Storm Water Quality Analysis:

Yermo Solar Farm

County of San Bernardino, California

November 7, 2024

Prepared for:

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1 INTRODUCTION

1.1 Project Overview

Glacier Power and Gas, LLC, is proposing construction of a 24-acre solar farm within the unincorporated area of Yermo within San Bernardino County.

The Project would be located within San Bernardino County, California, approximately 12 miles east from the town of Barstow in the unincorporated area of Yermo. The Project would be adjacent to the northern side of Calico Boulevard and south of the Union Pacific Railroad and Yermo Road. Development for this project will be completed within a single parcel identified with APNs 053816128 within Township 10 North, Range 2 East, Section 32. Future development is anticipated for a second parcel identified by APN 053816129 to the west of the project site. The project coordinates are (Lat: 34°54'36.09"N; Long: 116°47'24.61"W).

The Project is entirely bordered by undeveloped land to the south of Calico Boulevard and north of the UPRR and Yermo Road.

Specifically, the Project will consist of the following activities:

- construction of ingress and egress to the Project site from Calico Boulevard
- construction of 24 acres of solar panel units and distribution facilities in Parcel B, with future expansion of 17 acres for Parcel A.
- construction of drainage infrastructure

The project location is illustrated in Figure 1-1 and **Error! Reference source not found.**.

1.2 The Goals and Objectives

The goal of this water quality assessment is to define the water quality framework, identify the pollutants of concern, and recommend water quality Best Management Practices (BMPs) during the construction phase and for the life of the project (post-construction).

The Project is located in a nonurban area, with less than 50,000 people per the Census 2020 Urban Area Reference Maps (U.S. Census Bureau). The County of San Bernardino, as Principal Permittee, does not reference the unincorporated area of Yermo California in the stormwater implementation documents for the Mojave Watershed. Specifically, the Project falls within an unincorporated area that is not subject to the requirements of either the Phase I or Phase II MS4 Permits under the National Pollutant Discharge Elimination System (NPDES).

As outlined by the California State Water Resources Control Board, construction and land disturbance activities which disrupt greater than 1-acre of soil must be compliant with the National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities.

The potential for storm water runoff infiltration into the underlying native soils is evaluated using the NRCS web soil survey database.

1.3 Hydrologic Setting

The Project is located in the Mojave River Watershed in the Sunrise Canyon-Mojave River Hydrologic Unit (#180902081402). The Mojave Subbasin encompasses approximately 3 million acres, with over 26,000 acres considered a part of the Sunrise Canyon-Mojave River Subwatershed. The Mojave River Flows easterly towards a large inland delta forming the Mojave River Wash. During larger storm events, the Mojave River reaches Soda Lake near Baker, California and Lake Cronese in Cronese Valley. The Mojave River flows intermittently throughout the year approximately 0.6 Miles to the South of the project site.

