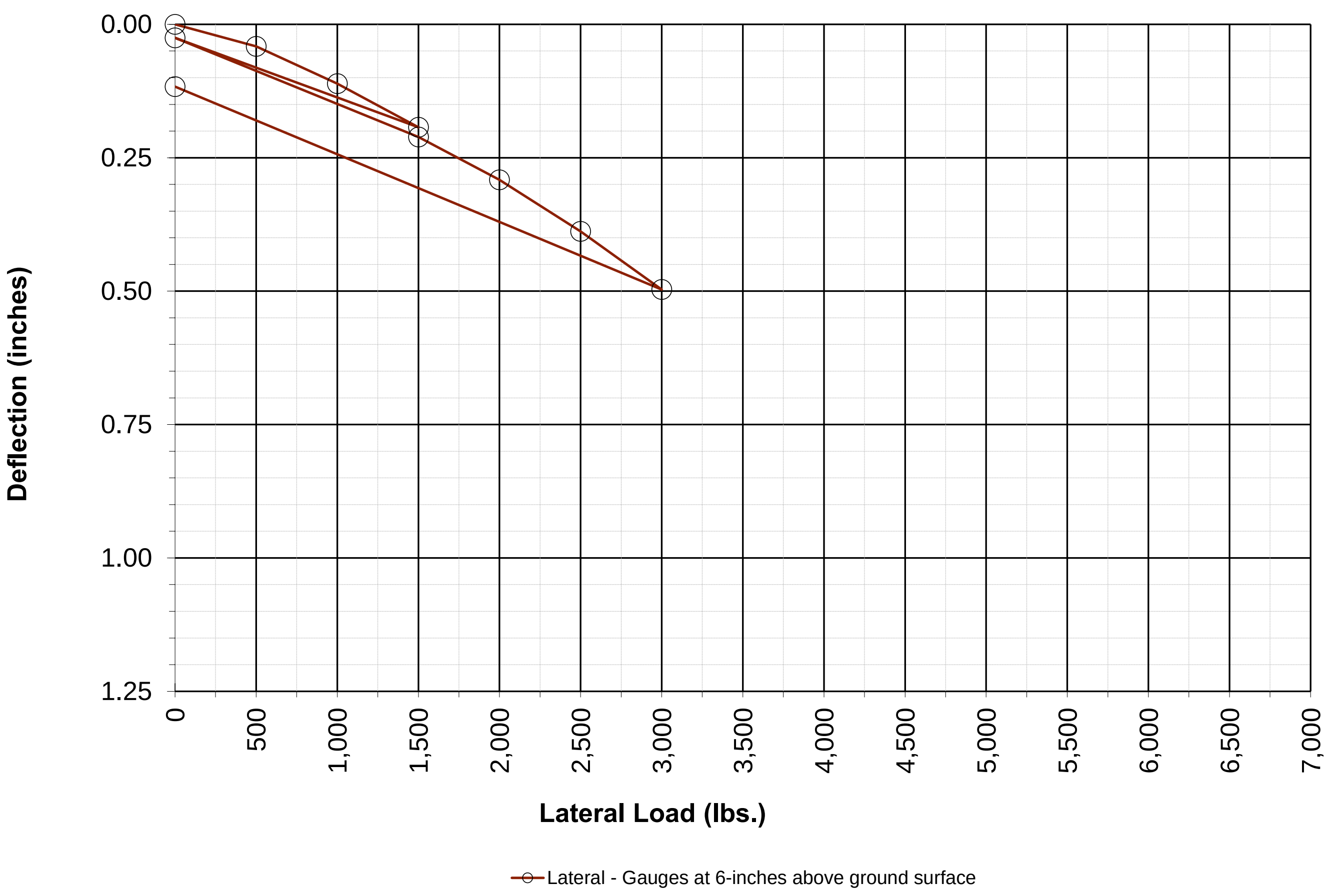
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-4B |
| Group Latitude [deg.]: | 36.1282 |
| Group Longitude [deg.]: | -119.3952 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 96 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 15 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.041 | |
| 14% | 1,000 | 0.111 | |
| 21% | 1,500 | 0.193 | |
| 0% | 0 | 0.026 | |
| 21% | 1,500 | 0.211 | |
| 29% | 2,000 | 0.291 | |
| 36% | 2,500 | 0.388 | |
| 43% | 3,000 | 0.497 | |
| 0% | 0 | | |
| 43% | 3,000 | | |
| 50% | 3,500 | | |
| 57% | 4,000 | | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.117 | |



# Lateral Load Test Result for PLT-5A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

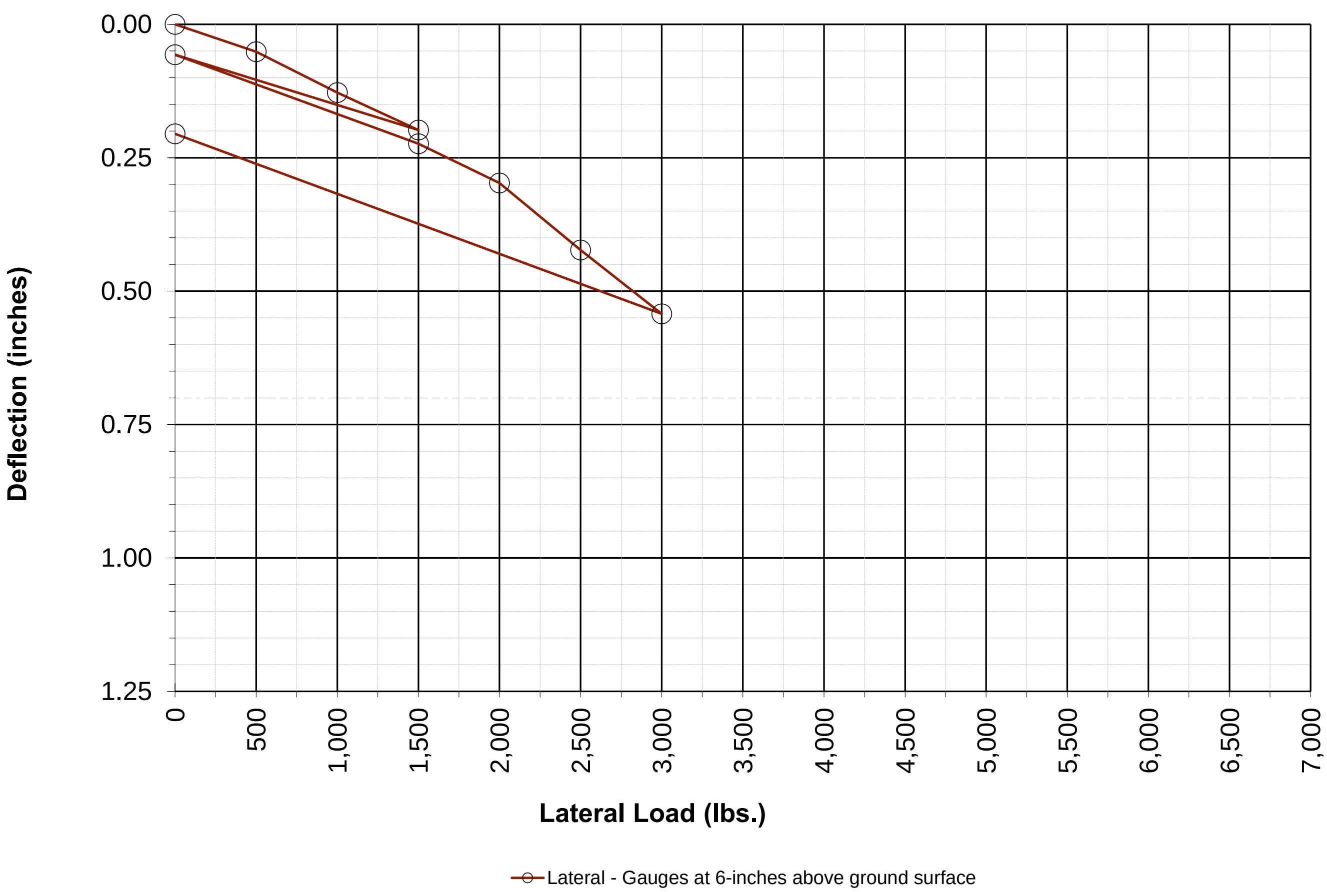
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-5A |
| Group Latitude [deg.]: | 36.1249 |
| Group Longitude [deg.]: | -119.4081 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 60 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 8 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.051 | |
| 14% | 1,000 | 0.128 | |
| 21% | 1,500 | 0.198 | |
| 0% | 0 | 0.057 | |
| 21% | 1,500 | 0.224 | |
| 29% | 2,000 | 0.297 | |
| 36% | 2,500 | 0.423 | |
| 43% | 3,000 | 0.543 | |
| 0% | 0 | | |
| 43% | 3,000 | | |
| 50% | 3,500 | | |
| 57% | 4,000 | | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.205 | |



# Lateral Load Test Result for PLT-5B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

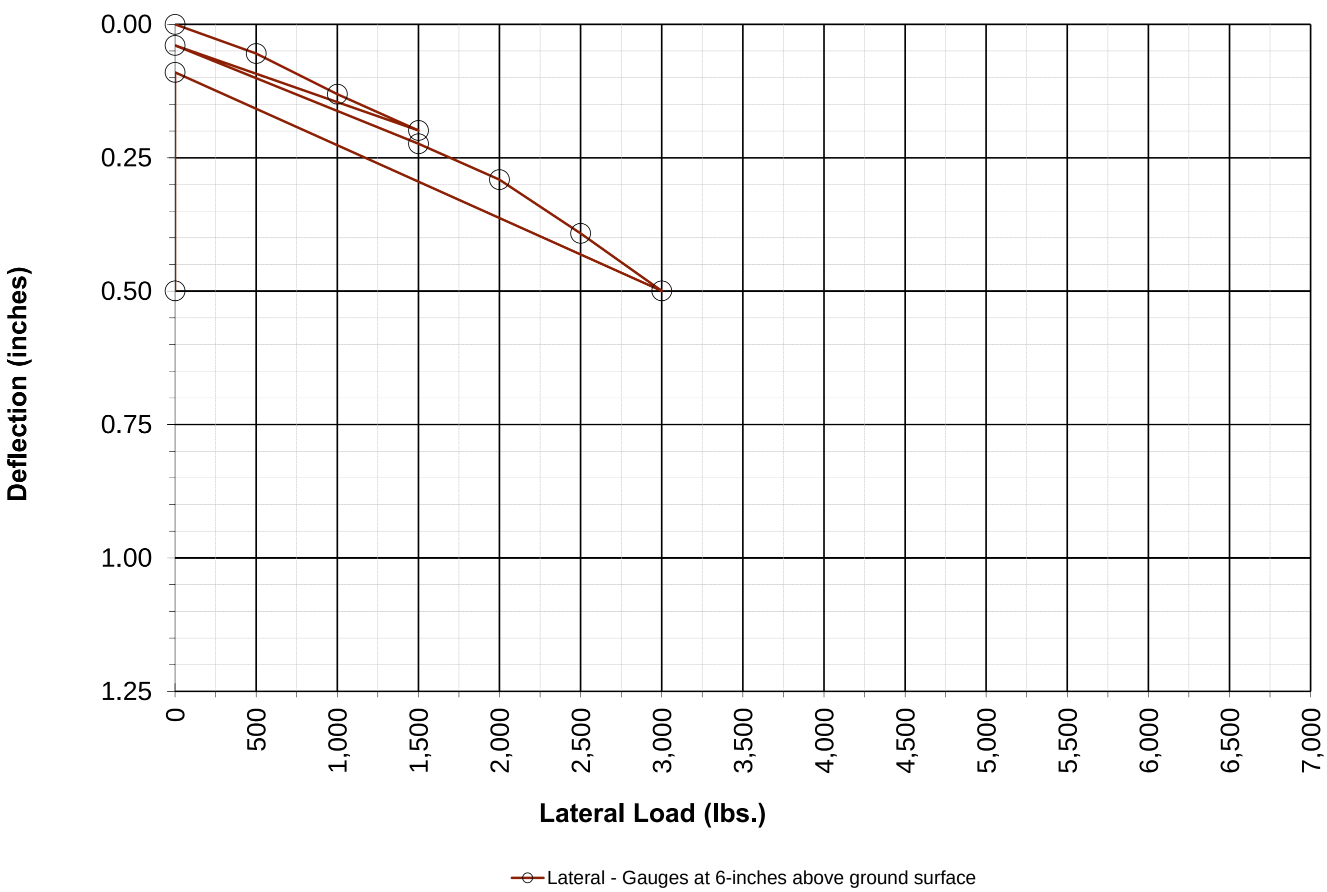
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-5B |
| Group Latitude [deg.]: | 36.1249 |
| Group Longitude [deg.]: | -119.4081 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 108 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 17 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.055 | |
| 14% | 1,000 | 0.131 | |
| 21% | 1,500 | 0.199 | |
| 0% | 0 | 0.039 | |
| 21% | 1,500 | 0.224 | |
| 29% | 2,000 | 0.291 | |
| 36% | 2,500 | 0.392 | |
| 43% | 3,000 | 0.500 | |
| 0% | 0 | 0.090 | |
| 43% | 3,000 | | |
| 50% | 3,500 | | |
| 57% | 4,000 | | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.500 | |



# Lateral Load Test Result for PLT-6A

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

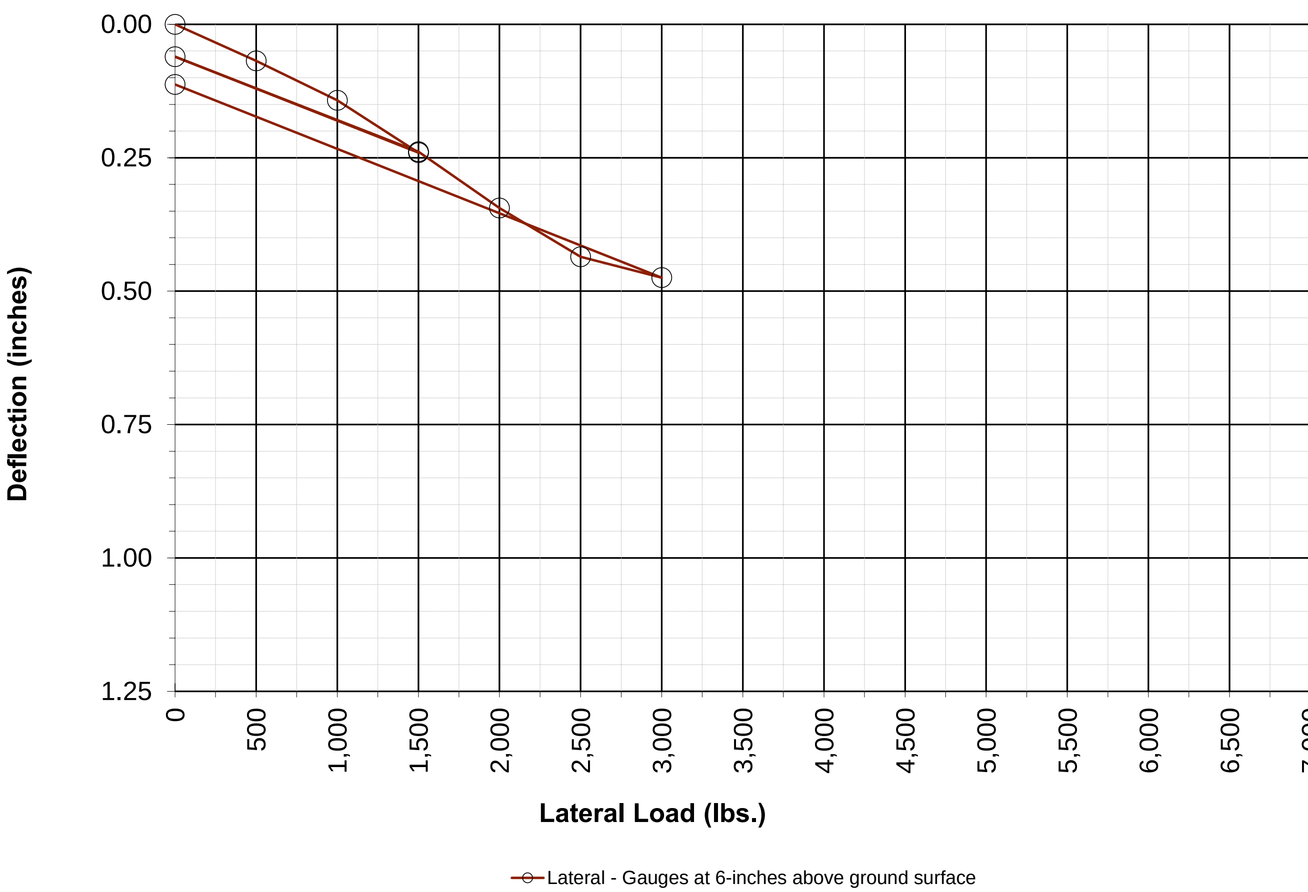
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT- 6A |
| Group Latitude [deg.]: | 36.1265 |
| Group Longitude [deg.]: | -119.3955 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 84 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 17 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.069 | |
| 14% | 1,000 | 0.142 | |
| 21% | 1,500 | 0.241 | |
| 0% | 0 | 0.061 | |
| 21% | 1,500 | 0.239 | |
| 29% | 2,000 | 0.344 | |
| 36% | 2,500 | 0.436 | |
| 43% | 3,000 | 0.475 | |
| 0% | 0 | | |
| 43% | 3,000 | | |
| 50% | 3,500 | | |
| 57% | 4,000 | | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.113 | |



# Lateral Load Test Result for PLT-6B

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**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.]: | 30 |
| Load Cell: | DILLON ED |

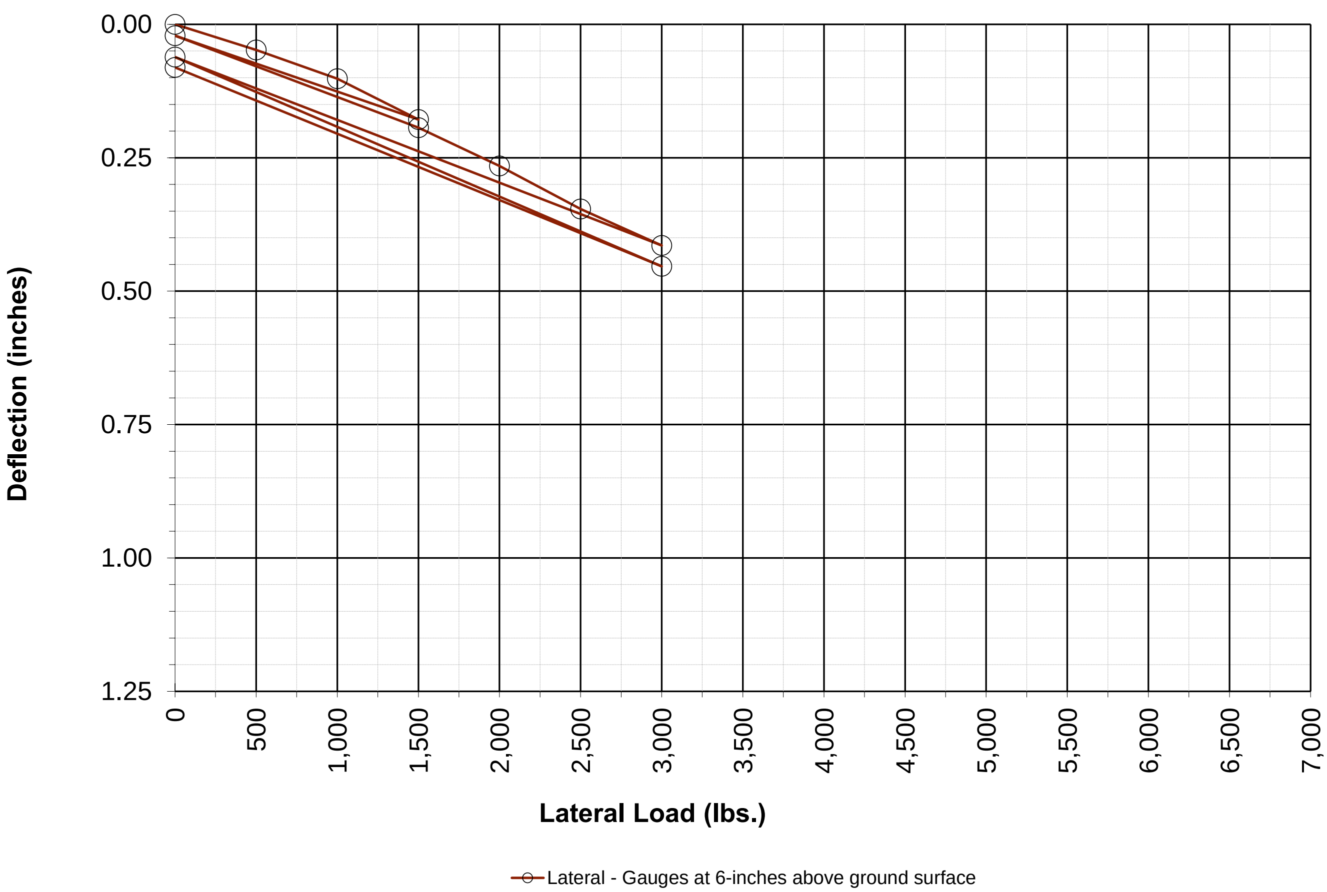
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | AC/JB |
| Date Tested: | 1/2/2024 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-6B |
| Group Latitude [deg.]: | 36.1265 |
| Group Longitude [deg.]: | -119.3955 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 120 |
| Pile Stick-Up [in.]: | 5.9 |
| Lateral Target Load [lbs.]: | 7,000 |
| Drive Time [sec.]: | 55 |

| % of Target Load | Lateral Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 7% | 500 | 0.048 | |
| 14% | 1,000 | 0.102 | |
| 21% | 1,500 | 0.178 | |
| 0% | 0 | 0.021 | |
| 21% | 1,500 | 0.194 | |
| 29% | 2,000 | 0.265 | |
| 36% | 2,500 | 0.346 | |
| 43% | 3,000 | 0.414 | |
| 0% | 0 | 0.062 | |
| 43% | 3,000 | 0.454 | |
| 50% | 3,500 | | |
| 57% | 4,000 | | |
| 64% | 4,500 | | |
| 0% | 0 | | |
| 64% | 4,500 | | |
| 71% | 5,000 | | |
| 79% | 5,500 | | |
| 86% | 6,000 | | |
| 0% | 0 | | |
| 86% | 6,000 | | |
| 93% | 6,500 | | |
| 100% | 7,000 | | |
| 0% | 0 | 0.081 | |