Figure 1-1 Vicinity Map

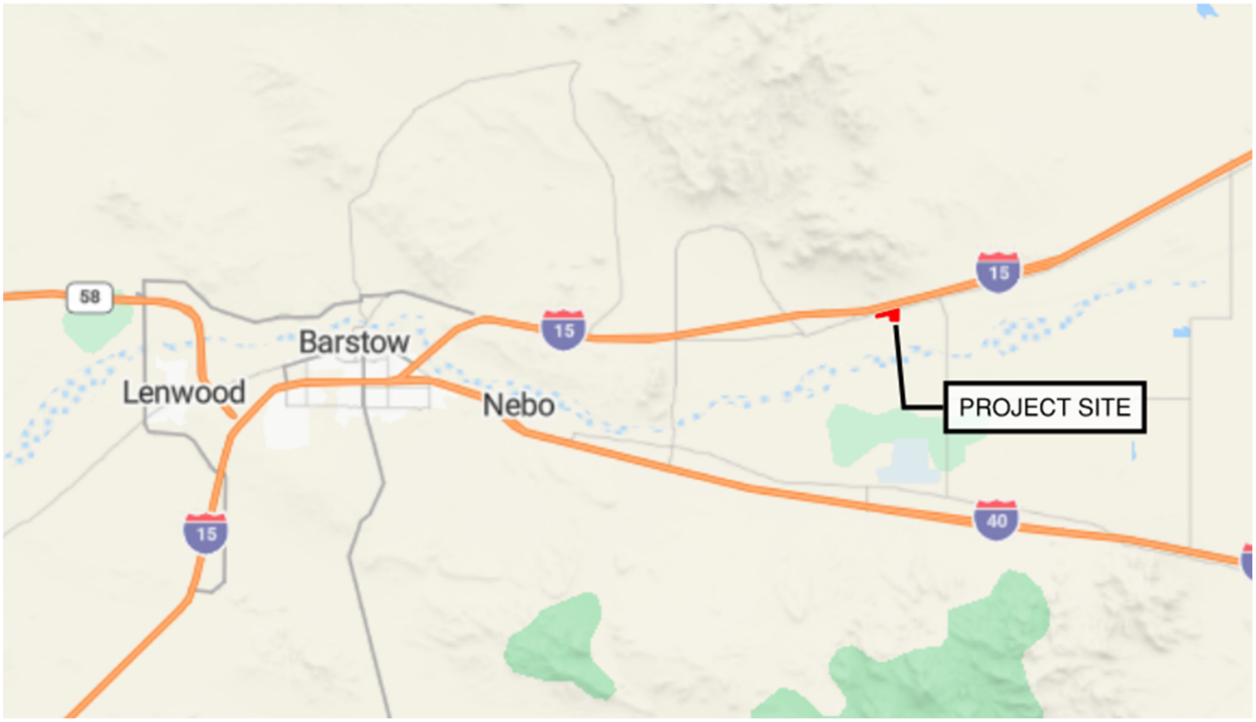
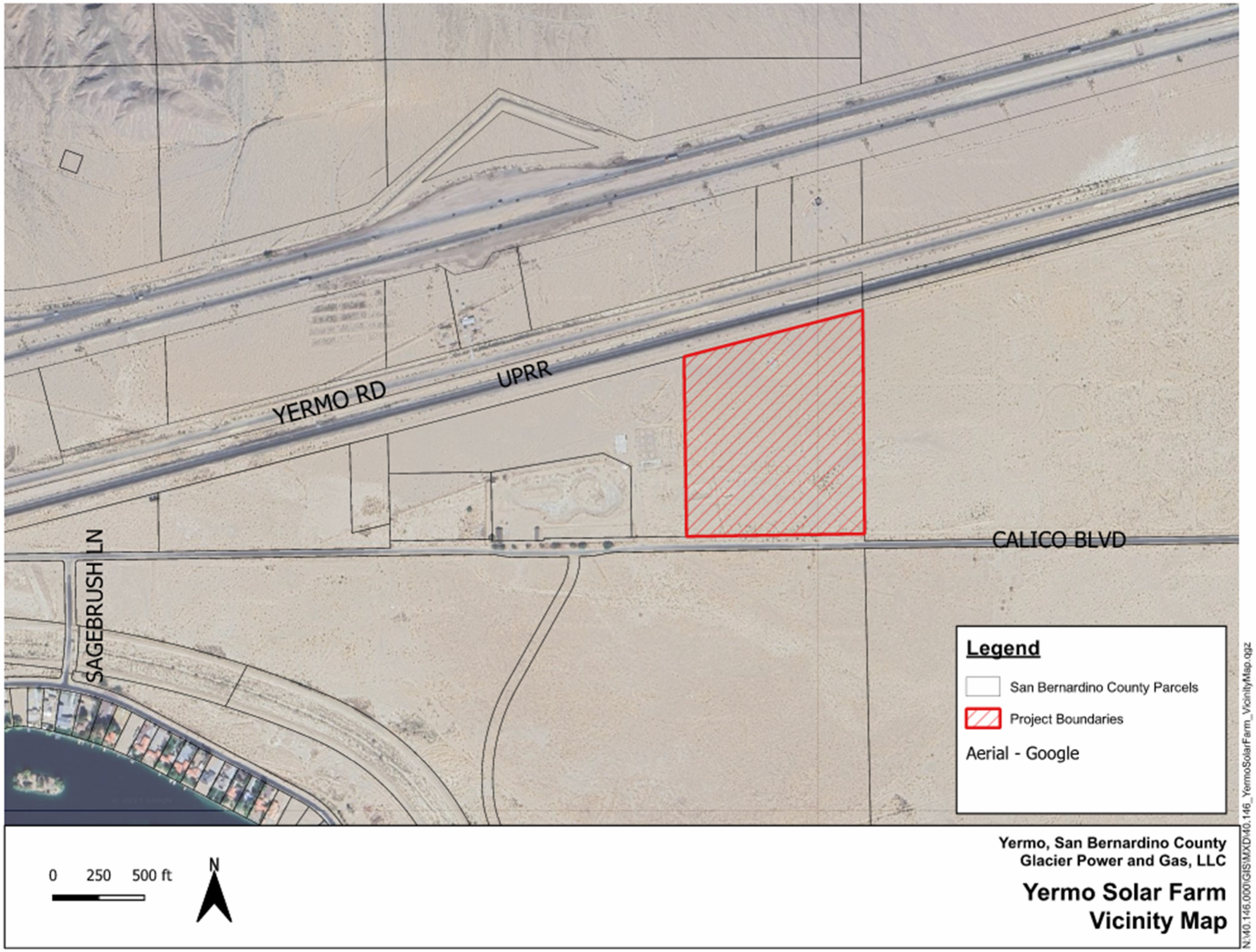