# Axial Compression Test Results

Terracon

## Compression Load

| Pile No. | | Pile Type | Embedment Depth, ft | Pile Drive Time, sec | Yield Deflection, in[1] | Load, lb |
|---|---|---|---|---|---|---|
| **PLT-1** | C | W6x9 | 5 | 13 | 0.08* | 13,000 |
| **PLT-2** | C | W6x9 | 7 | 21 | 0.03* | 13,000 |
| **PLT-3** | C | W6x9 | 7 | 11 | 0.05* | 13,000 |
| **PLT-4** | C | W6x9 | 7 | 16 | 0.06* | 13,000 |
| **PLT-5** | C | W6x9 | 6 | 13 | 0.10 | 13,000 |
| **PLT-6** | C | W6x9 | 7 | 22 | 0.04* | 13,000 |

[1] Yield deflection is defined near ¼"

* Maximum load reached prior to deflection criteria

# Compression Load Test Result for PLT-1C

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in]: | 6 |
| Load Cell: | OHAUS 10Ton |

**Test Date and Representative**

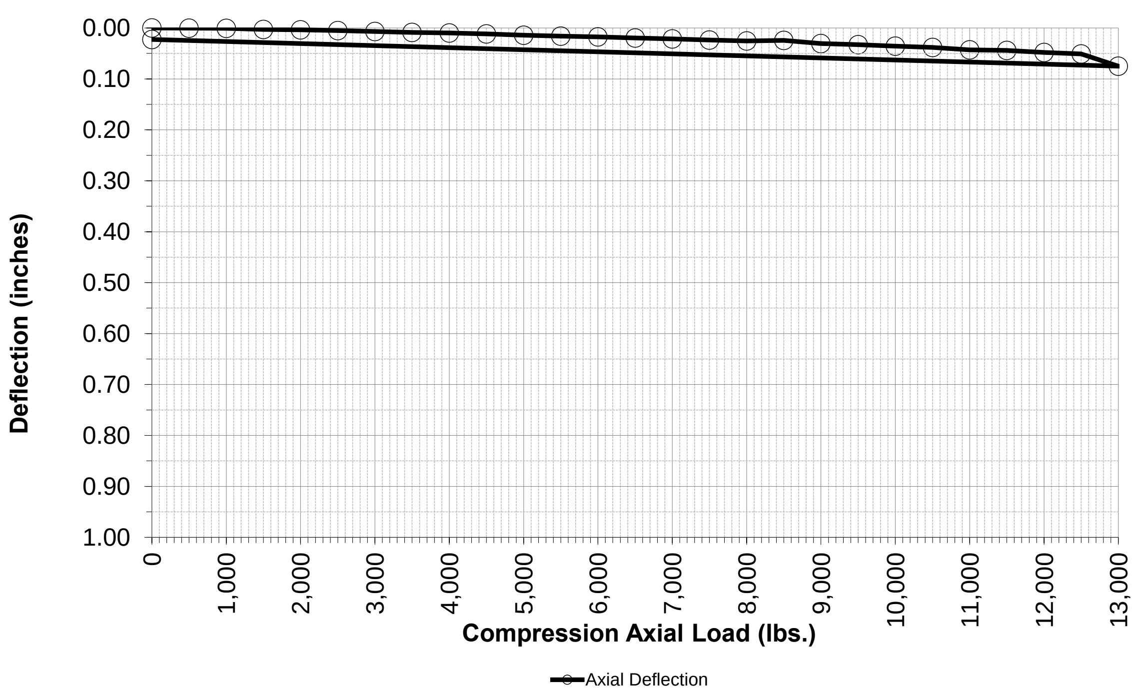
| | |
|---|---|
| Tested By Terracon Rep: | JB |
| Date Tested: | 1/4/2023 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-1C |
| Latitude [deg.]: | 36.132683° |
| Longitude [deg.]: | -119.40963 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 60 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Design Load [lbs.]: | 13,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 13 |

**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% | 1,000 | 0.001 | |
| 12% | 1,500 | 0.003 | |
| 15% | 2,000 | 0.004 | |
| 19% | 2,500 | 0.005 | |
| 23% | 3,000 | 0.007 | |
| 27% | 3,500 | 0.009 | |
| 31% | 4,000 | 0.010 | |
| 35% | 4,500 | 0.012 | |
| 38% | 5,000 | 0.014 | |
| 42% | 5,500 | 0.016 | |
| 46% | 6,000 | 0.018 | |
| 50% | 6,500 | 0.020 | |
| 54% | 7,000 | 0.022 | |
| 58% | 7,500 | 0.024 | |
| 62% | 8,000 | 0.026 | |
| 65% | 8,500 | 0.025 | |
| 69% | 9,000 | 0.031 | |
| 73% | 9,500 | 0.033 | |
| 77% | 10,000 | 0.036 | |
| 81% | 10,500 | 0.038 | |
| 85% | 11,000 | 0.043 | |
| 88% | 11,500 | 0.044 | |
| 92% | 12,000 | 0.048 | |
| 96% | 12,500 | 0.051 | |
| 100% | 13,000 | 0.075 | |
| 0% | 0 | 0.023 | |



# Compression Load Test Result for PLT-2C

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in]: | 6 |
| Load Cell: | OHAUS 10Ton |

**Test Date and Representative**

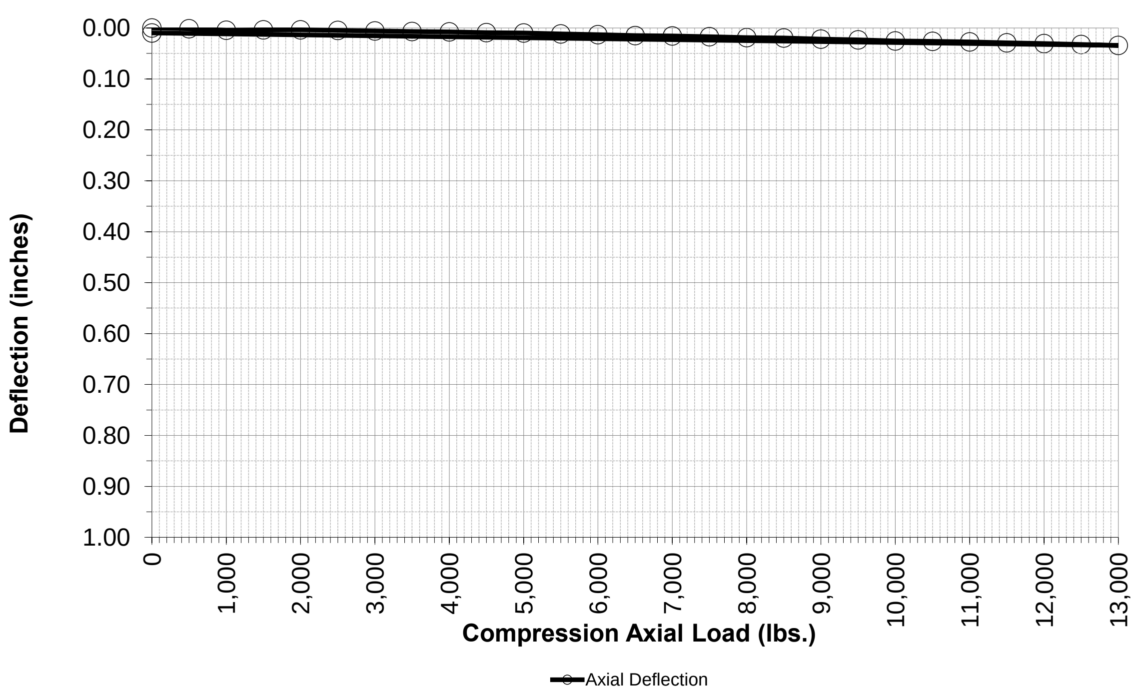
| | |
|---|---|
| Tested By Terracon Rep: | JB |
| Date Tested: | 1/4/2023 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-2C |
| Latitude [deg.]: | 36.131832° |
| Longitude [deg.]: | -119.396316° |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 84 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 24 |
| Axial Design Load [lbs.]: | 13,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 21 |

**Compression Test Results**

| % of Design Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
|---|---|---|---|
| 0% | 0 | 0.000 | |
| 4% | 500 | 0.002 | |
| 8% | 1,000 | 0.005 | |
| 12% | 1,500 | 0.004 | |
| 15% | 2,000 | 0.004 | |
| 19% | 2,500 | 0.005 | |
| 23% | 3,000 | 0.006 | |
| 27% | 3,500 | 0.007 | |
| 31% | 4,000 | 0.008 | |
| 35% | 4,500 | 0.009 | |
| 38% | 5,000 | 0.010 | |
| 42% | 5,500 | 0.012 | |
| 46% | 6,000 | 0.013 | |
| 50% | 6,500 | 0.015 | |
| 54% | 7,000 | 0.016 | |
| 58% | 7,500 | 0.017 | |
| 62% | 8,000 | 0.019 | |
| 65% | 8,500 | 0.020 | |
| 69% | 9,000 | 0.022 | |
| 73% | 9,500 | 0.023 | |
| 77% | 10,000 | 0.026 | |
| 81% | 10,500 | 0.026 | |
| 85% | 11,000 | 0.027 | |
| 88% | 11,500 | 0.029 | |
| 92% | 12,000 | 0.031 | |
| 96% | 12,500 | 0.032 | |
| 100% | 13,000 | 0.034 | |
| 0% | 0 | 0.010 | |



# Compression Load Test Result for PLT-3C

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in]: | 6 |
| Load Cell: | OHAUS 10Ton |

**Test Date and Representative**

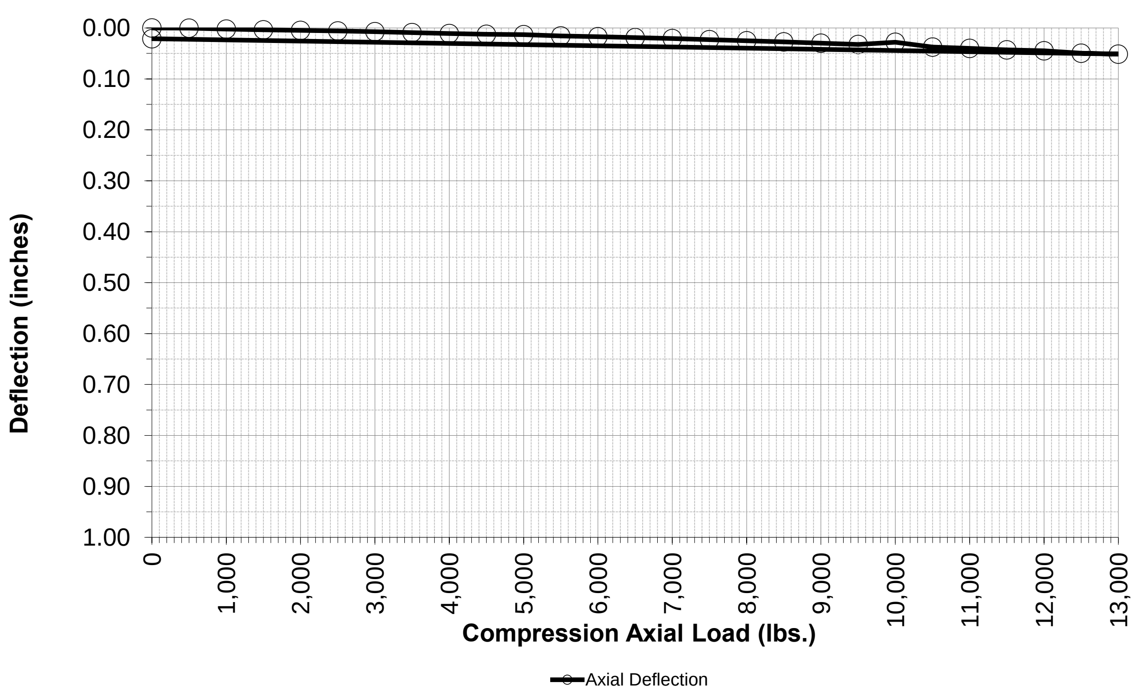
| | |
|---|---|
| Tested By Terracon Rep: | JB |
| Date Tested: | 1/4/2023 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-3C |
| Latitude [deg.]: | 36.12758 |
| Longitude [deg.]: | -119.40368 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 84 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 24 |
| Axial Design Load [lbs.]: | 13,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 11 |

**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% | 1,000 | 0.002 | |
| 12% | 1,500 | 0.004 | |
| 15% | 2,000 | 0.005 | |
| 19% | 2,500 | 0.006 | |
| 23% | 3,000 | 0.007 | |
| 27% | 3,500 | 0.009 | |
| 31% | 4,000 | 0.011 | |
| 35% | 4,500 | 0.012 | |
| 38% | 5,000 | 0.013 | |
| 42% | 5,500 | 0.016 | |
| 46% | 6,000 | 0.017 | |
| 50% | 6,500 | 0.019 | |
| 54% | 7,000 | 0.021 | |
| 58% | 7,500 | 0.023 | |
| 62% | 8,000 | 0.025 | |
| 65% | 8,500 | 0.027 | |
| 69% | 9,000 | 0.030 | |
| 73% | 9,500 | 0.033 | |
| 77% | 10,000 | 0.028 | |
| 81% | 10,500 | 0.038 | |
| 85% | 11,000 | 0.040 | |
| 88% | 11,500 | 0.043 | |
| 92% | 12,000 | 0.045 | |
| 96% | 12,500 | 0.050 | |
| 100% | 13,000 | 0.051 | |
| 0% | 0 | 0.021 | |



# Compression Load Test Result for PLT-4C

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in]: | 6 |
| Load Cell: | OHAUS 10Ton |

**Test Date and Representative**

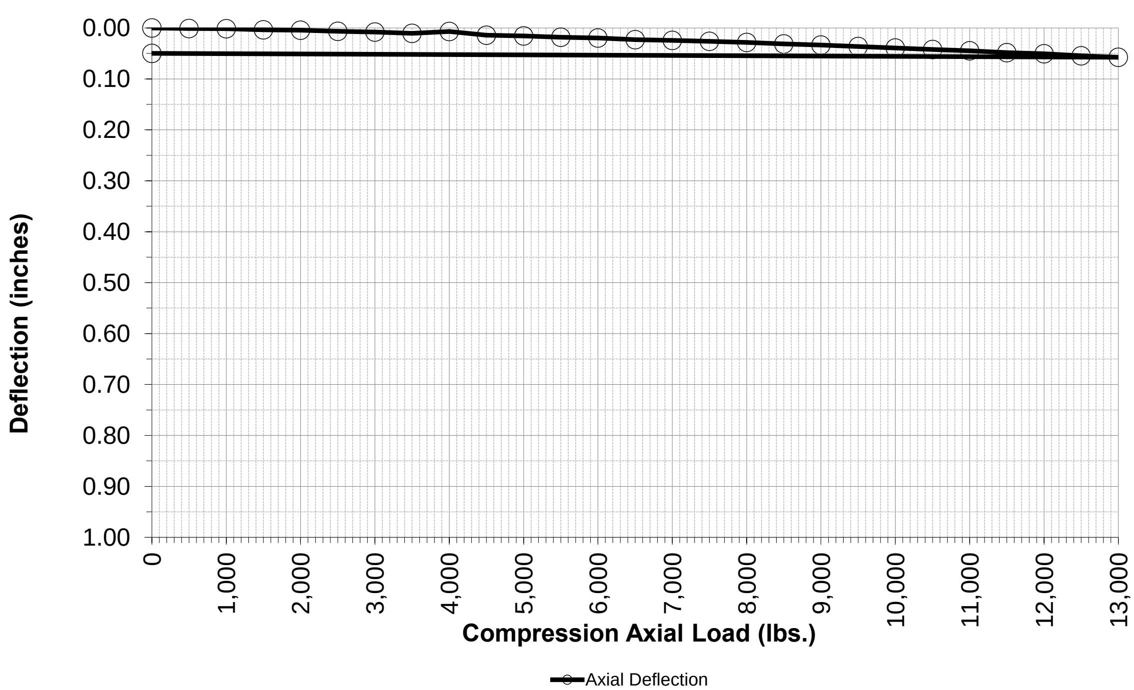
| | |
|---|---|
| Tested By Terracon Rep: | JB |
| Date Tested: | 1/4/2023 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-4C |
| Latitude [deg.]: | 36.12815 |
| Longitude [deg.]: | -119.39515 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 84 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 36 |
| Axial Design Load [lbs.]: | 13,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 16 |

**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% | 1,000 | 0.002 | |
| 12% | 1,500 | 0.004 | |
| 15% | 2,000 | 0.005 | |
| 19% | 2,500 | 0.007 | |
| 23% | 3,000 | 0.008 | |
| 27% | 3,500 | 0.011 | |
| 31% | 4,000 | 0.007 | |
| 35% | 4,500 | 0.014 | |
| 38% | 5,000 | 0.016 | |
| 42% | 5,500 | 0.018 | |
| 46% | 6,000 | 0.020 | |
| 50% | 6,500 | 0.023 | |
| 54% | 7,000 | 0.025 | |
| 58% | 7,500 | 0.026 | |
| 62% | 8,000 | 0.028 | |
| 65% | 8,500 | 0.031 | |
| 69% | 9,000 | 0.034 | |
| 73% | 9,500 | 0.037 | |
| 77% | 10,000 | 0.039 | |
| 81% | 10,500 | 0.042 | |
| 85% | 11,000 | 0.045 | |
| 88% | 11,500 | 0.048 | |
| 92% | 12,000 | 0.051 | |
| 96% | 12,500 | 0.055 | |
| 100% | 13,000 | 0.058 | |
| 0% | 0 | 0.050 | |



# Compression Load Test Result for PLT-5C

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in]: | 6 |
| Load Cell: | OHAUS 10Ton |