Figure 1-2 **Project Location Map**



2 STORM WATER QUALITY FRAMEWORK

2.1 Basin Plan's Beneficial Uses

A comprehensive review of the latest Water Quality Control Plan for the Lahontan Region (Basin Plan) was conducted to identify the beneficial uses for the Project's Receiving Waters. As mandated by the Clean Water Act and the State's Porter-Cologne Water Quality Control Act, water quality standards are established in the Basin Plan to provide the foundation for the regulatory programs implemented by the state. The Lahontan Region Basin Plan, which covers the project area, designates beneficial uses for surface waters and ground waters. Beneficial uses are summarized in Table 2-1 below.

Table 2-1 – Beneficial Uses from Basin Plan

Receiving Water	Hydrologic Unit Code	Beneficial Uses	Distance from Project (miles)
Lower Mojave River Valley Groundwater Basin	628.50	MUN- Municipal and Domestic Supply AGR- Agricultural Supply IND- Industrial Service Supply FRSH- Freshwater Replenishment AQUA- Aquaculture	NA
Soda Lake	628.50	MUN- Municipal and Domestic Supply AGR- Agricultural Supply GWR- Ground Water Recharge REC-1- Water Contact Recreation REC-2- Noncontact Water Recreation COMM- Commercial and Sportfishing WAR- Warm Freshwater Habitat WILD- Wildlife Habitat BIOL- Preservation of Biological Habitats of Special Significance RARE- Rare, Threatened, or Endangered Species	42.0 miles
Cronese Lake	628.50	MUN- Municipal and Domestic Supply AGR- Agricultural Supply GWR- Ground Water Recharge REC-1- Water Contact Recreation REC-2- Noncontact Water Recreation COMM- Commercial and Sportfishing WAR- Warm Freshwater Habitat WILD- Wildlife Habitat BIOL- Preservation of Biological Habitats of Special Significance RARE- Rare, Threatened, or Endangered Species	31.3 miles

2.2 303(d) Impaired Waterbodies

The California Regional Water Quality Control Board, Lahontan Region (Lahontan Region Water Board) reviewed and received public comments to support the adoption of the 2018 California Integrated Report, which includes the 2018 303(d) list of impaired water bodies in the Lahontan Region. Based on the 2018 303(d) list, the Project's receiving waters do not currently have any listed impairments.

2.3 Established TMDLs

Currently, the Mojave River does not have any listed impairments with approved Total Maximum Daily Loads (TMDLs).

2.4 Construction General Permit (CGP)

The Construction General Permit (CGP), (Order 2009-0009-DWQ as amended by Order 2010- 0014-DWQ and Order 2021-0006-DWQ), issued by the SWRCB, regulates storm water and non- storm water discharges associated with construction activities disturbing 1 acre or greater of soil. Construction sites that qualify must submit a Notice of Intent (NOI) with the SWRCB to gain permit coverage or otherwise be in violation of the CWA and California Water Code.