**Test Date and Representative**

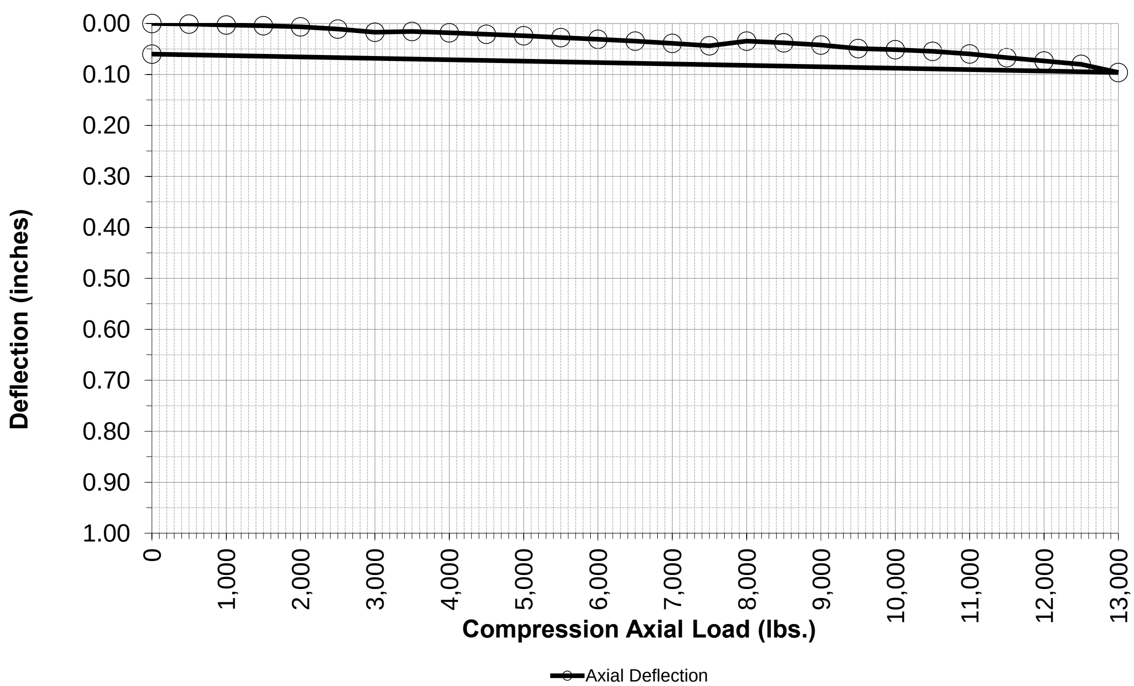
| | |
|---|---|
| Tested By Terracon Rep: | JB |
| Date Tested: | 1/4/2023 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-5C |
| Latitude [deg.]: | 36.12494 |
| Longitude [deg.]: | -119.40805 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 72 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 24 |
| Axial Design Load [lbs.]: | 13,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 13 |

**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% | 1,000 | 0.003 | |
| 12% | 1,500 | 0.004 | |
| 15% | 2,000 | 0.007 | |
| 19% | 2,500 | 0.011 | |
| 23% | 3,000 | 0.017 | |
| 27% | 3,500 | 0.016 | |
| 31% | 4,000 | 0.018 | |
| 35% | 4,500 | 0.021 | |
| 38% | 5,000 | 0.024 | |
| 42% | 5,500 | 0.028 | |
| 46% | 6,000 | 0.031 | |
| 50% | 6,500 | 0.035 | |
| 54% | 7,000 | 0.039 | |
| 58% | 7,500 | 0.044 | |
| 62% | 8,000 | 0.035 | |
| 65% | 8,500 | 0.038 | |
| 69% | 9,000 | 0.042 | |
| 73% | 9,500 | 0.049 | |
| 77% | 10,000 | 0.051 | |
| 81% | 10,500 | 0.055 | |
| 85% | 11,000 | 0.060 | |
| 88% | 11,500 | 0.067 | |
| 92% | 12,000 | 0.074 | |
| 96% | 12,500 | 0.080 | |
| 100% | 13,000 | 0.096 | |
| 0% | 0 | 0.060 | |



# Compression Load Test Result for PLT-6C

**Project Information**

| | |
|---|---|
| Project Name: | Perkins Solar |
| Project Location: | Imperial County, CA |
| Project Number: | 60235062 |

**Axial Load Test Set Up**

| | |
|---|---|
| Number of Gauges: | 2 |
| Height of Gauges [in]: | 6 |
| Load Cell: | OHAUS 10Ton |

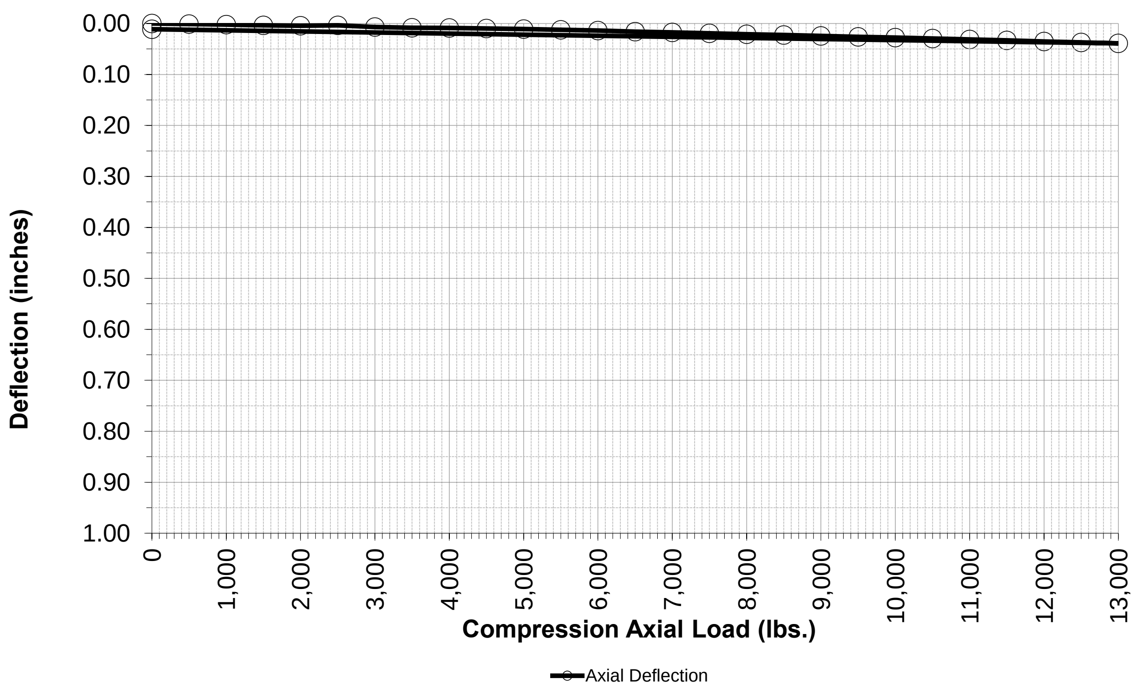
**Test Date and Representative**

| | |
|---|---|
| Tested By Terracon Rep: | JB |
| Date Tested: | 1/4/2023 |

**Pile Information**

| | |
|---|---|
| Pile ID: | PLT-6C |
| Latitude [deg.]: | 36.12650 |
| Longitude [deg.]: | -119.39547 |
| Pile Type: | W6x9 |
| Pile Embedment Depth [in.]: | 84 |
| Pile Diameter [in.]: | 5.9 |
| Pile Stick-Up [in.]: | 24 |
| Axial Design Load [lbs.]: | 13,000 |
| Pile Area [sq. in.]: | 2.68 |
| Elastic Modulus [ksi.]: | 29,000 |
| Drive Time [sec.]: | 22 |

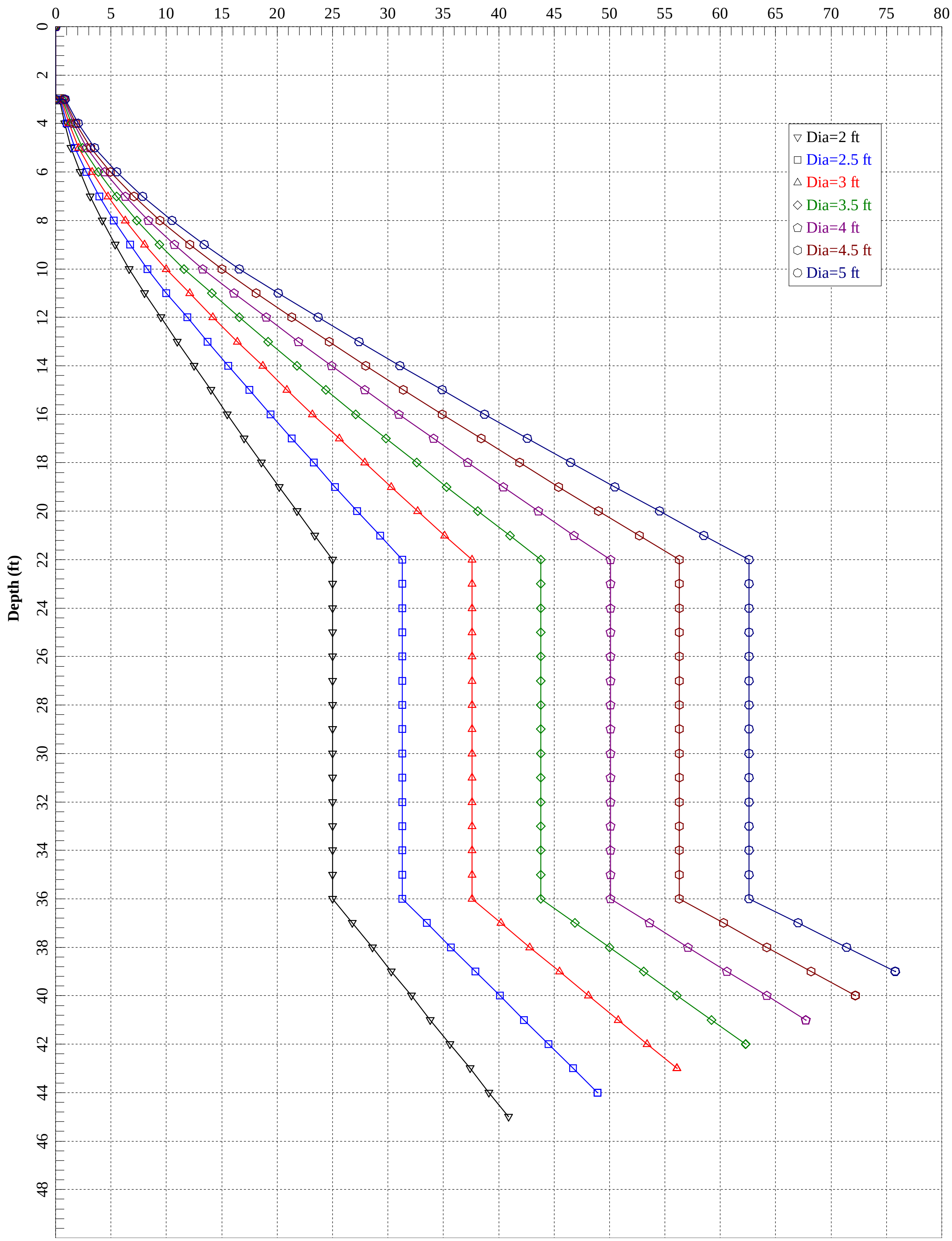
| Compression Test Results | | | |
|---|---|---|---|
| % of Design Load | Axial Load [lbs.] | Deflection Δ (in.) Gauges #1 & #2 | Comments |
| 0% | 0 | 0.000 | |
| 4% | 500 | 0.001 | |
| 8% | 1,000 | 0.002 | |
| 12% | 1,500 | 0.004 | |
| 15% | 2,000 | 0.004 | |
| 19% | 2,500 | 0.004 | |
| 23% | 3,000 | 0.007 | |
| 27% | 3,500 | 0.008 | |
| 31% | 4,000 | 0.009 | |
| 35% | 4,500 | 0.010 | |
| 38% | 5,000 | 0.011 | |
| 42% | 5,500 | 0.013 | |
| 46% | 6,000 | 0.014 | |
| 50% | 6,500 | 0.016 | |
| 54% | 7,000 | 0.018 | |
| 58% | 7,500 | 0.019 | |
| 62% | 8,000 | 0.021 | |
| 65% | 8,500 | 0.023 | |
| 69% | 9,000 | 0.025 | |
| 73% | 9,500 | 0.026 | |
| 77% | 10,000 | 0.028 | |
| 81% | 10,500 | 0.030 | |
| 85% | 11,000 | 0.031 | |
| 88% | 11,500 | 0.033 | |
| 92% | 12,000 | 0.035 | |
| 96% | 12,500 | 0.037 | |
| 100% | 13,000 | 0.039 | |
| 0% | 0 | 0.011 | |



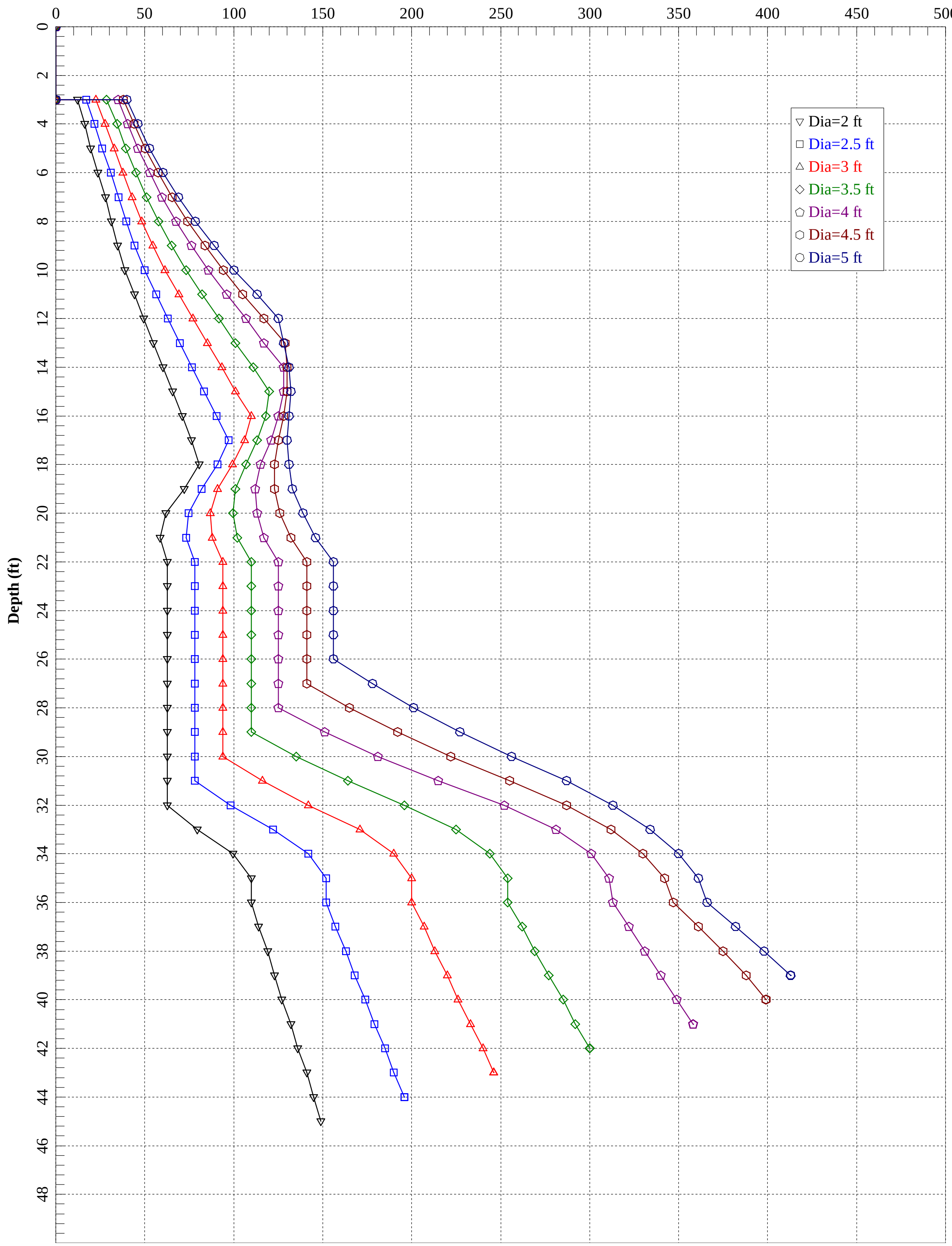
# Supporting Information

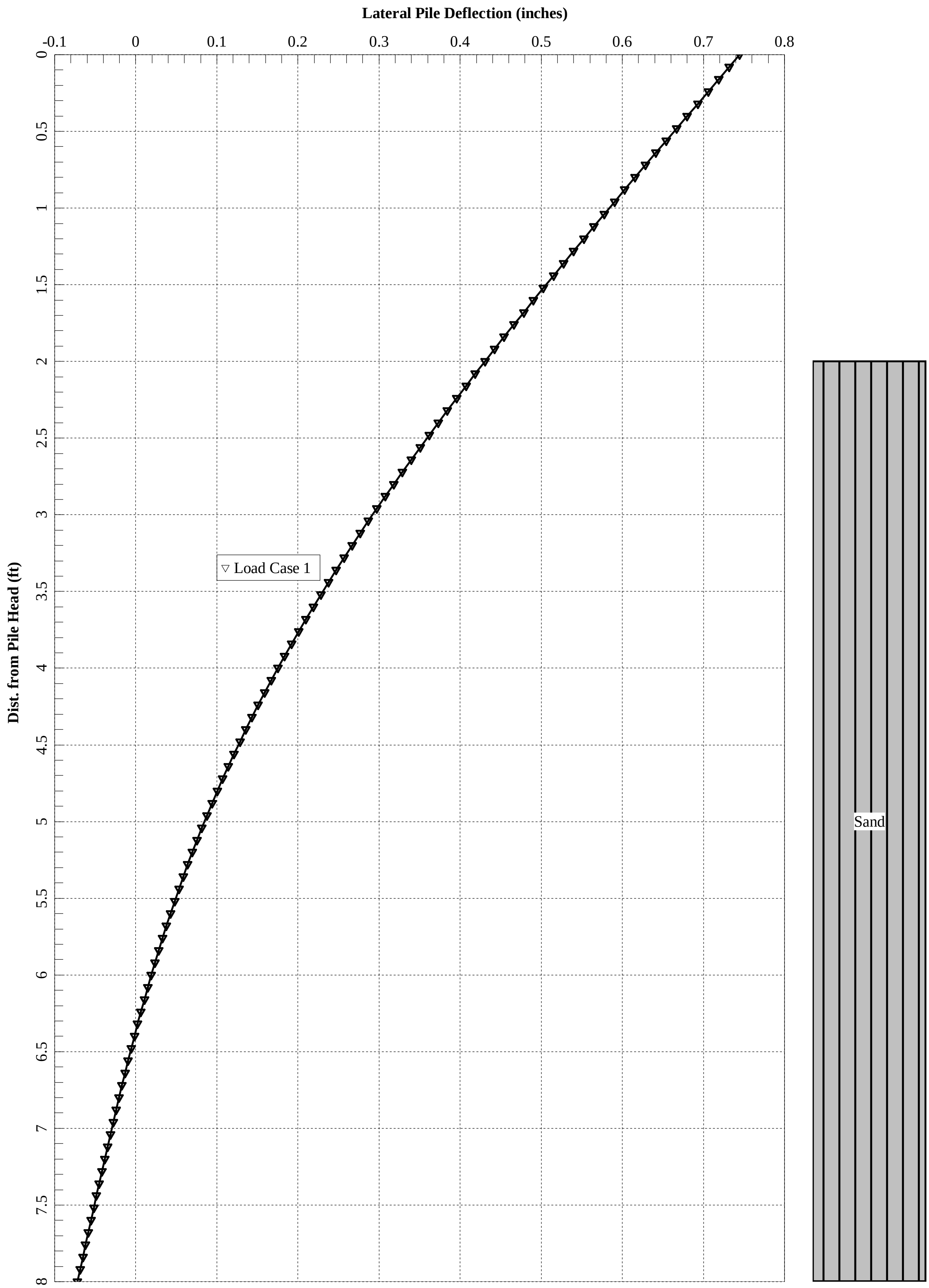
**Contents:**

Allowable Skin Friction
Side Resistance/F.S.  (tons)



**Allowable Downward Capacity**
**Ultimate Total Capacity (tons)**




Lateral Pile Deflection (inches)
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Dist. from Pile Head (ft)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
▽ Load Case 1
Sand

```
================================================================================

                    LPile for Windows, Version 2022-12.010

                Analysis of Individual Piles and Drilled Shafts
               Subjected to Lateral Loading Using the p-y Method
                          © 1985-2022 by Ensoft, Inc.
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================================================================================

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Terracon
Los Angeles


Serial Number of Security Device: 138584418

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--------------------------------------------------------------------------------
                             Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\Projects\2023\60235062\Working Files\Calculations-Analyses\Pile Analysis\

Name of input data file:
PLT-4A.lp12d

Name of output report file:
PLT-4A.lp12o

Name of plot output file:
PLT-4A.lp12p

Name of runtime message file:
PLT-4A.lp12r



--------------------------------------------------------------------------------
                            Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  January 25, 2024           Time:   8:22:34



--------------------------------------------------------------------------------
                                  Problem Title
--------------------------------------------------------------------------------

Project Name: Perkins


Job Number: 60235062


Client: IP Perkins LLC


Engineer:JV
```

Description: Perkins Solar Pile Lateral Analyses

---

## Program Options and Settings

---

Computational Options:
- Conventional Analysis

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Analysis Control Options:
- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:
- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

---

## Pile Structural Properties and Geometry

---

Number of pile sections defined = 1
Total length of pile = 8.000 ft
Depth of ground surface below top of pile = 2.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

| Point No. | Depth Below Pile Head feet | Pile Diameter inches |
|---|---|---|
| 1 | 0.000 | 3.9400 |
| 2 | 8.000 | 3.9400 |

Input Structural Properties for Pile Sections:

---

Pile Section No. 1:

Section 1 is a AISC strong axis steel pile
Length of section = 8.000000 ft
AISC Section Type = W

AISC Section Name = W6X9

Pile width = 3.940000 in

---

## Soil and Rock Layering Information

---

The soil profile is modelled using 1 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

| | | |
|---|---|---|
| Distance from top of pile to top of layer | = | 2.000000 ft |
| Distance from top of pile to bottom of layer | = | 8.000000 ft |
| Effective unit weight at top of layer | = | 100.000000 pcf |
| Effective unit weight at bottom of layer | = | 100.000000 pcf |
| Friction angle at top of layer | = | 29.000000 deg. |
| Friction angle at bottom of layer | = | 29.000000 deg. |
| Subgrade k at top of layer | = | 0.0000 pci |
| Subgrade k at bottom of layer | = | 0.0000 pci |

NOTE: Default values for subgrade k will be computed for this layer.