The CGP requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) for each individual construction project greater than or equal to 1 acre of disturbed soil area. The SWPPP must list Best Management Practices (BMPs) that the discharger will use to control sediment and other pollutants in storm water and non-storm water runoff. The CGP requires that the SWPPP is prepared by a Qualified SWPPP Developer (QSD) and implemented at the site under the review/direction of a Qualified SWPPP Practitioner (QSP).

The project includes over 1 acre of grading within the County of San Bernardino and is therefore subject to the storm water discharge requirements of the CGP. The Project will submit a NOI and prepare a SWPPP prior to the commencement of soil disturbing activities. In the Lower Mojave River Basin Region, where the project resides, the SWRCB is the permitting authority, while the County of San Bernardino and Lahontan RWQCB provide local oversight and enforcement of the CGP.

2.5 Post Construction Requirements

Section IV.N.4. of general permit states the following:

The discharger shall use non-structural and/or structural measures to replicate the preconstruction water balance (for this General Permit, defined as the volume of rainfall that ends up as runoff) for the smallest storms up to and including the 85th percentile, 24-hour precipitation event (or the smallest precipitation event that generates runoff, whichever is larger).

The project area includes 24 acres of development for the solar farm and an additional 17 acres of future development, therefore the project is subject to the above condition.

2.6 Industrial General Permit

In 2014, the State Water Resources Control Board adopted the Industrial General Permit (Water Quality Order No. 2014-0057-DWQ as amended by Order 2015-0122-DWQ). This NPDES permit was issued by the State of California to all qualifying industrial facilities based upon land use and Standard Industrial Code (SIC). Within San Bernardino County, the IGP is administered by the Lahontan Regional Water Quality Control Board.

Per Attachment A of Order 2014-0057-DWQ, the solar power generation activities within this project, specifically under SIC Code 4911 (Electric Services), would not be required to be enrolled in the IGP.

2.7 Groundwater Resources

Protection of groundwater resources are discussed in a separate report. Geographically, the project site is located within the Lower Mojave River Valley Groundwater Basin. The Lower Mojave River Valley Groundwater basin is bounded to the north by the Waterman and Calico Mountains and to the south by the consolidated rocks forming Daggett Ridge, the Newberry Mountains, and the Rodman Mountains. To the west, the basin is bounded by the Camp Rock-Harper Lake fault zone. The northeast boundary is an arbitrary division from the Coyote Lake Valley Basin and Caves Canyon Valley Basin. The southeastern boundary is formed by the Pisgah Fault. Major hydrologic feature include the Mojave River which flows intermittently from the west and through the valley to its exit from the basin in Afton Canyon.

The latest Water Quality Control Plan for the Lahontan Region identifies the following beneficial uses of groundwater within the Lower Mojave Hydrologic Unit:

- MUN – Municipal and Domestic Supply;
- AGR—Agricultural Supply;
- IND – Industrial Service Supply;
- FRSH- Freshwater Replenishment;
- AQUA—Aquaculture.

Within the project area, groundwater is not used.

3 STORM WATER QUALITY ASSESSMENT

3.1 Pollutants of Concern

Potential pollutants due to the solar power plant and access infrastructure to the facilities are listed below.

- Heavy metals from infrastructure and vehicular use. The primary sources of metals in storm water are metals typically used in transportation, buildings and infrastructure and also paints, fuels, adhesives and coatings. Potential sources of heavy metals from the project include vehicular use, building construction, solar array construction, and underground pipes. Copper, lead, and zinc are the most prevalent metals typically found in runoff from these sources. Other trace metals, such as cadmium, chromium, manganese, and mercury are typically not detected in runoff from these sources or are detected at very low levels. Trace metals have the potential to cause toxic effects on aquatic life and are a potential source of groundwater contamination.
- Trash and debris from human activity. Improperly disposed or handled trash (from human use of the site) such as paper, plastics and debris including biodegradable organic matter such as leaves, grass cuttings, and food waste can accumulate on the ground surface where it can be entrained in urban runoff. A large amount of trash and debris can have significant negative impacts on the recreational value of water body. Excessive organic matter can create a high biochemical oxygen demand in a stream and lower its water quality.
- Oil and grease from vehicular use.
- Organic compounds are carbon-based, and are typically found in pesticides, solvents, and hydrocarbons. Dirt, grease, and other particulates can also adsorb organic compounds in rinse water from cleaning objects, and can be harmful or hazardous to aquatic life either indirectly or directly. Organic compounds are therefore potentially present in runoff from the site due to vehicular use (hydrocarbons and grease) and may be present in runoff after project construction.
- Sediment tracking from vehicular use. Sediment can result from erosion during storm events, as well as from dust generated by wind erosion and vehicular traffic. Sediments increase the turbidity of the receiving waters and have the potential to adversely impact aquatic species.