(Depth of the lowest soil layer extends 0.000 ft below the pile tip)

---

## Summary of Input Soil Properties

---

| Layer Num. | Soil Type Name (p-y Curve Type) | Layer Depth ft | Effective Unit Wt. pcf | Angle of Friction deg. | kpy pci |
|---|---|---|---|---|---|
| 1 | Sand | 2.0000 | 100.0000 | 29.0000 | default |
| | (Reese, et al.) | 8.0000 | 100.0000 | 29.0000 | default |

---

## Modification Factors for p-y Curves

---

Distribution of p-y modifiers with depth defined using 2 points

| Point No. | Depth X ft | p-mult | y-mult |
|---|---|---|---|
| 1 | 2.000 | 2.1000 | 1.0000 |
| 2 | 8.000 | 2.1000 | 1.0000 |

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## Static Loading Type

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Static loading criteria were used when computing p-y curves for all analyses.

--------------------------------------------------------------------------------
Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 1

| Load No. | Load Type | Condition 1 | Condition 2 | Axial Thrust Force, lbs | Compute Top y vs. Pile Length | Run Analysis |
|---|---|---|---|---|---|---|
| 1 | 1 | V = 2000. lbs | M = 0.0000 in-lbs | 0.0000000 | No | Yes |

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

--------------------------------------------------------------------------------
Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
--------------------------------------------------------------------------------

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:
-------------------

Dimensions and Properties of Steel AISC Strong Axis:
---------------------------------------------

| | | |
|---|---|---|
| Length of Section | = | 8.000000 ft |
| Flange Width | = | 3.940000 in |
| Section Depth | = | 5.900000 in |
| Flange Thickness | = | 0.215000 in |
| Web Thickness | = | 0.170000 in |
| Yield Stress of Pipe | = | 36.000000 ksi |
| Elastic Modulus | = | 29000. ksi |
| Cross-sectional Area | = | 2.680000 sq. in. |
| Moment of Inertia | = | 16.400000 in^4 |
| Elastic Bending Stiffness | = | 475600. kip-in^2 |
| Plastic Modulus, Z | = | 6.230000in^3 |
| Plastic Moment Capacity = Fy Z | = | 224.280000in-kip |

Axial Structural Capacities:
----------------------------

| | | |
|---|---|---|
| Nom. Axial Structural Capacity = Fy As | = | 96.480 kips |
| Nominal Axial Tensile Capacity | = | -96.480 kips |

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

| Number | Axial Thrust Force kips |
|---|---|
| 1 | 0.000 |

Definition of Run Messages:

Y = part of pipe section has yielded.

Axial Thrust Force = 0.000 kips

| Bending Curvature rad/in. | Bending Moment in-kip | Bending Stiffness kip-in2 | Depth to N Axis in | Max Total Stress ksi | Run Msg |
|---|---|---|---|---|---|
| 0.00001339 | 6.2119176 | 463904. | 2.9500000 | 1.1341028 | |
| 0.00002678 | 12.4238352 | 463904. | 2.9500000 | 2.2682057 | |
| 0.00004017 | 18.6357527 | 463904. | 2.9500000 | 3.4023085 | |
| 0.00005356 | 24.8476703 | 463904. | 2.9500000 | 4.5364113 | |
| 0.00006695 | 31.0595879 | 463904. | 2.9500000 | 5.6705142 | |
| 0.00008034 | 37.2715055 | 463904. | 2.9500000 | 6.8046170 | |
| 0.00009373 | 43.4834230 | 463904. | 2.9500000 | 7.9387198 | |
| 0.0001071 | 49.6953406 | 463904. | 2.9500000 | 9.0728226 | |
| 0.0001205 | 55.9072582 | 463904. | 2.9500000 | 10.2069255 | |
| 0.0001339 | 62.1191758 | 463904. | 2.9500000 | 11.3410283 | |
| 0.0001473 | 68.3310933 | 463904. | 2.9500000 | 12.4751311 | |
| 0.0001607 | 74.5430109 | 463904. | 2.9500000 | 13.6092340 | |
| 0.0001741 | 80.7549285 | 463904. | 2.9500000 | 14.7433368 | |
| 0.0001875 | 86.9668461 | 463904. | 2.9500000 | 15.8774396 | |
| 0.0002009 | 93.1787636 | 463904. | 2.9500000 | 17.0115425 | |
| 0.0002142 | 99.3906812 | 463904. | 2.9500000 | 18.1456453 | |
| 0.0002276 | 105.6025988 | 463904. | 2.9500000 | 19.2797481 | |
| 0.0002410 | 111.8145164 | 463904. | 2.9500000 | 20.4138510 | |
| 0.0002544 | 118.0264339 | 463904. | 2.9500000 | 21.5479538 | |
| 0.0002678 | 124.2383515 | 463904. | 2.9500000 | 22.6820566 | |
| 0.0002812 | 130.4502691 | 463904. | 2.9500000 | 23.8161594 | |
| 0.0002946 | 136.6621867 | 463904. | 2.9500000 | 24.9502623 | |
| 0.0003080 | 142.8741043 | 463904. | 2.9500000 | 26.0843651 | |
| 0.0003214 | 149.0860218 | 463904. | 2.9500000 | 27.2184679 | |
| 0.0003348 | 155.2979394 | 463904. | 2.9500000 | 28.3525708 | |
| 0.0003482 | 161.5098570 | 463904. | 2.9500000 | 29.4866736 | |
| 0.0003615 | 167.7217746 | 463904. | 2.9500000 | 30.6207764 | |
| 0.0003749 | 173.9336921 | 463904. | 2.9500000 | 31.7548793 | |
| 0.0003883 | 180.1456097 | 463904. | 2.9500000 | 32.8889821 | |
| 0.0004017 | 186.3575273 | 463904. | 2.9500000 | 34.0230849 | |
| 0.0004151 | 192.5694449 | 463904. | 2.9500000 | 35.1571878 | |
| 0.0004285 | 198.3858501 | 462981. | 2.9500000 | 36.0000000 | Y |
| 0.0004419 | 202.1674371 | 457509. | 2.9500000 | 36.0000000 | Y |
| 0.0004553 | 203.8690456 | 447791. | 2.9500000 | 36.0000000 | Y |
| 0.0004687 | 204.7225650 | 436818. | 2.9500000 | 36.0000000 | Y |
| 0.0004821 | 205.5090588 | 426316. | 2.9500000 | 36.0000000 | Y |
| 0.0004954 | 206.2324428 | 416254. | 2.9500000 | 36.0000000 | Y |
| 0.0005088 | 206.8955817 | 406603. | 2.9500000 | 36.0000000 | Y |
| 0.0005222 | 207.5094289 | 397353. | 2.9500000 | 36.0000000 | Y |
| 0.0005490 | 208.6070369 | 379969. | 2.9500000 | 36.0000000 | Y |
| 0.0005758 | 209.5569063 | 363945. | 2.9500000 | 36.0000000 | Y |
| 0.0006026 | 210.3767021 | 349131. | 2.9500000 | 36.0000000 | Y |
| 0.0006294 | 211.1017225 | 335426. | 2.9500000 | 36.0000000 | Y |
| 0.0006561 | 211.7325300 | 322697. | 2.9500000 | 36.0000000 | Y |
| 0.0006829 | 212.2946712 | 310865. | 2.9500000 | 36.0000000 | Y |
| 0.0007097 | 212.7956846 | 299840. | 2.9500000 | 36.0000000 | Y |
| 0.0007365 | 213.2426746 | 289544. | 2.9500000 | 36.0000000 | Y |
| 0.0007633 | 213.6423118 | 279908. | 2.9500000 | 36.0000000 | Y |
| 0.0007900 | 214.0008330 | 270873. | 2.9500000 | 36.0000000 | Y |
| 0.0008168 | 214.3240410 | 262388. | 2.9500000 | 36.0000000 | Y |
| 0.0008436 | 214.6173049 | 254406. | 2.9500000 | 36.0000000 | Y |
| 0.0008704 | 214.8855597 | 246886. | 2.9500000 | 36.0000000 | Y |
| 0.0008972 | 215.1333070 | 239793. | 2.9500000 | 36.0000000 | Y |
| 0.0009239 | 215.3531522 | 233080. | 2.9500000 | 36.0000000 | Y |
| 0.0009507 | 215.5570040 | 226729. | 2.9500000 | 36.0000000 | Y |
| 0.0009775 | 215.7493940 | 220714. | 2.9500000 | 36.0000000 | Y |
| 0.0010043 | 215.9177564 | 214996. | 2.9500000 | 36.0000000 | Y |
| 0.0010311 | 216.0810673 | 209570. | 2.9500000 | 36.0000000 | Y |
| 0.0010579 | 216.2255971 | 204401. | 2.9500000 | 36.0000000 | Y |
| 0.0010846 | 216.3657837 | 199483. | 2.9500000 | 36.0000000 | Y |
| 0.0011114 | 216.4896915 | 194788. | 2.9500000 | 36.0000000 | Y |
| 0.0011382 | 216.6129905 | 190313. | 2.9500000 | 36.0000000 | Y |
| 0.0011650 | 216.7183372 | 186028. | 2.9500000 | 36.0000000 | Y |
| 0.0011918 | 216.8236840 | 181936. | 2.9500000 | 36.0000000 | Y |
| 0.0012185 | 216.9189640 | 178016. | 2.9500000 | 36.0000000 | Y |
| 0.0012453 | 217.0077021 | 174259. | 2.9500000 | 36.0000000 | Y |

| | | | | | |
|---|---|---|---|---|---|
| 0.0012721 | 217.0964401 | 170660. | 2.9500000 | 36.0000000 | Y |
| 0.0012989 | 217.1721073 | 167200. | 2.9500000 | 36.0000000 | Y |
| 0.0013257 | 217.2460805 | 163878. | 2.9500000 | 36.0000000 | Y |
| 0.0013524 | 217.3200538 | 160687. | 2.9500000 | 36.0000000 | Y |
| 0.0013792 | 217.3834295 | 157613. | 2.9500000 | 36.0000000 | Y |
| 0.0014060 | 217.4443734 | 154654. | 2.9500000 | 36.0000000 | Y |
| 0.0014328 | 217.5053172 | 151806. | 2.9500000 | 36.0000000 | Y |
| 0.0014596 | 217.5626383 | 149060. | 2.9500000 | 36.0000000 | Y |
| 0.0014863 | 217.6121798 | 146407. | 2.9500000 | 36.0000000 | Y |
| 0.0015131 | 217.6617212 | 143849. | 2.9500000 | 36.0000000 | Y |
| 0.0015399 | 217.7112627 | 141379. | 2.9500000 | 36.0000000 | Y |
| 0.0015667 | 217.7577973 | 138992. | 2.9500000 | 36.0000000 | Y |
| 0.0015935 | 217.7974548 | 136681. | 2.9500000 | 36.0000000 | Y |
| 0.0017006 | 217.9505893 | 128161. | 2.9500000 | 36.0000000 | Y |
| 0.0018077 | 218.0753242 | 120636. | 2.9500000 | 36.0000000 | Y |
| 0.0019148 | 218.1772283 | 113940. | 2.9500000 | 36.0000000 | Y |
| 0.0020220 | 218.2692272 | 107949. | 2.9500000 | 36.0000000 | Y |
| 0.0021291 | 218.3413565 | 102551. | 2.9500000 | 36.0000000 | Y |

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Summary of Results for Nominal Moment Capacity for Section 1

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| Load No. | Axial Thrust kips | Nominal Moment Capacity in-kips |
|---|---|---|
| 1 | 0.00000000 | 218.3413565420 |

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

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Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 2000.0 lbs
Applied moment at pile head = 0.0 in-lbs
Axial thrust load on pile head = 0.0 lbs

| Depth X feet | Deflect. y inches | Bending Moment in-lbs | Shear Force lbs | Slope S radians | Total Stress psi* | Bending Stiffness lb-in^2 | Soil Res. p lb/inch | Soil Spr. Es*H lb/inch | Distrib. Lat. Load lb/inch |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.7449 | -2.29E-06 | 2000. | -0.01351 | 2.75E-07 | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 0.08000 | 0.7319 | 1920. | 2000. | -0.01351 | 230.6341 | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 0.1600 | 0.7189 | 3840. | 2000. | -0.01350 | 461.2683 | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 0.2400 | 0.7060 | 5760. | 2000. | -0.01349 | 691.9024 | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 0.3200 | 0.6930 | 7680. | 2000. | -0.01348 | 922.5366 | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 0.4000 | 0.6801 | 9600. | 2000. | -0.01346 | 1153. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 0.4800 | 0.6672 | 11520. | 2000. | -0.01344 | 1384. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 0.5600 | 0.6543 | 13440. | 2000. | -0.01341 | 1614. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 0.6400 | 0.6414 | 15360. | 2000. | -0.01338 | 1845. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 0.7200 | 0.6286 | 17280. | 2000. | -0.01335 | 2076. | 4.64E+08 | 0.00 | 0.00 | 0.00 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.8000 | 0.6158 | 19200. | 2000. | -0.01331 | 2306. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 0.8800 | 0.6030 | 21120. | 2000. | -0.01327 | 2537. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 0.9600 | 0.5903 | 23040. | 2000. | -0.01322 | 2768. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.0400 | 0.5776 | 24960. | 2000. | -0.01317 | 2998. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.1200 | 0.5650 | 26880. | 2000. | -0.01312 | 3229. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.2000 | 0.5525 | 28800. | 2000. | -0.01306 | 3460. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.2800 | 0.5399 | 30720. | 2000. | -0.01300 | 3690. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.3600 | 0.5275 | 32640. | 2000. | -0.01294 | 3921. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.4400 | 0.5151 | 34560. | 2000. | -0.01287 | 4151. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.5200 | 0.5028 | 36480. | 2000. | -0.01279 | 4382. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.6000 | 0.4905 | 38400. | 2000. | -0.01272 | 4613. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.6800 | 0.4784 | 40320. | 2000. | -0.01263 | 4843. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.7600 | 0.4663 | 42240. | 2000. | -0.01255 | 5074. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.8400 | 0.4543 | 44160. | 2000. | -0.01246 | 5305. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 1.9200 | 0.4424 | 46080. | 2000. | -0.01237 | 5535. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 2.0000 | 0.4305 | 48000. | 2000. | -0.01227 | 5766. | 4.64E+08 | 0.00 | 0.00 | 0.00 |
| 2.0800 | 0.4188 | 49920. | 1998. | -0.01217 | 5996. | 4.64E+08 | -3.620 | 8.2980 | 0.00 |
| 2.1600 | 0.4072 | 51837. | 1993. | -0.01206 | 6227. | 4.64E+08 | -7.751 | 18.2744 | 0.00 |
| 2.2400 | 0.3956 | 53746. | 1983. | -0.01195 | 6456. | 4.64E+08 | -12.144 | 29.4651 | 0.00 |
| 2.3200 | 0.3842 | 55645. | 1969. | -0.01184 | 6684. | 4.64E+08 | -16.595 | 41.4635 | 0.00 |
| 2.4000 | 0.3729 | 57528. | 1951. | -0.01172 | 6910. | 4.64E+08 | -20.989 | 54.0324 | 0.00 |
| 2.4800 | 0.3617 | 59391. | 1929. | -0.01160 | 7134. | 4.64E+08 | -25.092 | 66.5940 | 0.00 |
| 2.5600 | 0.3506 | 61232. | 1903. | -0.01148 | 7355. | 4.64E+08 | -29.207 | 79.9631 | 0.00 |
| 2.6400 | 0.3397 | 63045. | 1873. | -0.01135 | 7573. | 4.64E+08 | -32.974 | 93.1898 | 0.00 |
| 2.7200 | 0.3289 | 64829. | 1840. | -0.01122 | 7787. | 4.64E+08 | -36.464 | 106.4477 | 0.00 |
| 2.8000 | 0.3182 | 66578. | 1804. | -0.01108 | 7998. | 4.64E+08 | -39.420 | 118.9472 | 0.00 |
| 2.8800 | 0.3076 | 68292. | 1764. | -0.01094 | 8203. | 4.64E+08 | -42.685 | 133.2238 | 0.00 |
| 2.9600 | 0.2971 | 69966. | 1722. | -0.01080 | 8404. | 4.64E+08 | -45.817 | 148.0222 | 0.00 |
| 3.0400 | 0.2869 | 71597. | 1676. | -0.01065 | 8600. | 4.64E+08 | -49.858 | 166.8585 | 0.00 |
| 3.1200 | 0.2767 | 73183. | 1626. | -0.01050 | 8791. | 4.64E+08 | -54.394 | 188.7188 | 0.00 |
| 3.2000 | 0.2667 | 74719. | 1571. | -0.01035 | 8975. | 4.64E+08 | -58.801 | 211.6645 | 0.00 |
| 3.2800 | 0.2568 | 76200. | 1513. | -0.01019 | 9153. | 4.64E+08 | -63.033 | 235.6093 | 0.00 |
| 3.3600 | 0.2471 | 77624. | 1450. | -0.01003 | 9324. | 4.64E+08 | -68.565 | 266.3563 | 0.00 |
| 3.4400 | 0.2376 | 78984. | 1381. | -0.00987 | 9488. | 4.64E+08 | -75.351 | 304.4868 | 0.00 |
| 3.5200 | 0.2282 | 80275. | 1305. | -0.00971 | 9643. | 4.64E+08 | -82.405 | 346.7088 | 0.00 |
| 3.6000 | 0.2189 | 81490. | 1222. | -0.00954 | 9789. | 4.64E+08 | -89.724 | 393.4285 | 0.00 |
| 3.6800 | 0.2099 | 82622. | 1132. | -0.00937 | 9925. | 4.64E+08 | -97.559 | 446.2863 | 0.00 |
| 3.7600 | 0.2009 | 83664. | 1035. | -0.00920 | 10050. | 4.64E+08 | -105.998 | 506.3909 | 0.00 |
| 3.8400 | 0.1922 | 84609. | 928.7966 | -0.00902 | 10163. | 4.64E+08 | -114.781 | 573.3013 | 0.00 |
| 3.9200 | 0.1836 | 85447. | 814.2255 | -0.00885 | 10264. | 4.64E+08 | -123.909 | 647.8015 | 0.00 |
| 4.0000 | 0.1752 | 86172. | 690.7262 | -0.00867 | 10351. | 4.64E+08 | -133.381 | 730.7849 | 0.00 |
| 4.0800 | 0.1670 | 86773. | 557.9675 | -0.00849 | 10423. | 4.64E+08 | -143.199 | 823.2725 | 0.00 |
| 4.1600 | 0.1589 | 87243. | 415.6187 | -0.00831 | 10480. | 4.64E+08 | -153.361 | 926.4364 | 0.00 |
| 4.2400 | 0.1510 | 87571. | 263.3485 | -0.00813 | 10519. | 4.64E+08 | -163.868 | 1042. | 0.00 |
| 4.3200 | 0.1433 | 87749. | 102.7862 | -0.00795 | 10541. | 4.64E+08 | -170.636 | 1143. | 0.00 |
| 4.4000 | 0.1358 | 87769. | -62.733 | -0.00777 | 10543. | 4.64E+08 | -174.195 | 1232. | 0.00 |
| 4.4800 | 0.1284 | 87628. | -231.477 | -0.00758 | 10526. | 4.64E+08 | -177.355 | 1326. | 0.00 |
| 4.5600 | 0.1212 | 87324. | -403.059 | -0.00740 | 10490. | 4.64E+08 | -180.109 | 1427. | 0.00 |
| 4.6400 | 0.1142 | 86854. | -577.087 | -0.00722 | 10433. | 4.64E+08 | -182.448 | 1534. | 0.00 |
| 4.7200 | 0.1073 | 86216. | -753.159 | -0.00704 | 10356. | 4.64E+08 | -184.369 | 1649. | 0.00 |
| 4.8000 | 0.1007 | 85408. | -930.871 | -0.00687 | 10259. | 4.64E+08 | -185.864 | 1773. | 0.00 |
| 4.8800 | 0.09415 | 84429. | -1110. | -0.00669 | 10142. | 4.64E+08 | -186.932 | 1906. | 0.00 |
| 4.9600 | 0.08782 | 83278. | -1290. | -0.00652 | 10003. | 4.64E+08 | -187.569 | 2051. | 0.00 |
| 5.0400 | 0.08164 | 81953. | -1470. | -0.00635 | 9844. | 4.64E+08 | -187.774 | 2208. | 0.00 |
| 5.1200 | 0.07563 | 80456. | -1649. | -0.00618 | 9664. | 4.64E+08 | -185.696 | 2357. | 0.00 |
| 5.2000 | 0.06978 | 78787. | -1822. | -0.00601 | 9464. | 4.64E+08 | -175.724 | 2418. | 0.00 |
| 5.2800 | 0.06409 | 76956. | -1986. | -0.00585 | 9244. | 4.64E+08 | -165.418 | 2478. | 0.00 |
| 5.3600 | 0.05854 | 74973. | -2140. | -0.00569 | 9006. | 4.64E+08 | -154.800 | 2538. | 0.00 |
| 5.4400 | 0.05315 | 72848. | -2283. | -0.00554 | 8751. | 4.64E+08 | -143.887 | 2599. | 0.00 |
| 5.5200 | 0.04790 | 70590. | -2416. | -0.00539 | 8479. | 4.64E+08 | -132.696 | 2659. | 0.00 |
| 5.6000 | 0.04280 | 68209. | -2538. | -0.00525 | 8193. | 4.64E+08 | -121.242 | 2720. | 0.00 |
| 5.6800 | 0.03782 | 65717. | -2649. | -0.00511 | 7894. | 4.64E+08 | -109.537 | 2780. | 0.00 |
| 5.7600 | 0.03298 | 63123. | -2748. | -0.00498 | 7583. | 4.64E+08 | -97.592 | 2841. | 0.00 |
| 5.8400 | 0.02827 | 60440. | -2836. | -0.00485 | 7260. | 4.64E+08 | -85.416 | 2901. | 0.00 |
| 5.9200 | 0.02367 | 57678. | -2912. | -0.00473 | 6928. | 4.64E+08 | -73.017 | 2961. | 0.00 |
| 6.0000 | 0.01919 | 54849. | -2976. | -0.00461 | 6589. | 4.64E+08 | -60.400 | 3022. | 0.00 |
| 6.0800 | 0.01482 | 51964. | -3028. | -0.00450 | 6242. | 4.64E+08 | -47.569 | 3082. | 0.00 |
| 6.1600 | 0.01055 | 49035. | -3067. | -0.00440 | 5890. | 4.64E+08 | -34.525 | 3143. | 0.00 |
| 6.2400 | 0.00637 | 46075. | -3094. | -0.00430 | 5535. | 4.64E+08 | -21.268 | 3203. | 0.00 |
| 6.3200 | 0.00229 | 43095. | -3108. | -0.00421 | 5177. | 4.64E+08 | -7.797 | 3264. | 0.00 |
| 6.4000 | -0.00170 | 40107. | -3109. | -0.00412 | 4818. | 4.64E+08 | 5.8907 | 3324. | 0.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6.4800 | -0.00562 | 37126. | -3097. | -0.00404 | 4460. | 4.64E+08 | 19.8009 | 3385. | 0.00 |
| 6.5600 | -0.00946 | 34162. | -3071. | -0.00397 | 4104. | 4.64E+08 | 33.9393 | 3445. | 0.00 |
| 6.6400 | -0.01323 | 31230. | -3031. | -0.00390 | 3751. | 4.64E+08 | 48.3136 | 3505. | 0.00 |
| 6.7200 | -0.01694 | 28342. | -2978. | -0.00384 | 3404. | 4.64E+08 | 62.9326 | 3566. | 0.00 |
| 6.8000 | -0.02060 | 25512. | -2910. | -0.00378 | 3065. | 4.64E+08 | 77.8062 | 3626. | 0.00 |
| 6.8800 | -0.02420 | 22754. | -2828. | -0.00373 | 2733. | 4.64E+08 | 92.9454 | 3687. | 0.00 |
| 6.9600 | -0.02776 | 20081. | -2732. | -0.00369 | 2412. | 4.64E+08 | 108.3620 | 3747. | 0.00 |
| 7.0400 | -0.03128 | 17509. | -2620. | -0.00365 | 2103. | 4.64E+08 | 124.0686 | 3808. | 0.00 |
| 7.1200 | -0.03477 | 15050. | -2493. | -0.00361 | 1808. | 4.64E+08 | 140.0782 | 3868. | 0.00 |
| 7.2000 | -0.03822 | 12721. | -2351. | -0.00359 | 1528. | 4.64E+08 | 156.4041 | 3928. | 0.00 |
| 7.2800 | -0.04165 | 10536. | -2193. | -0.00356 | 1266. | 4.64E+08 | 173.0600 | 3989. | 0.00 |
| 7.3600 | -0.04506 | 8511. | -2019. | -0.00354 | 1022. | 4.64E+08 | 190.0595 | 4049. | 0.00 |
| 7.4400 | -0.04845 | 6660. | -1828. | -0.00353 | 800.0527 | 4.64E+08 | 207.4157 | 4110. | 0.00 |
| 7.5200 | -0.05183 | 5001. | -1620. | -0.00351 | 600.7438 | 4.64E+08 | 225.1416 | 4170. | 0.00 |
| 7.6000 | -0.05520 | 3549. | -1395. | -0.00351 | 426.3590 | 4.64E+08 | 243.2490 | 4231. | 0.00 |
| 7.6800 | -0.05856 | 2322. | -1153. | -0.00350 | 278.9029 | 4.64E+08 | 261.7490 | 4291. | 0.00 |
| 7.7600 | -0.06192 | 1336. | -892.709 | -0.00350 | 160.4237 | 4.64E+08 | 280.6513 | 4352. | 0.00 |
| 7.8400 | -0.06527 | 607.8298 | -614.014 | -0.00349 | 73.0137 | 4.64E+08 | 299.9642 | 4412. | 0.00 |
| 7.9200 | -0.06862 | 156.6001 | -316.578 | -0.00349 | 18.8111 | 4.64E+08 | 319.6937 | 4472. | 0.00 |
| 8.0000 | -0.07197 | 0.00 | 0.00 | -0.00349 | 0.00 | 4.64E+08 | 339.8439 | 2266. | 0.00 |

* This analysis computed pile response using nonlinear moment-curvature relationships. Values of total stress due to combined axial and bending stresses are computed only for elastic sections only and do not equal the actual stresses in concrete and steel. Stresses in concrete and steel may be interpolated from the output for nonlinear bending properties relative to the magnitude of bending moment developed in the pile.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.74485757 inches
Computed slope at pile head = -0.0135099 radians
Maximum bending moment = 87769. inch-lbs
Maximum shear force = -3109. lbs
Depth of maximum bending moment = 4.40000000 feet below pile head
Depth of maximum shear force = 6.40000000 feet below pile head
Number of iterations = 10
Number of zero deflection points = 1
Pile deflection at ground = 0.43053617 inches

--------------------------------------------------------------------------------
Summary of Pile-head Responses for Conventional Analyses
--------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

| Load Case No. | Load Type 1 | Pile-head Load 1 | Load Type 2 | Pile-head Load 2 | Axial Loading lbs | Pile-head Deflection inches | Pile-head Rotation radians | Max Shear in Pile lbs | Max Moment in Pile in-lbs |
|---|---|---|---|---|---|---|---|---|---|
| 1 | V, lb | 2000. | M, in-lb | 0.00 | 0.00 | 0.7449 | -0.01351 | -3109. | 87769. |

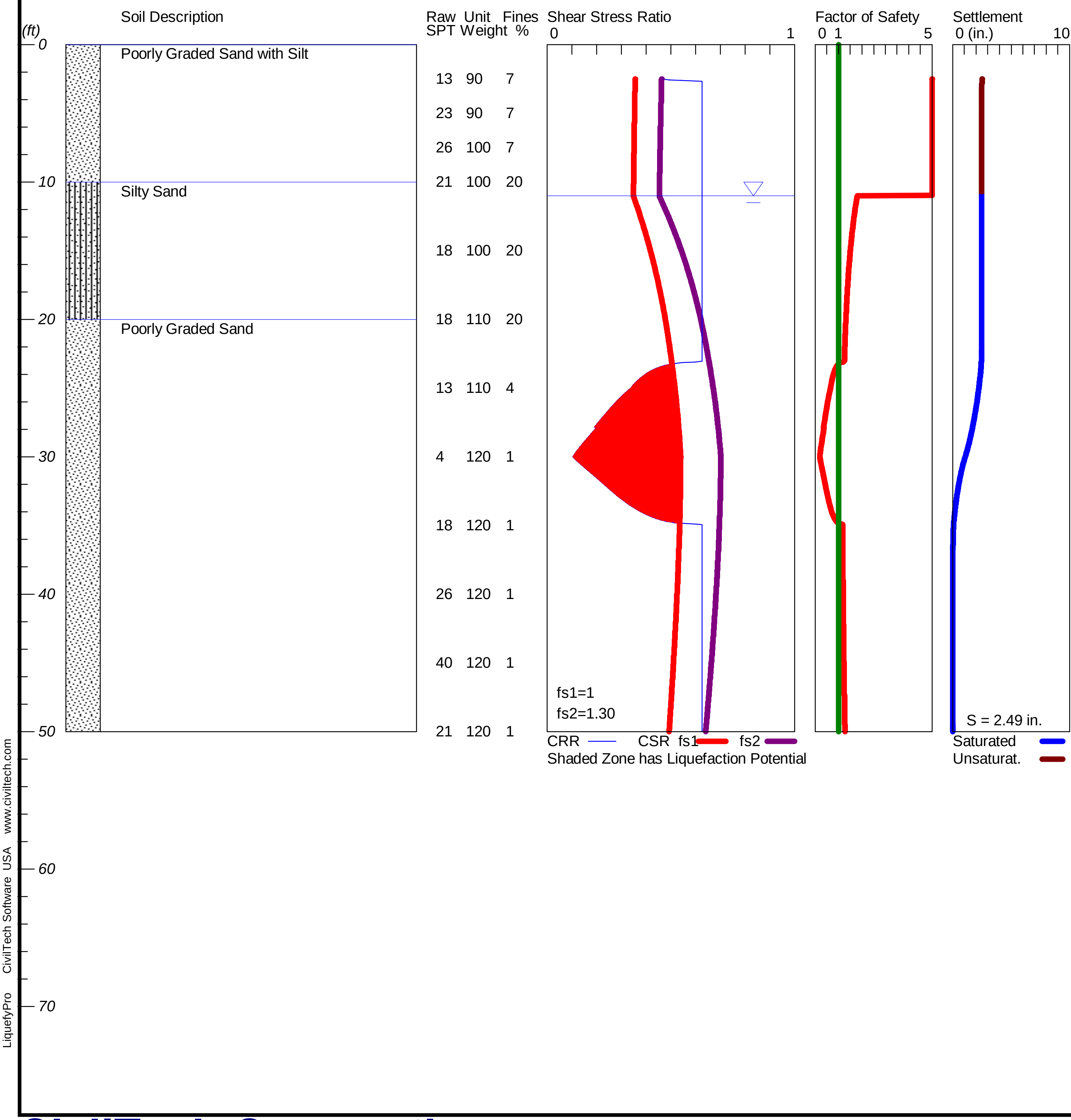
Maximum pile-head deflection = 0.7448575745 inches
Maximum pile-head rotation = -0.0135099414 radians = -0.774063 deg.

The analysis ended normally.

# LIQUEFACTION ANALYSIS

## 60235062

***Hole No.=B-3 and B-6   Water Depth=11 ft   Surface Elev.=100   Magnitude=6.87***
***Acceleration=0.55g***




**CivilTech Corporation** **Perkins Solar** **Plate A-1**

```
*******************************************************************************************************
                                    LIQUEFACTION ANALYSIS SUMMARY
                                  Copyright by CivilTech Software
                                         www.civiltech.com
*******************************************************************************************************
    Font: Courier New, Regular, Size 8 is recommended for this report.
    Licensed to ,   1/25/2024       1:22:34 PM

    Input File Name: N:\Projects\2023\60235062\Working Files\Calculations-Analyses\Liquefaction\B-3 and B-6.liq
    Title:  60235062
    Subtitle:  Perkins Solar

    Surface Elev.=100
    Hole No.=B-3 and B-6
    Depth of Hole= 50.00 ft
    Water Table during Earthquake= 11.00 ft
    Water Table during In-Situ Testing= 11.00 ft
    Max. Acceleration= 0.55 g
    Earthquake Magnitude= 6.87

Input Data:
    Surface Elev.=100
    Hole No.=B-3 and B-6
    Depth of Hole=50.00 ft
    Water Table during Earthquake= 11.00 ft
    Water Table during In-Situ Testing= 11.00 ft
    Max. Acceleration=0.55 g
    Earthquake Magnitude=6.87
    No-Liquefiable Soils:   Based on Analysis

    1. SPT or BPT Calculation.
    2. Settlement Analysis Method: Tokimatsu, M-correction
    3. Fines Correction for Liquefaction: Idriss/Seed
    4. Fine Correction for Settlement: During Liquefaction*
    5. Settlement Calculation in: All zones*
    6. Hammer Energy Ratio,                                  Ce = 1.25
    7. Borehole Diameter,                                        Cb= 1.15
    8. Sampling Method,                                        Cs= 1.2
    9. User request factor of safety (apply to CSR) ,   User= 1.3
       Plot two CSR (fs1=1, fs2=User)
    10. Use Curve Smoothing: Yes*
    * Recommended Options

    In-Situ Test Data:
    Depth   SPT     gamma   Fines
    ft              pcf     %
    ____________________________________
    2.50    13.00   90.00   7.00
    5.00    23.00   90.00   7.00
    7.50    26.00   100.00  7.00
    10.00   21.00   100.00  20.00
    15.00   18.00   100.00  20.00
    20.00   18.00   110.00  20.00
    25.00   13.00   110.00  4.00
    30.00   4.00    120.00  1.00
    35.00   18.00   120.00  1.00
    40.00   26.00   120.00  1.00
    45.00   40.00   120.00  1.00
    50.00   21.00   120.00  1.00
    ____________________________________

Output Results:
    Settlement of Saturated Sands=2.48 in.
    Settlement of Unsaturated Sands=0.02 in.
    Total Settlement of Saturated and Unsaturated Sands=2.49 in.
    Differential Settlement=1.246 to 1.644 in.

    Depth   CRRm    CSRfs   F.S.    S_sat.  S_dry   S_all
    ft                              in.     in.     in.
    _______________________________________________________
    2.50    0.47    0.36    5.00    2.48    0.02    2.49
```

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.55 | 0.49 | 0.36 | 5.00 | 2.48 | 0.02 | 2.49 |
| 2.60 | 0.54 | 0.36 | 5.00 | 2.48 | 0.02 | 2.49 |
| 2.65 | 0.63 | 0.36 | 5.00 | 2.48 | 0.02 | 2.49 |
| 2.70 | 0.63 | 0.36 | 5.00 | 2.48 | 0.02 | 2.49 |
| 2.75 | 0.63 | 0.36 | 5.00 | 2.48 | 0.02 | 2.49 |
| 2.80 | 0.63 | 0.36 | 5.00 | 2.48 | 0.01 | 2.49 |
| 2.85 | 0.63 | 0.36 | 5.00 | 2.48 | 0.01 | 2.49 |
| 2.90 | 0.63 | 0.36 | 5.00 | 2.48 | 0.01 | 2.49 |
| 2.95 | 0.63 | 0.36 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.00 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.05 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.10 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.15 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.20 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.25 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.30 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.35 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.40 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.45 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.50 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.55 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.60 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.65 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.70 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.75 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.80 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.85 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.90 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 3.95 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.00 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.05 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.10 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.15 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.20 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.25 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.30 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.35 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.40 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.45 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.50 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.55 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.60 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.65 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.70 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.75 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.80 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.85 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.90 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 4.95 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.00 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.05 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.10 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.15 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.20 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.25 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.30 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.35 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.40 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.45 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.50 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.55 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.60 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.65 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.70 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.75 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.49 |
| 5.80 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 5.85 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 5.90 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 5.95 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.00 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.05 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6.10 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.15 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.20 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.25 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.30 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.35 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.40 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.45 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.50 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.55 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.60 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.65 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.70 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.75 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.80 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.85 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.90 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 6.95 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.00 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.05 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.10 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.15 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.20 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.25 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.30 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.35 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.40 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.45 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.50 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.55 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.60 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.65 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.70 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.75 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.80 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.85 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.90 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 7.95 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.00 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.05 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.10 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.15 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.20 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.25 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.30 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.35 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.40 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.45 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.50 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.55 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.60 | 0.63 | 0.35 | 5.00 | 2.48 | 0.01 | 2.48 |
| 8.65 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 8.70 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 8.75 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 8.80 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 8.85 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 8.90 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 8.95 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.00 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.05 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.10 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.15 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.20 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.25 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.30 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.35 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.40 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.45 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.50 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.55 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.60 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 9.65 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.70 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.75 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.80 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.85 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.90 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 9.95 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.00 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.05 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.10 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.15 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.20 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.25 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.30 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.35 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.40 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.45 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.50 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.55 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.60 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.65 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.70 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.75 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.80 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.85 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.90 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 10.95 | 0.63 | 0.35 | 5.00 | 2.48 | 0.00 | 2.48 |
| 11.00 | 0.63 | 0.35 | 1.80 | 2.48 | 0.00 | 2.48 |
| 11.05 | 0.63 | 0.35 | 1.79 | 2.48 | 0.00 | 2.48 |
| 11.10 | 0.63 | 0.35 | 1.79 | 2.48 | 0.00 | 2.48 |
| 11.15 | 0.63 | 0.35 | 1.78 | 2.48 | 0.00 | 2.48 |
| 11.20 | 0.63 | 0.35 | 1.78 | 2.48 | 0.00 | 2.48 |
| 11.25 | 0.63 | 0.35 | 1.77 | 2.48 | 0.00 | 2.48 |
| 11.30 | 0.63 | 0.35 | 1.77 | 2.48 | 0.00 | 2.48 |
| 11.35 | 0.63 | 0.36 | 1.76 | 2.48 | 0.00 | 2.48 |
| 11.40 | 0.63 | 0.36 | 1.76 | 2.48 | 0.00 | 2.48 |
| 11.45 | 0.63 | 0.36 | 1.75 | 2.48 | 0.00 | 2.48 |
| 11.50 | 0.63 | 0.36 | 1.75 | 2.48 | 0.00 | 2.48 |
| 11.55 | 0.63 | 0.36 | 1.74 | 2.48 | 0.00 | 2.48 |
| 11.60 | 0.63 | 0.36 | 1.74 | 2.48 | 0.00 | 2.48 |
| 11.65 | 0.63 | 0.36 | 1.73 | 2.48 | 0.00 | 2.48 |
| 11.70 | 0.63 | 0.36 | 1.73 | 2.48 | 0.00 | 2.48 |
| 11.75 | 0.63 | 0.36 | 1.72 | 2.48 | 0.00 | 2.48 |
| 11.80 | 0.63 | 0.36 | 1.72 | 2.48 | 0.00 | 2.48 |
| 11.85 | 0.63 | 0.36 | 1.71 | 2.48 | 0.00 | 2.48 |
| 11.90 | 0.63 | 0.37 | 1.71 | 2.48 | 0.00 | 2.48 |
| 11.95 | 0.63 | 0.37 | 1.71 | 2.48 | 0.00 | 2.48 |
| 12.00 | 0.63 | 0.37 | 1.70 | 2.48 | 0.00 | 2.48 |
| 12.05 | 0.63 | 0.37 | 1.70 | 2.48 | 0.00 | 2.48 |
| 12.10 | 0.63 | 0.37 | 1.69 | 2.48 | 0.00 | 2.48 |
| 12.15 | 0.63 | 0.37 | 1.69 | 2.48 | 0.00 | 2.48 |
| 12.20 | 0.63 | 0.37 | 1.68 | 2.48 | 0.00 | 2.48 |
| 12.25 | 0.63 | 0.37 | 1.68 | 2.48 | 0.00 | 2.48 |
| 12.30 | 0.63 | 0.37 | 1.68 | 2.48 | 0.00 | 2.48 |
| 12.35 | 0.63 | 0.37 | 1.67 | 2.48 | 0.00 | 2.48 |
| 12.40 | 0.63 | 0.37 | 1.67 | 2.48 | 0.00 | 2.48 |
| 12.45 | 0.63 | 0.38 | 1.66 | 2.48 | 0.00 | 2.48 |
| 12.50 | 0.63 | 0.38 | 1.66 | 2.48 | 0.00 | 2.48 |
| 12.55 | 0.63 | 0.38 | 1.66 | 2.48 | 0.00 | 2.48 |
| 12.60 | 0.63 | 0.38 | 1.65 | 2.48 | 0.00 | 2.48 |
| 12.65 | 0.63 | 0.38 | 1.65 | 2.48 | 0.00 | 2.48 |
| 12.70 | 0.63 | 0.38 | 1.65 | 2.48 | 0.00 | 2.48 |
| 12.75 | 0.63 | 0.38 | 1.64 | 2.48 | 0.00 | 2.48 |
| 12.80 | 0.63 | 0.38 | 1.64 | 2.48 | 0.00 | 2.48 |
| 12.85 | 0.63 | 0.38 | 1.63 | 2.48 | 0.00 | 2.48 |
| 12.90 | 0.63 | 0.38 | 1.63 | 2.48 | 0.00 | 2.48 |
| 12.95 | 0.63 | 0.38 | 1.63 | 2.48 | 0.00 | 2.48 |
| 13.00 | 0.63 | 0.39 | 1.62 | 2.48 | 0.00 | 2.48 |
| 13.05 | 0.63 | 0.39 | 1.62 | 2.48 | 0.00 | 2.48 |
| 13.10 | 0.63 | 0.39 | 1.62 | 2.48 | 0.00 | 2.48 |
| 13.15 | 0.63 | 0.39 | 1.61 | 2.48 | 0.00 | 2.48 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13.20 | 0.63 | 0.39 | 1.61 | 2.48 | 0.00 | 2.48 |
| 13.25 | 0.63 | 0.39 | 1.61 | 2.48 | 0.00 | 2.48 |
| 13.30 | 0.63 | 0.39 | 1.60 | 2.48 | 0.00 | 2.48 |
| 13.35 | 0.63 | 0.39 | 1.60 | 2.48 | 0.00 | 2.48 |
| 13.40 | 0.63 | 0.39 | 1.59 | 2.48 | 0.00 | 2.48 |
| 13.45 | 0.63 | 0.39 | 1.59 | 2.48 | 0.00 | 2.48 |
| 13.50 | 0.63 | 0.39 | 1.59 | 2.48 | 0.00 | 2.48 |
| 13.55 | 0.63 | 0.39 | 1.58 | 2.48 | 0.00 | 2.48 |
| 13.60 | 0.63 | 0.40 | 1.58 | 2.48 | 0.00 | 2.48 |
| 13.65 | 0.63 | 0.40 | 1.58 | 2.48 | 0.00 | 2.48 |
| 13.70 | 0.63 | 0.40 | 1.57 | 2.48 | 0.00 | 2.48 |
| 13.75 | 0.63 | 0.40 | 1.57 | 2.48 | 0.00 | 2.48 |
| 13.80 | 0.63 | 0.40 | 1.57 | 2.48 | 0.00 | 2.48 |
| 13.85 | 0.63 | 0.40 | 1.57 | 2.48 | 0.00 | 2.48 |
| 13.90 | 0.63 | 0.40 | 1.56 | 2.48 | 0.00 | 2.48 |
| 13.95 | 0.63 | 0.40 | 1.56 | 2.48 | 0.00 | 2.48 |
| 14.00 | 0.63 | 0.40 | 1.56 | 2.48 | 0.00 | 2.48 |
| 14.05 | 0.63 | 0.40 | 1.55 | 2.48 | 0.00 | 2.48 |
| 14.10 | 0.63 | 0.40 | 1.55 | 2.48 | 0.00 | 2.48 |
| 14.15 | 0.63 | 0.40 | 1.55 | 2.48 | 0.00 | 2.48 |
| 14.20 | 0.63 | 0.41 | 1.54 | 2.48 | 0.00 | 2.48 |
| 14.25 | 0.63 | 0.41 | 1.54 | 2.48 | 0.00 | 2.48 |
| 14.30 | 0.63 | 0.41 | 1.54 | 2.48 | 0.00 | 2.48 |
| 14.35 | 0.63 | 0.41 | 1.53 | 2.48 | 0.00 | 2.48 |
| 14.40 | 0.63 | 0.41 | 1.53 | 2.48 | 0.00 | 2.48 |
| 14.45 | 0.63 | 0.41 | 1.53 | 2.48 | 0.00 | 2.48 |
| 14.50 | 0.63 | 0.41 | 1.53 | 2.48 | 0.00 | 2.48 |
| 14.55 | 0.63 | 0.41 | 1.52 | 2.48 | 0.00 | 2.48 |
| 14.60 | 0.63 | 0.41 | 1.52 | 2.48 | 0.00 | 2.48 |
| 14.65 | 0.63 | 0.41 | 1.52 | 2.48 | 0.00 | 2.48 |
| 14.70 | 0.63 | 0.41 | 1.51 | 2.48 | 0.00 | 2.48 |
| 14.75 | 0.63 | 0.41 | 1.51 | 2.48 | 0.00 | 2.48 |
| 14.80 | 0.63 | 0.41 | 1.51 | 2.48 | 0.00 | 2.48 |
| 14.85 | 0.63 | 0.42 | 1.51 | 2.48 | 0.00 | 2.48 |
| 14.90 | 0.63 | 0.42 | 1.50 | 2.48 | 0.00 | 2.48 |
| 14.95 | 0.63 | 0.42 | 1.50 | 2.48 | 0.00 | 2.48 |
| 15.00 | 0.63 | 0.42 | 1.50 | 2.48 | 0.00 | 2.48 |
| 15.05 | 0.63 | 0.42 | 1.50 | 2.48 | 0.00 | 2.48 |
| 15.10 | 0.63 | 0.42 | 1.49 | 2.48 | 0.00 | 2.48 |
| 15.15 | 0.63 | 0.42 | 1.49 | 2.48 | 0.00 | 2.48 |
| 15.20 | 0.63 | 0.42 | 1.49 | 2.48 | 0.00 | 2.48 |
| 15.25 | 0.63 | 0.42 | 1.49 | 2.48 | 0.00 | 2.48 |
| 15.30 | 0.63 | 0.42 | 1.48 | 2.48 | 0.00 | 2.48 |
| 15.35 | 0.63 | 0.42 | 1.48 | 2.48 | 0.00 | 2.48 |
| 15.40 | 0.63 | 0.42 | 1.48 | 2.48 | 0.00 | 2.48 |
| 15.45 | 0.63 | 0.42 | 1.48 | 2.48 | 0.00 | 2.48 |
| 15.50 | 0.63 | 0.42 | 1.47 | 2.48 | 0.00 | 2.48 |
| 15.55 | 0.63 | 0.43 | 1.47 | 2.48 | 0.00 | 2.48 |
| 15.60 | 0.63 | 0.43 | 1.47 | 2.48 | 0.00 | 2.48 |
| 15.65 | 0.63 | 0.43 | 1.47 | 2.48 | 0.00 | 2.48 |
| 15.70 | 0.63 | 0.43 | 1.46 | 2.48 | 0.00 | 2.48 |
| 15.75 | 0.63 | 0.43 | 1.46 | 2.48 | 0.00 | 2.48 |
| 15.80 | 0.63 | 0.43 | 1.46 | 2.48 | 0.00 | 2.48 |
| 15.85 | 0.63 | 0.43 | 1.46 | 2.48 | 0.00 | 2.48 |
| 15.90 | 0.63 | 0.43 | 1.45 | 2.48 | 0.00 | 2.48 |
| 15.95 | 0.63 | 0.43 | 1.45 | 2.48 | 0.00 | 2.48 |
| 16.00 | 0.63 | 0.43 | 1.45 | 2.48 | 0.00 | 2.48 |
| 16.05 | 0.63 | 0.43 | 1.45 | 2.48 | 0.00 | 2.48 |
| 16.10 | 0.63 | 0.43 | 1.44 | 2.48 | 0.00 | 2.48 |
| 16.15 | 0.63 | 0.43 | 1.44 | 2.48 | 0.00 | 2.48 |
| 16.20 | 0.63 | 0.43 | 1.44 | 2.48 | 0.00 | 2.48 |
| 16.25 | 0.63 | 0.44 | 1.44 | 2.48 | 0.00 | 2.48 |
| 16.30 | 0.63 | 0.44 | 1.44 | 2.48 | 0.00 | 2.48 |
| 16.35 | 0.63 | 0.44 | 1.43 | 2.48 | 0.00 | 2.48 |
| 16.40 | 0.63 | 0.44 | 1.43 | 2.48 | 0.00 | 2.48 |
| 16.45 | 0.63 | 0.44 | 1.43 | 2.48 | 0.00 | 2.48 |
| 16.50 | 0.63 | 0.44 | 1.43 | 2.48 | 0.00 | 2.48 |
| 16.55 | 0.63 | 0.44 | 1.43 | 2.48 | 0.00 | 2.48 |
| 16.60 | 0.63 | 0.44 | 1.42 | 2.48 | 0.00 | 2.48 |
| 16.65 | 0.63 | 0.44 | 1.42 | 2.48 | 0.00 | 2.48 |
| 16.70 | 0.63 | 0.44 | 1.42 | 2.48 | 0.00 | 2.48 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 16.75 | 0.63 | 0.44 | 1.42 | 2.48 | 0.00 | 2.48 |
| 16.80 | 0.63 | 0.44 | 1.41 | 2.48 | 0.00 | 2.48 |
| 16.85 | 0.63 | 0.44 | 1.41 | 2.48 | 0.00 | 2.48 |
| 16.90 | 0.63 | 0.44 | 1.41 | 2.48 | 0.00 | 2.48 |
| 16.95 | 0.63 | 0.44 | 1.41 | 2.48 | 0.00 | 2.48 |
| 17.00 | 0.63 | 0.44 | 1.41 | 2.48 | 0.00 | 2.48 |
| 17.05 | 0.63 | 0.45 | 1.40 | 2.48 | 0.00 | 2.48 |
| 17.10 | 0.63 | 0.45 | 1.40 | 2.48 | 0.00 | 2.48 |
| 17.15 | 0.63 | 0.45 | 1.40 | 2.48 | 0.00 | 2.48 |
| 17.20 | 0.63 | 0.45 | 1.40 | 2.48 | 0.00 | 2.48 |
| 17.25 | 0.63 | 0.45 | 1.40 | 2.48 | 0.00 | 2.48 |
| 17.30 | 0.63 | 0.45 | 1.40 | 2.48 | 0.00 | 2.48 |
| 17.35 | 0.63 | 0.45 | 1.39 | 2.48 | 0.00 | 2.48 |
| 17.40 | 0.63 | 0.45 | 1.39 | 2.48 | 0.00 | 2.48 |
| 17.45 | 0.63 | 0.45 | 1.39 | 2.48 | 0.00 | 2.48 |
| 17.50 | 0.63 | 0.45 | 1.39 | 2.48 | 0.00 | 2.48 |
| 17.55 | 0.63 | 0.45 | 1.39 | 2.48 | 0.00 | 2.48 |
| 17.60 | 0.63 | 0.45 | 1.38 | 2.48 | 0.00 | 2.48 |
| 17.65 | 0.63 | 0.45 | 1.38 | 2.48 | 0.00 | 2.48 |
| 17.70 | 0.63 | 0.45 | 1.38 | 2.48 | 0.00 | 2.48 |
| 17.75 | 0.63 | 0.45 | 1.38 | 2.48 | 0.00 | 2.48 |
| 17.80 | 0.63 | 0.45 | 1.38 | 2.48 | 0.00 | 2.48 |
| 17.85 | 0.63 | 0.46 | 1.38 | 2.48 | 0.00 | 2.48 |
| 17.90 | 0.63 | 0.46 | 1.37 | 2.48 | 0.00 | 2.48 |
| 17.95 | 0.63 | 0.46 | 1.37 | 2.48 | 0.00 | 2.48 |
| 18.00 | 0.63 | 0.46 | 1.37 | 2.48 | 0.00 | 2.48 |
| 18.05 | 0.63 | 0.46 | 1.37 | 2.48 | 0.00 | 2.48 |
| 18.10 | 0.63 | 0.46 | 1.37 | 2.48 | 0.00 | 2.48 |
| 18.15 | 0.63 | 0.46 | 1.36 | 2.48 | 0.00 | 2.48 |
| 18.20 | 0.63 | 0.46 | 1.36 | 2.48 | 0.00 | 2.48 |
| 18.25 | 0.63 | 0.46 | 1.36 | 2.48 | 0.00 | 2.48 |
| 18.30 | 0.63 | 0.46 | 1.36 | 2.48 | 0.00 | 2.48 |
| 18.35 | 0.63 | 0.46 | 1.36 | 2.48 | 0.00 | 2.48 |
| 18.40 | 0.63 | 0.46 | 1.36 | 2.48 | 0.00 | 2.48 |
| 18.45 | 0.63 | 0.46 | 1.35 | 2.48 | 0.00 | 2.48 |
| 18.50 | 0.63 | 0.46 | 1.35 | 2.48 | 0.00 | 2.48 |
| 18.55 | 0.63 | 0.46 | 1.35 | 2.48 | 0.00 | 2.48 |
| 18.60 | 0.63 | 0.46 | 1.35 | 2.48 | 0.00 | 2.48 |
| 18.65 | 0.63 | 0.46 | 1.35 | 2.48 | 0.00 | 2.48 |
| 18.70 | 0.63 | 0.46 | 1.35 | 2.48 | 0.00 | 2.48 |
| 18.75 | 0.63 | 0.47 | 1.35 | 2.48 | 0.00 | 2.48 |
| 18.80 | 0.63 | 0.47 | 1.34 | 2.48 | 0.00 | 2.48 |
| 18.85 | 0.63 | 0.47 | 1.34 | 2.48 | 0.00 | 2.48 |
| 18.90 | 0.63 | 0.47 | 1.34 | 2.48 | 0.00 | 2.48 |
| 18.95 | 0.63 | 0.47 | 1.34 | 2.48 | 0.00 | 2.48 |
| 19.00 | 0.63 | 0.47 | 1.34 | 2.48 | 0.00 | 2.48 |
| 19.05 | 0.63 | 0.47 | 1.34 | 2.48 | 0.00 | 2.48 |
| 19.10 | 0.63 | 0.47 | 1.34 | 2.48 | 0.00 | 2.48 |
| 19.15 | 0.63 | 0.47 | 1.33 | 2.48 | 0.00 | 2.48 |
| 19.20 | 0.63 | 0.47 | 1.33 | 2.48 | 0.00 | 2.48 |
| 19.25 | 0.63 | 0.47 | 1.33 | 2.48 | 0.00 | 2.48 |
| 19.30 | 0.63 | 0.47 | 1.33 | 2.48 | 0.00 | 2.48 |
| 19.35 | 0.63 | 0.47 | 1.33 | 2.48 | 0.00 | 2.48 |
| 19.40 | 0.63 | 0.47 | 1.33 | 2.48 | 0.00 | 2.48 |
| 19.45 | 0.63 | 0.47 | 1.33 | 2.48 | 0.00 | 2.48 |
| 19.50 | 0.63 | 0.47 | 1.32 | 2.48 | 0.00 | 2.48 |
| 19.55 | 0.63 | 0.47 | 1.32 | 2.48 | 0.00 | 2.48 |
| 19.60 | 0.63 | 0.47 | 1.32 | 2.48 | 0.00 | 2.48 |
| 19.65 | 0.63 | 0.47 | 1.32 | 2.48 | 0.00 | 2.48 |
| 19.70 | 0.63 | 0.47 | 1.32 | 2.48 | 0.00 | 2.48 |
| 19.75 | 0.63 | 0.48 | 1.32 | 2.48 | 0.00 | 2.48 |
| 19.80 | 0.63 | 0.48 | 1.32 | 2.48 | 0.00 | 2.48 |
| 19.85 | 0.63 | 0.48 | 1.31 | 2.48 | 0.00 | 2.48 |
| 19.90 | 0.63 | 0.48 | 1.31 | 2.48 | 0.00 | 2.48 |
| 19.95 | 0.63 | 0.48 | 1.31 | 2.48 | 0.00 | 2.48 |
| 20.00 | 0.63 | 0.48 | 1.31 | 2.48 | 0.00 | 2.48 |
| 20.05 | 0.63 | 0.48 | 1.31 | 2.48 | 0.00 | 2.48 |
| 20.10 | 0.63 | 0.48 | 1.31 | 2.48 | 0.00 | 2.48 |
| 20.15 | 0.63 | 0.48 | 1.31 | 2.48 | 0.00 | 2.48 |
| 20.20 | 0.63 | 0.48 | 1.31 | 2.48 | 0.00 | 2.48 |
| 20.25 | 0.63 | 0.48 | 1.30 | 2.48 | 0.00 | 2.48 |

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|---|---|---|---|---|---|---|
| 20.30 | 0.63 | 0.48 | 1.30 | 2.48 | 0.00 | 2.48 |
| 20.35 | 0.63 | 0.48 | 1.30 | 2.48 | 0.00 | 2.48 |
| 20.40 | 0.63 | 0.48 | 1.30 | 2.48 | 0.00 | 2.48 |
| 20.45 | 0.63 | 0.48 | 1.30 | 2.48 | 0.00 | 2.48 |
| 20.50 | 0.63 | 0.48 | 1.30 | 2.48 | 0.00 | 2.48 |
| 20.55 | 0.63 | 0.48 | 1.30 | 2.48 | 0.00 | 2.48 |
| 20.60 | 0.63 | 0.48 | 1.30 | 2.48 | 0.00 | 2.48 |
| 20.65 | 0.63 | 0.48 | 1.29 | 2.48 | 0.00 | 2.48 |
| 20.70 | 0.63 | 0.48 | 1.29 | 2.48 | 0.00 | 2.48 |
| 20.75 | 0.63 | 0.48 | 1.29 | 2.48 | 0.00 | 2.48 |
| 20.80 | 0.63 | 0.48 | 1.29 | 2.48 | 0.00 | 2.48 |
| 20.85 | 0.63 | 0.49 | 1.29 | 2.48 | 0.00 | 2.48 |
| 20.90 | 0.63 | 0.49 | 1.29 | 2.48 | 0.00 | 2.48 |
| 20.95 | 0.63 | 0.49 | 1.29 | 2.48 | 0.00 | 2.48 |
| 21.00 | 0.63 | 0.49 | 1.29 | 2.48 | 0.00 | 2.48 |
| 21.05 | 0.63 | 0.49 | 1.28 | 2.48 | 0.00 | 2.48 |
| 21.10 | 0.63 | 0.49 | 1.28 | 2.48 | 0.00 | 2.48 |
| 21.15 | 0.63 | 0.49 | 1.28 | 2.48 | 0.00 | 2.48 |
| 21.20 | 0.63 | 0.49 | 1.28 | 2.48 | 0.00 | 2.48 |
| 21.25 | 0.63 | 0.49 | 1.28 | 2.48 | 0.00 | 2.48 |
| 21.30 | 0.63 | 0.49 | 1.28 | 2.48 | 0.00 | 2.48 |
| 21.35 | 0.63 | 0.49 | 1.28 | 2.48 | 0.00 | 2.48 |
| 21.40 | 0.63 | 0.49 | 1.28 | 2.48 | 0.00 | 2.48 |
| 21.45 | 0.63 | 0.49 | 1.28 | 2.48 | 0.00 | 2.48 |
| 21.50 | 0.63 | 0.49 | 1.27 | 2.48 | 0.00 | 2.48 |
| 21.55 | 0.63 | 0.49 | 1.27 | 2.48 | 0.00 | 2.48 |
| 21.60 | 0.63 | 0.49 | 1.27 | 2.48 | 0.00 | 2.48 |
| 21.65 | 0.63 | 0.49 | 1.27 | 2.48 | 0.00 | 2.48 |
| 21.70 | 0.63 | 0.49 | 1.27 | 2.48 | 0.00 | 2.48 |
| 21.75 | 0.63 | 0.49 | 1.27 | 2.48 | 0.00 | 2.48 |
| 21.80 | 0.63 | 0.49 | 1.27 | 2.48 | 0.00 | 2.48 |
| 21.85 | 0.63 | 0.49 | 1.27 | 2.48 | 0.00 | 2.48 |
| 21.90 | 0.63 | 0.49 | 1.27 | 2.48 | 0.00 | 2.48 |
| 21.95 | 0.63 | 0.49 | 1.27 | 2.48 | 0.00 | 2.48 |
| 22.00 | 0.63 | 0.49 | 1.26 | 2.48 | 0.00 | 2.48 |
| 22.05 | 0.63 | 0.50 | 1.26 | 2.48 | 0.00 | 2.48 |
| 22.10 | 0.63 | 0.50 | 1.26 | 2.48 | 0.00 | 2.48 |
| 22.15 | 0.63 | 0.50 | 1.26 | 2.48 | 0.00 | 2.48 |
| 22.20 | 0.63 | 0.50 | 1.26 | 2.48 | 0.00 | 2.48 |
| 22.25 | 0.63 | 0.50 | 1.26 | 2.48 | 0.00 | 2.48 |
| 22.30 | 0.63 | 0.50 | 1.26 | 2.47 | 0.00 | 2.47 |
| 22.35 | 0.63 | 0.50 | 1.26 | 2.47 | 0.00 | 2.47 |
| 22.40 | 0.63 | 0.50 | 1.26 | 2.47 | 0.00 | 2.47 |
| 22.45 | 0.63 | 0.50 | 1.26 | 2.47 | 0.00 | 2.47 |
| 22.50 | 0.63 | 0.50 | 1.25 | 2.47 | 0.00 | 2.47 |
| 22.55 | 0.63 | 0.50 | 1.25 | 2.47 | 0.00 | 2.47 |
| 22.60 | 0.63 | 0.50 | 1.25 | 2.47 | 0.00 | 2.47 |
| 22.65 | 0.63 | 0.50 | 1.25 | 2.47 | 0.00 | 2.47 |
| 22.70 | 0.63 | 0.50 | 1.25 | 2.47 | 0.00 | 2.47 |
| 22.75 | 0.63 | 0.50 | 1.25 | 2.47 | 0.00 | 2.47 |
| 22.80 | 0.63 | 0.50 | 1.25 | 2.47 | 0.00 | 2.47 |
| 22.85 | 0.63 | 0.50 | 1.25 | 2.46 | 0.00 | 2.46 |
| 22.90 | 0.63 | 0.50 | 1.25 | 2.46 | 0.00 | 2.46 |
| 22.95 | 0.63 | 0.50 | 1.25 | 2.46 | 0.00 | 2.46 |
| 23.00 | 0.63 | 0.50 | 1.25 | 2.46 | 0.00 | 2.46 |
| 23.05 | 0.63 | 0.50 | 1.24 | 2.45 | 0.00 | 2.45 |
| 23.10 | 0.60 | 0.50 | 1.19 | 2.45 | 0.00 | 2.45 |
| 23.15 | 0.55 | 0.50 | 1.09 | 2.45 | 0.00 | 2.45 |
| 23.20 | 0.52 | 0.50 | 1.03 | 2.44 | 0.00 | 2.44 |
| 23.25 | 0.50 | 0.50 | 0.99* | 2.44 | 0.00 | 2.44 |
| 23.30 | 0.49 | 0.50 | 0.96* | 2.44 | 0.00 | 2.44 |
| 23.35 | 0.48 | 0.51 | 0.94* | 2.43 | 0.00 | 2.43 |
| 23.40 | 0.47 | 0.51 | 0.92* | 2.43 | 0.00 | 2.43 |
| 23.45 | 0.46 | 0.51 | 0.90* | 2.42 | 0.00 | 2.42 |
| 23.50 | 0.45 | 0.51 | 0.89* | 2.42 | 0.00 | 2.42 |
| 23.55 | 0.44 | 0.51 | 0.87* | 2.41 | 0.00 | 2.41 |
| 23.60 | 0.44 | 0.51 | 0.86* | 2.41 | 0.00 | 2.41 |
| 23.65 | 0.43 | 0.51 | 0.85* | 2.40 | 0.00 | 2.40 |
| 23.70 | 0.42 | 0.51 | 0.84* | 2.40 | 0.00 | 2.40 |
| 23.75 | 0.42 | 0.51 | 0.82* | 2.39 | 0.00 | 2.39 |
| 23.80 | 0.41 | 0.51 | 0.81* | 2.39 | 0.00 | 2.39 |

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|---|---|---|---|---|---|---|
| 23.85 | 0.41 | 0.51 | 0.80* | 2.38 | 0.00 | 2.38 |
| 23.90 | 0.40 | 0.51 | 0.79* | 2.37 | 0.00 | 2.37 |
| 23.95 | 0.40 | 0.51 | 0.79* | 2.37 | 0.00 | 2.37 |
| 24.00 | 0.40 | 0.51 | 0.78* | 2.36 | 0.00 | 2.36 |
| 24.05 | 0.39 | 0.51 | 0.77* | 2.36 | 0.00 | 2.36 |
| 24.10 | 0.39 | 0.51 | 0.76* | 2.35 | 0.00 | 2.35 |
| 24.15 | 0.38 | 0.51 | 0.75* | 2.34 | 0.00 | 2.34 |
| 24.20 | 0.38 | 0.51 | 0.75* | 2.34 | 0.00 | 2.34 |
| 24.25 | 0.38 | 0.51 | 0.74* | 2.33 | 0.00 | 2.33 |
| 24.30 | 0.37 | 0.51 | 0.73* | 2.32 | 0.00 | 2.32 |
| 24.35 | 0.37 | 0.51 | 0.73* | 2.32 | 0.00 | 2.32 |
| 24.40 | 0.37 | 0.51 | 0.72* | 2.31 | 0.00 | 2.31 |
| 24.45 | 0.37 | 0.51 | 0.71* | 2.30 | 0.00 | 2.30 |
| 24.50 | 0.36 | 0.51 | 0.71* | 2.30 | 0.00 | 2.30 |
| 24.55 | 0.36 | 0.51 | 0.70* | 2.29 | 0.00 | 2.29 |
| 24.60 | 0.36 | 0.51 | 0.70* | 2.28 | 0.00 | 2.28 |
| 24.65 | 0.35 | 0.51 | 0.69* | 2.28 | 0.00 | 2.28 |
| 24.70 | 0.35 | 0.51 | 0.68* | 2.27 | 0.00 | 2.27 |
| 24.75 | 0.35 | 0.51 | 0.68* | 2.26 | 0.00 | 2.26 |
| 24.80 | 0.35 | 0.51 | 0.67* | 2.26 | 0.00 | 2.26 |
| 24.85 | 0.34 | 0.52 | 0.67* | 2.25 | 0.00 | 2.25 |
| 24.90 | 0.34 | 0.52 | 0.66* | 2.24 | 0.00 | 2.24 |
| 24.95 | 0.34 | 0.52 | 0.66* | 2.24 | 0.00 | 2.24 |
| 25.00 | 0.34 | 0.52 | 0.66* | 2.23 | 0.00 | 2.23 |
| 25.05 | 0.33 | 0.52 | 0.65* | 2.22 | 0.00 | 2.22 |
| 25.10 | 0.33 | 0.52 | 0.64* | 2.21 | 0.00 | 2.21 |
| 25.15 | 0.33 | 0.52 | 0.63* | 2.21 | 0.00 | 2.21 |
| 25.20 | 0.32 | 0.52 | 0.63* | 2.20 | 0.00 | 2.20 |
| 25.25 | 0.32 | 0.52 | 0.62* | 2.19 | 0.00 | 2.19 |
| 25.30 | 0.32 | 0.52 | 0.61* | 2.18 | 0.00 | 2.18 |
| 25.35 | 0.32 | 0.52 | 0.61* | 2.18 | 0.00 | 2.18 |
| 25.40 | 0.31 | 0.52 | 0.60* | 2.17 | 0.00 | 2.17 |
| 25.45 | 0.31 | 0.52 | 0.60* | 2.16 | 0.00 | 2.16 |
| 25.50 | 0.31 | 0.52 | 0.59* | 2.15 | 0.00 | 2.15 |
| 25.55 | 0.30 | 0.52 | 0.58* | 2.14 | 0.00 | 2.14 |
| 25.60 | 0.30 | 0.52 | 0.58* | 2.14 | 0.00 | 2.14 |
| 25.65 | 0.30 | 0.52 | 0.57* | 2.13 | 0.00 | 2.13 |
| 25.70 | 0.29 | 0.52 | 0.57* | 2.12 | 0.00 | 2.12 |
| 25.75 | 0.29 | 0.52 | 0.56* | 2.11 | 0.00 | 2.11 |
| 25.80 | 0.29 | 0.52 | 0.56* | 2.10 | 0.00 | 2.10 |
| 25.85 | 0.29 | 0.52 | 0.55* | 2.09 | 0.00 | 2.09 |
| 25.90 | 0.28 | 0.52 | 0.54* | 2.09 | 0.00 | 2.09 |
| 25.95 | 0.28 | 0.52 | 0.54* | 2.08 | 0.00 | 2.08 |
| 26.00 | 0.28 | 0.52 | 0.53* | 2.07 | 0.00 | 2.07 |
| 26.05 | 0.28 | 0.52 | 0.53* | 2.06 | 0.00 | 2.06 |
| 26.10 | 0.27 | 0.52 | 0.52* | 2.05 | 0.00 | 2.05 |
| 26.15 | 0.27 | 0.52 | 0.52* | 2.04 | 0.00 | 2.04 |
| 26.20 | 0.27 | 0.52 | 0.51* | 2.03 | 0.00 | 2.03 |
| 26.25 | 0.27 | 0.52 | 0.51* | 2.02 | 0.00 | 2.02 |
| 26.30 | 0.26 | 0.52 | 0.50* | 2.02 | 0.00 | 2.02 |
| 26.35 | 0.26 | 0.52 | 0.50* | 2.01 | 0.00 | 2.01 |
| 26.40 | 0.26 | 0.52 | 0.49* | 2.00 | 0.00 | 2.00 |
| 26.45 | 0.26 | 0.52 | 0.49* | 1.99 | 0.00 | 1.99 |
| 26.50 | 0.25 | 0.52 | 0.48* | 1.98 | 0.00 | 1.98 |
| 26.55 | 0.25 | 0.53 | 0.48* | 1.97 | 0.00 | 1.97 |
| 26.60 | 0.25 | 0.53 | 0.47* | 1.96 | 0.00 | 1.96 |
| 26.65 | 0.25 | 0.53 | 0.47* | 1.95 | 0.00 | 1.95 |
| 26.70 | 0.24 | 0.53 | 0.46* | 1.94 | 0.00 | 1.94 |
| 26.75 | 0.24 | 0.53 | 0.46* | 1.93 | 0.00 | 1.93 |
| 26.80 | 0.24 | 0.53 | 0.45* | 1.92 | 0.00 | 1.92 |
| 26.85 | 0.24 | 0.53 | 0.45* | 1.91 | 0.00 | 1.91 |
| 26.90 | 0.23 | 0.53 | 0.44* | 1.90 | 0.00 | 1.90 |
| 26.95 | 0.23 | 0.53 | 0.44* | 1.89 | 0.00 | 1.89 |
| 27.00 | 0.23 | 0.53 | 0.44* | 1.88 | 0.00 | 1.88 |
| 27.05 | 0.23 | 0.53 | 0.43* | 1.87 | 0.00 | 1.87 |
| 27.10 | 0.22 | 0.53 | 0.43* | 1.86 | 0.00 | 1.86 |
| 27.15 | 0.22 | 0.53 | 0.42* | 1.85 | 0.00 | 1.85 |
| 27.20 | 0.22 | 0.53 | 0.42* | 1.84 | 0.00 | 1.84 |
| 27.25 | 0.22 | 0.53 | 0.41* | 1.83 | 0.00 | 1.83 |
| 27.30 | 0.22 | 0.53 | 0.41* | 1.81 | 0.00 | 1.81 |
| 27.35 | 0.21 | 0.53 | 0.40* | 1.80 | 0.00 | 1.80 |

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|---|---|---|---|---|---|---|
| 27.40 | 0.21 | 0.53 | 0.40* | 1.79 | 0.00 | 1.79 |
| 27.45 | 0.21 | 0.53 | 0.39* | 1.78 | 0.00 | 1.78 |
| 27.50 | 0.21 | 0.53 | 0.39* | 1.77 | 0.00 | 1.77 |
| 27.55 | 0.20 | 0.53 | 0.39* | 1.76 | 0.00 | 1.76 |
| 27.60 | 0.20 | 0.53 | 0.38* | 1.75 | 0.00 | 1.75 |
| 27.65 | 0.20 | 0.53 | 0.38* | 1.74 | 0.00 | 1.74 |
| 27.70 | 0.20 | 0.53 | 0.37* | 1.73 | 0.00 | 1.73 |
| 27.75 | 0.19 | 0.53 | 0.37* | 1.71 | 0.00 | 1.71 |
| 27.80 | 0.19 | 0.53 | 0.36* | 1.70 | 0.00 | 1.70 |
| 27.85 | 0.19 | 0.53 | 0.36* | 1.69 | 0.00 | 1.69 |
| 27.90 | 0.20 | 0.53 | 0.37* | 1.68 | 0.00 | 1.68 |
| 27.95 | 0.20 | 0.53 | 0.37* | 1.67 | 0.00 | 1.67 |
| 28.00 | 0.19 | 0.53 | 0.36* | 1.66 | 0.00 | 1.66 |
| 28.05 | 0.19 | 0.53 | 0.36* | 1.64 | 0.00 | 1.64 |
| 28.10 | 0.19 | 0.53 | 0.35* | 1.63 | 0.00 | 1.63 |
| 28.15 | 0.19 | 0.53 | 0.35* | 1.62 | 0.00 | 1.62 |
| 28.20 | 0.18 | 0.53 | 0.34* | 1.61 | 0.00 | 1.61 |
| 28.25 | 0.18 | 0.53 | 0.34* | 1.60 | 0.00 | 1.60 |
| 28.30 | 0.18 | 0.53 | 0.33* | 1.58 | 0.00 | 1.58 |
| 28.35 | 0.18 | 0.53 | 0.33* | 1.57 | 0.00 | 1.57 |
| 28.40 | 0.17 | 0.53 | 0.33* | 1.56 | 0.00 | 1.56 |
| 28.45 | 0.17 | 0.53 | 0.32* | 1.55 | 0.00 | 1.55 |
| 28.50 | 0.17 | 0.53 | 0.32* | 1.53 | 0.00 | 1.53 |
| 28.55 | 0.17 | 0.53 | 0.31* | 1.52 | 0.00 | 1.52 |
| 28.60 | 0.16 | 0.53 | 0.31* | 1.51 | 0.00 | 1.51 |
| 28.65 | 0.16 | 0.53 | 0.30* | 1.49 | 0.00 | 1.49 |
| 28.70 | 0.16 | 0.54 | 0.30* | 1.48 | 0.00 | 1.48 |
| 28.75 | 0.16 | 0.54 | 0.29* | 1.47 | 0.00 | 1.47 |
| 28.80 | 0.15 | 0.54 | 0.29* | 1.45 | 0.00 | 1.45 |
| 28.85 | 0.15 | 0.54 | 0.28* | 1.44 | 0.00 | 1.44 |
| 28.90 | 0.15 | 0.54 | 0.28* | 1.42 | 0.00 | 1.42 |
| 28.95 | 0.15 | 0.54 | 0.28* | 1.41 | 0.00 | 1.41 |
| 29.00 | 0.15 | 0.54 | 0.27* | 1.39 | 0.00 | 1.39 |
| 29.05 | 0.14 | 0.54 | 0.27* | 1.38 | 0.00 | 1.38 |
| 29.10 | 0.14 | 0.54 | 0.26* | 1.36 | 0.00 | 1.36 |
| 29.15 | 0.14 | 0.54 | 0.26* | 1.35 | 0.00 | 1.35 |
| 29.20 | 0.14 | 0.54 | 0.25* | 1.33 | 0.00 | 1.33 |
| 29.25 | 0.13 | 0.54 | 0.25* | 1.32 | 0.00 | 1.32 |
| 29.30 | 0.13 | 0.54 | 0.24* | 1.30 | 0.00 | 1.30 |
| 29.35 | 0.13 | 0.54 | 0.24* | 1.29 | 0.00 | 1.29 |
| 29.40 | 0.13 | 0.54 | 0.24* | 1.27 | 0.00 | 1.27 |
| 29.45 | 0.13 | 0.54 | 0.23* | 1.26 | 0.00 | 1.26 |
| 29.50 | 0.12 | 0.54 | 0.23* | 1.24 | 0.00 | 1.24 |
| 29.55 | 0.12 | 0.54 | 0.22* | 1.22 | 0.00 | 1.22 |
| 29.60 | 0.12 | 0.54 | 0.22* | 1.21 | 0.00 | 1.21 |
| 29.65 | 0.12 | 0.54 | 0.22* | 1.19 | 0.00 | 1.19 |
| 29.70 | 0.11 | 0.54 | 0.21* | 1.17 | 0.00 | 1.17 |
| 29.75 | 0.11 | 0.54 | 0.21* | 1.16 | 0.00 | 1.16 |
| 29.80 | 0.11 | 0.54 | 0.20* | 1.14 | 0.00 | 1.14 |
| 29.85 | 0.11 | 0.54 | 0.20* | 1.12 | 0.00 | 1.12 |
| 29.90 | 0.11 | 0.54 | 0.20* | 1.10 | 0.00 | 1.10 |
| 29.95 | 0.10 | 0.54 | 0.19* | 1.09 | 0.00 | 1.09 |
| 30.00 | 0.10 | 0.54 | 0.19* | 1.07 | 0.00 | 1.07 |
| 30.05 | 0.11 | 0.54 | 0.20* | 1.05 | 0.00 | 1.05 |
| 30.10 | 0.11 | 0.54 | 0.20* | 1.03 | 0.00 | 1.03 |
| 30.15 | 0.11 | 0.54 | 0.21* | 1.01 | 0.00 | 1.01 |
| 30.20 | 0.11 | 0.54 | 0.21* | 1.00 | 0.00 | 1.00 |
| 30.25 | 0.12 | 0.54 | 0.22* | 0.98 | 0.00 | 0.98 |
| 30.30 | 0.12 | 0.54 | 0.22* | 0.96 | 0.00 | 0.96 |
| 30.35 | 0.12 | 0.54 | 0.23* | 0.95 | 0.00 | 0.95 |
| 30.40 | 0.13 | 0.54 | 0.23* | 0.93 | 0.00 | 0.93 |
| 30.45 | 0.13 | 0.54 | 0.24* | 0.91 | 0.00 | 0.91 |
| 30.50 | 0.13 | 0.54 | 0.25* | 0.90 | 0.00 | 0.90 |
| 30.55 | 0.14 | 0.54 | 0.25* | 0.88 | 0.00 | 0.88 |
| 30.60 | 0.14 | 0.54 | 0.26* | 0.87 | 0.00 | 0.87 |
| 30.65 | 0.14 | 0.54 | 0.26* | 0.85 | 0.00 | 0.85 |
| 30.70 | 0.15 | 0.54 | 0.27* | 0.84 | 0.00 | 0.84 |
| 30.75 | 0.15 | 0.54 | 0.28* | 0.82 | 0.00 | 0.82 |
| 30.80 | 0.15 | 0.54 | 0.28* | 0.81 | 0.00 | 0.81 |
| 30.85 | 0.16 | 0.54 | 0.29* | 0.79 | 0.00 | 0.79 |
| 30.90 | 0.16 | 0.54 | 0.29* | 0.78 | 0.00 | 0.78 |

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|---|---|---|---|---|---|---|
| 30.95 | 0.16 | 0.54 | 0.30* | 0.76 | 0.00 | 0.76 |
| 31.00 | 0.17 | 0.54 | 0.31* | 0.75 | 0.00 | 0.75 |
| 31.05 | 0.17 | 0.54 | 0.31* | 0.74 | 0.00 | 0.74 |
| 31.10 | 0.17 | 0.54 | 0.32* | 0.72 | 0.00 | 0.72 |
| 31.15 | 0.17 | 0.54 | 0.32* | 0.71 | 0.00 | 0.71 |
| 31.20 | 0.18 | 0.54 | 0.33* | 0.70 | 0.00 | 0.70 |
| 31.25 | 0.18 | 0.54 | 0.34* | 0.69 | 0.00 | 0.69 |
| 31.30 | 0.18 | 0.54 | 0.34* | 0.67 | 0.00 | 0.67 |
| 31.35 | 0.19 | 0.54 | 0.35* | 0.66 | 0.00 | 0.66 |
| 31.40 | 0.19 | 0.54 | 0.35* | 0.65 | 0.00 | 0.65 |
| 31.45 | 0.19 | 0.54 | 0.36* | 0.64 | 0.00 | 0.64 |
| 31.50 | 0.20 | 0.54 | 0.37* | 0.63 | 0.00 | 0.63 |
| 31.55 | 0.20 | 0.54 | 0.37* | 0.62 | 0.00 | 0.62 |
| 31.60 | 0.20 | 0.54 | 0.38* | 0.60 | 0.00 | 0.60 |
| 31.65 | 0.21 | 0.54 | 0.38* | 0.59 | 0.00 | 0.59 |
| 31.70 | 0.21 | 0.54 | 0.39* | 0.58 | 0.00 | 0.58 |
| 31.75 | 0.21 | 0.54 | 0.40* | 0.57 | 0.00 | 0.57 |
| 31.80 | 0.22 | 0.54 | 0.40* | 0.56 | 0.00 | 0.56 |
| 31.85 | 0.22 | 0.54 | 0.41* | 0.55 | 0.00 | 0.55 |
| 31.90 | 0.22 | 0.54 | 0.41* | 0.54 | 0.00 | 0.54 |
| 31.95 | 0.23 | 0.54 | 0.42* | 0.53 | 0.00 | 0.53 |
| 32.00 | 0.23 | 0.54 | 0.43* | 0.52 | 0.00 | 0.52 |
| 32.05 | 0.23 | 0.54 | 0.43* | 0.51 | 0.00 | 0.51 |
| 32.10 | 0.24 | 0.54 | 0.44* | 0.50 | 0.00 | 0.50 |
| 32.15 | 0.24 | 0.54 | 0.44* | 0.49 | 0.00 | 0.49 |
| 32.20 | 0.24 | 0.54 | 0.45* | 0.48 | 0.00 | 0.48 |
| 32.25 | 0.24 | 0.54 | 0.45* | 0.47 | 0.00 | 0.47 |
| 32.30 | 0.25 | 0.54 | 0.46* | 0.46 | 0.00 | 0.46 |
| 32.35 | 0.25 | 0.54 | 0.47* | 0.45 | 0.00 | 0.45 |
| 32.40 | 0.25 | 0.54 | 0.47* | 0.44 | 0.00 | 0.44 |
| 32.45 | 0.26 | 0.54 | 0.48* | 0.43 | 0.00 | 0.43 |
| 32.50 | 0.26 | 0.54 | 0.48* | 0.42 | 0.00 | 0.42 |
| 32.55 | 0.26 | 0.54 | 0.49* | 0.41 | 0.00 | 0.41 |
| 32.60 | 0.27 | 0.54 | 0.50* | 0.40 | 0.00 | 0.40 |
| 32.65 | 0.27 | 0.54 | 0.50* | 0.39 | 0.00 | 0.39 |
| 32.70 | 0.27 | 0.54 | 0.51* | 0.38 | 0.00 | 0.38 |
| 32.75 | 0.28 | 0.54 | 0.51* | 0.37 | 0.00 | 0.37 |
| 32.80 | 0.28 | 0.54 | 0.52* | 0.36 | 0.00 | 0.36 |
| 32.85 | 0.28 | 0.54 | 0.53* | 0.35 | 0.00 | 0.35 |
| 32.90 | 0.29 | 0.54 | 0.53* | 0.35 | 0.00 | 0.35 |
| 32.95 | 0.29 | 0.54 | 0.54* | 0.34 | 0.00 | 0.34 |
| 33.00 | 0.29 | 0.54 | 0.55* | 0.33 | 0.00 | 0.33 |
| 33.05 | 0.30 | 0.54 | 0.55* | 0.32 | 0.00 | 0.32 |
| 33.10 | 0.30 | 0.54 | 0.56* | 0.31 | 0.00 | 0.31 |
| 33.15 | 0.31 | 0.54 | 0.57* | 0.30 | 0.00 | 0.30 |
| 33.20 | 0.31 | 0.54 | 0.57* | 0.30 | 0.00 | 0.30 |
| 33.25 | 0.31 | 0.54 | 0.58* | 0.29 | 0.00 | 0.29 |
| 33.30 | 0.32 | 0.54 | 0.59* | 0.28 | 0.00 | 0.28 |
| 33.35 | 0.32 | 0.54 | 0.60* | 0.27 | 0.00 | 0.27 |
| 33.40 | 0.32 | 0.54 | 0.60* | 0.26 | 0.00 | 0.26 |
| 33.45 | 0.33 | 0.54 | 0.61* | 0.26 | 0.00 | 0.26 |
| 33.50 | 0.33 | 0.54 | 0.62* | 0.25 | 0.00 | 0.25 |
| 33.55 | 0.34 | 0.54 | 0.63* | 0.24 | 0.00 | 0.24 |
| 33.60 | 0.34 | 0.54 | 0.63* | 0.23 | 0.00 | 0.23 |
| 33.65 | 0.34 | 0.54 | 0.64* | 0.23 | 0.00 | 0.23 |
| 33.70 | 0.35 | 0.54 | 0.65* | 0.22 | 0.00 | 0.22 |
| 33.75 | 0.35 | 0.54 | 0.66* | 0.21 | 0.00 | 0.21 |
| 33.80 | 0.36 | 0.54 | 0.67* | 0.21 | 0.00 | 0.21 |
| 33.85 | 0.36 | 0.54 | 0.68* | 0.20 | 0.00 | 0.20 |
| 33.90 | 0.37 | 0.54 | 0.69* | 0.19 | 0.00 | 0.19 |
| 33.95 | 0.37 | 0.54 | 0.69* | 0.19 | 0.00 | 0.19 |
| 34.00 | 0.38 | 0.54 | 0.70* | 0.18 | 0.00 | 0.18 |
| 34.05 | 0.38 | 0.54 | 0.71* | 0.17 | 0.00 | 0.17 |
| 34.10 | 0.39 | 0.54 | 0.72* | 0.17 | 0.00 | 0.17 |
| 34.15 | 0.39 | 0.54 | 0.73* | 0.16 | 0.00 | 0.16 |
| 34.20 | 0.40 | 0.54 | 0.75* | 0.15 | 0.00 | 0.15 |
| 34.25 | 0.41 | 0.54 | 0.76* | 0.15 | 0.00 | 0.15 |
| 34.30 | 0.41 | 0.54 | 0.77* | 0.14 | 0.00 | 0.14 |
| 34.35 | 0.42 | 0.54 | 0.78* | 0.14 | 0.00 | 0.14 |
| 34.40 | 0.43 | 0.54 | 0.79* | 0.13 | 0.00 | 0.13 |
| 34.45 | 0.43 | 0.54 | 0.81* | 0.12 | 0.00 | 0.12 |

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|---|---|---|---|---|---|---|
| 34.50 | 0.44 | 0.54 | 0.82* | 0.12 | 0.00 | 0.12 |
| 34.55 | 0.45 | 0.54 | 0.84* | 0.11 | 0.00 | 0.11 |
| 34.60 | 0.46 | 0.54 | 0.86* | 0.11 | 0.00 | 0.11 |
| 34.65 | 0.47 | 0.54 | 0.88* | 0.10 | 0.00 | 0.10 |
| 34.70 | 0.48 | 0.54 | 0.90* | 0.10 | 0.00 | 0.10 |
| 34.75 | 0.50 | 0.54 | 0.93* | 0.09 | 0.00 | 0.09 |
| 34.80 | 0.52 | 0.54 | 0.96* | 0.09 | 0.00 | 0.09 |
| 34.85 | 0.55 | 0.54 | 1.02 | 0.08 | 0.00 | 0.08 |
| 34.90 | 0.61 | 0.54 | 1.13 | 0.08 | 0.00 | 0.08 |
| 34.95 | 0.63 | 0.54 | 1.17 | 0.08 | 0.00 | 0.08 |
| 35.00 | 0.63 | 0.54 | 1.17 | 0.07 | 0.00 | 0.07 |
| 35.05 | 0.63 | 0.54 | 1.17 | 0.07 | 0.00 | 0.07 |
| 35.10 | 0.63 | 0.54 | 1.17 | 0.07 | 0.00 | 0.07 |
| 35.15 | 0.63 | 0.54 | 1.17 | 0.06 | 0.00 | 0.06 |
| 35.20 | 0.63 | 0.54 | 1.17 | 0.06 | 0.00 | 0.06 |
| 35.25 | 0.63 | 0.53 | 1.17 | 0.06 | 0.00 | 0.06 |
| 35.30 | 0.63 | 0.53 | 1.17 | 0.05 | 0.00 | 0.05 |
| 35.35 | 0.63 | 0.53 | 1.17 | 0.05 | 0.00 | 0.05 |
| 35.40 | 0.63 | 0.53 | 1.17 | 0.05 | 0.00 | 0.05 |
| 35.45 | 0.63 | 0.53 | 1.17 | 0.04 | 0.00 | 0.04 |
| 35.50 | 0.63 | 0.53 | 1.17 | 0.04 | 0.00 | 0.04 |
| 35.55 | 0.63 | 0.53 | 1.17 | 0.04 | 0.00 | 0.04 |
| 35.60 | 0.63 | 0.53 | 1.17 | 0.04 | 0.00 | 0.04 |
| 35.65 | 0.63 | 0.53 | 1.17 | 0.04 | 0.00 | 0.04 |
| 35.70 | 0.63 | 0.53 | 1.17 | 0.03 | 0.00 | 0.03 |
| 35.75 | 0.63 | 0.53 | 1.17 | 0.03 | 0.00 | 0.03 |
| 35.80 | 0.63 | 0.53 | 1.17 | 0.03 | 0.00 | 0.03 |
| 35.85 | 0.63 | 0.53 | 1.17 | 0.03 | 0.00 | 0.03 |
| 35.90 | 0.63 | 0.53 | 1.17 | 0.03 | 0.00 | 0.03 |
| 35.95 | 0.63 | 0.53 | 1.17 | 0.03 | 0.00 | 0.03 |
| 36.00 | 0.63 | 0.53 | 1.17 | 0.03 | 0.00 | 0.03 |
| 36.05 | 0.63 | 0.53 | 1.17 | 0.03 | 0.00 | 0.03 |
| 36.10 | 0.63 | 0.53 | 1.17 | 0.03 | 0.00 | 0.03 |
| 36.15 | 0.63 | 0.53 | 1.17 | 0.02 | 0.00 | 0.02 |
| 36.20 | 0.63 | 0.53 | 1.17 | 0.02 | 0.00 | 0.02 |
| 36.25 | 0.63 | 0.53 | 1.17 | 0.02 | 0.00 | 0.02 |
| 36.30 | 0.63 | 0.53 | 1.17 | 0.02 | 0.00 | 0.02 |
| 36.35 | 0.63 | 0.53 | 1.17 | 0.02 | 0.00 | 0.02 |
| 36.40 | 0.63 | 0.53 | 1.17 | 0.02 | 0.00 | 0.02 |
| 36.45 | 0.63 | 0.53 | 1.17 | 0.02 | 0.00 | 0.02 |
| 36.50 | 0.63 | 0.53 | 1.17 | 0.02 | 0.00 | 0.02 |
| 36.55 | 0.63 | 0.53 | 1.17 | 0.02 | 0.00 | 0.02 |
| 36.60 | 0.63 | 0.53 | 1.17 | 0.02 | 0.00 | 0.02 |
| 36.65 | 0.63 | 0.53 | 1.18 | 0.02 | 0.00 | 0.02 |
| 36.70 | 0.63 | 0.53 | 1.18 | 0.02 | 0.00 | 0.02 |
| 36.75 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 36.80 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 36.85 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 36.90 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 36.95 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.00 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.05 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.10 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.15 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.20 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.25 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.30 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.35 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.40 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.45 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.50 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.55 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.60 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.65 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.70 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.75 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.80 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.85 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.90 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 37.95 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.00 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |

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|---|---|---|---|---|---|---|
| 38.05 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.10 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.15 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.20 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.25 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.30 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.35 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.40 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.45 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.50 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.55 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.60 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.65 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.70 | 0.63 | 0.53 | 1.18 | 0.01 | 0.00 | 0.01 |
| 38.75 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 38.80 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 38.85 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 38.90 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 38.95 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.00 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.05 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.10 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.15 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.20 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.25 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.30 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.35 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.40 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.45 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.50 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.55 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.60 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.65 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.70 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.75 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.80 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.85 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.90 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 39.95 | 0.63 | 0.53 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.00 | 0.63 | 0.52 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.05 | 0.63 | 0.52 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.10 | 0.63 | 0.52 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.15 | 0.63 | 0.52 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.20 | 0.63 | 0.52 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.25 | 0.63 | 0.52 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.30 | 0.63 | 0.52 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.35 | 0.63 | 0.52 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.40 | 0.63 | 0.52 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.45 | 0.63 | 0.52 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.50 | 0.63 | 0.52 | 1.19 | 0.01 | 0.00 | 0.01 |
| 40.55 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 40.60 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 40.65 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 40.70 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 40.75 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 40.80 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 40.85 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 40.90 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 40.95 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.00 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.05 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.10 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.15 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.20 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.25 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.30 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.35 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.40 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.45 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.50 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.55 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |

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|---|---|---|---|---|---|---|
| 41.60 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.65 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.70 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.75 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.80 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.85 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.90 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 41.95 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 42.00 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 42.05 | 0.63 | 0.52 | 1.20 | 0.01 | 0.00 | 0.01 |
| 42.10 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.15 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.20 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.25 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.30 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.35 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.40 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.45 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.50 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.55 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.60 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.65 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.70 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.75 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.80 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.85 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.90 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 42.95 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.00 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.05 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.10 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.15 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.20 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.25 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.30 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.35 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.40 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.45 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.50 | 0.63 | 0.52 | 1.21 | 0.01 | 0.00 | 0.01 |
| 43.55 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 43.60 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 43.65 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 43.70 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 43.75 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 43.80 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 43.85 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 43.90 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 43.95 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.00 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.05 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.10 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.15 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.20 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.25 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.30 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.35 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.40 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.45 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.50 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.55 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.60 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.65 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.70 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.75 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.80 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.85 | 0.63 | 0.51 | 1.22 | 0.01 | 0.00 | 0.01 |
| 44.90 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 44.95 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.00 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.05 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.10 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |

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|---|---|---|---|---|---|---|
| 45.15 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.20 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.25 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.30 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.35 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.40 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.45 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.50 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.55 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.60 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.65 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.70 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.75 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.80 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.85 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.90 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 45.95 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 46.00 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 46.05 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 46.10 | 0.63 | 0.51 | 1.23 | 0.01 | 0.00 | 0.01 |
| 46.15 | 0.63 | 0.51 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.20 | 0.63 | 0.51 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.25 | 0.63 | 0.51 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.30 | 0.63 | 0.51 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.35 | 0.63 | 0.51 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.40 | 0.63 | 0.51 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.45 | 0.63 | 0.51 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.50 | 0.63 | 0.51 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.55 | 0.63 | 0.51 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.60 | 0.63 | 0.51 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.65 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.70 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.75 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.80 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.85 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.90 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 46.95 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 47.00 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 47.05 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 47.10 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 47.15 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 47.20 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 47.25 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 47.30 | 0.63 | 0.50 | 1.24 | 0.01 | 0.00 | 0.01 |
| 47.35 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.40 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.45 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.50 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.55 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.60 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.65 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.70 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.75 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.80 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.85 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.90 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 47.95 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 48.00 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 48.05 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 48.10 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 48.15 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 48.20 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 48.25 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 48.30 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 48.35 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 48.40 | 0.63 | 0.50 | 1.25 | 0.01 | 0.00 | 0.01 |
| 48.45 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 48.50 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 48.55 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 48.60 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 48.65 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |

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|---|---|---|---|---|---|---|
| 48.70 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 48.75 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 48.80 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 48.85 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 48.90 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 48.95 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.00 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.05 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.10 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.15 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.20 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.25 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.30 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.35 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.40 | 0.63 | 0.50 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.45 | 0.63 | 0.49 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.50 | 0.63 | 0.49 | 1.26 | 0.01 | 0.00 | 0.01 |
| 49.55 | 0.63 | 0.49 | 1.27 | 0.01 | 0.00 | 0.01 |
| 49.60 | 0.63 | 0.49 | 1.27 | 0.01 | 0.00 | 0.01 |
| 49.65 | 0.63 | 0.49 | 1.27 | 0.01 | 0.00 | 0.01 |
| 49.70 | 0.63 | 0.49 | 1.27 | 0.01 | 0.00 | 0.01 |
| 49.75 | 0.63 | 0.49 | 1.27 | 0.01 | 0.00 | 0.01 |
| 49.80 | 0.63 | 0.49 | 1.27 | 0.01 | 0.00 | 0.01 |
| 49.85 | 0.63 | 0.49 | 1.27 | 0.01 | 0.00 | 0.01 |
| 49.90 | 0.63 | 0.49 | 1.27 | 0.00 | 0.00 | 0.00 |
| 49.95 | 0.63 | 0.49 | 1.27 | 0.00 | 0.00 | 0.00 |
| 50.00 | 0.63 | 0.49 | 1.27 | 0.00 | 0.00 | 0.00 |

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

| | |
|---|---|
| CRRm | Cyclic resistance ratio from soils |
| CSRsf | Cyclic stress ratio induced by a given earthquake (with user request factor of safety) |
| F.S. | Factor of Safety against liquefaction, F.S.=CRRm/CSRsf |
| S_sat | Settlement from saturated sands |
| S_dry | Settlement from Unsaturated Sands |
| S_all | Total Settlement from Saturated and Unsaturated Sands |
| NoLiq | No-Liquefy Soils |

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# General Notes

## Sampling

- Auger Cuttings
- Modified Dames & Moore Ring Sampler
- Grab Sample
- Standard Penetration Test

## Water Level

- Water Initially Encountered
- Water Level After a Specified Period of Time
- Water Level After a Specified Period of Time
- Cave In Encountered

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 | | | |
|---|---|---|---|---|---|---|
| **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.)** |
| Very Loose | 0 - 3 | 0 - 6 | Very Soft | less than 0.25 | 0 - 1 | < 3 |
| Loose | 4 - 9 | 7 - 18 | Soft | 0.25 to 0.50 | 2 - 4 | 3 - 4 |
| Medium Dense | 10 - 29 | 19 - 58 | Medium Stiff | 0.50 to 1.00 | 4 - 8 | 5 - 9 |
| Dense | 30 - 50 | 59 - 98 | Stiff | 1.00 to 2.00 | 8 - 15 | 10 - 18 |
| Very Dense | > 50 | > 99 | Very Stiff | 2.00 to 4.00 | 15 - 30 | 19 - 42 |
| | | | 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] |
| | **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] $Cu = D_{60}/D_{10}$   Cc = ______
[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.