The receiving waters for the project site do not have any of the potential pollutants of concern as existing impairments.

In examining these anticipated pollutants, the proposed project has the potential to be a source of pollutants based on historic/existing land use and typical activities involved in operating a geothermal power plant and a lithium extraction plant. Through proper planning and operation of the facility however, no runoff leaving the site is anticipated and the concentrations can be reduced to levels which will not contribute to the impairment of beneficial uses in downstream surface waters. Specifically, the project proposes the implementation of infiltration basins in the central southern boundary to fully retain the 85th percentile storm event volume via infiltration and evaporation. No discharge from the site is anticipated, except during extreme storm events. All pollutants of concern will be eliminated.

3.2 Construction BMPs

During the construction phase, sedimentation and erosion can occur because of tracking from earthmoving equipment, erosion and subsequent runoff of soil, and improperly designed stockpiles. Although the project site is relatively flat, the large amount of potential disturbed area results in the potential for erosion/sediment issues. The utilization of proper erosion and sediment control BMPs is critical in preventing discharge to surface waters/drains. The project will employ proper Best Management Practices (BMPs) to meet the criteria set forth in the CGP.

In addition to erosion and sedimentation, the use of materials such as fuels, solvents, and paints has the potential to affect surface water quality. Many different types of hazardous compounds will be used during the construction phase, with proper containment being of high importance. Poorly managed construction materials can lead to the possibility for exposure of potential contaminants to precipitation. When this occurs, these visible and/or non-visible constituents become entrained in storm water runoff. If they are not intercepted or are left uncontrolled, the polluted runoff would otherwise freely sheet flow from the project to the Salton Sea and could cause pollution accumulation in the receiving waters. A list of anticipated construction materials and their associated construction activity are provided in Table 3-1 below.

Table 3-1 – Anticipated Pollutants from Construction Activities

Construction Activity	Construction Site Material	Visually Observable
Paving	Hot Asphalt	Yes - Rainbow Surface or Brown Suspension
	Asphalt Emulsion	
	Liquid Asphalt (tack coat)	
	Cold Mix	
	Crumb Rubber	Yes – Black, solid material
	Asphalt Concrete (Any Type)	Yes - Rainbow Surface or Brown Suspension
Substation and Transmission Line Construction	Gasoline/Diesel	No
	Mineral and Crankcase Oil	
	Lubricants	
	Cleaning Solvents	
Equipment Cleaning	Acids	No
	Bleaches	
	Detergents	Yes - Foam
	Solvents	No
Concrete Work	Portland Cement (PCC)	Yes - Milky Liquid
	Masonry products	No
	Sealant (Methyl Methacrylate - MMA)	No
	Incinerator Bottom Ash, Bottom Ash, Steel Slag, Foundry Sand, Fly Ash, Municipal Solid Waste	No
	Mortar	Yes - Milky Liquid
	Concrete Rinse Water	Yes - Milky Liquid
	Non-Pigmented Curing Compounds	No
	Lime	No
Painting	Paint	Yes
	Paint Strippers	No
	Resins	
	Sealants	
	Solvents	
	Lacquers, Varnish, Enamels, and Turpentine	
	Thinners	
Portable Toilet Facilities	Portable Toilet Waste	Yes
Adhesives	Adhesives	No
Dust Control	Water	No
	Liquid Polymer or Polymer Blend	
Vehicle Maintenance	Antifreeze and Other Vehicle Fluids	Yes - Colored Liquid

Construction Activity	Construction Site Material	Visually Observable
	Batteries	No
	Fuels, Oils, Lubricants	Yes - Rainbow Surface Sheen and Odor
Soil Amendment/Stabilization	Polymer/Copolymer	No
	Quicklime	No
	Herbicide, Pesticide	No
	Lignin Sulfonate	No
	Psyllium	
	Guar/Plant Gums	
	Gypsum	

Prior to the beginning of construction, the project Owner will be required to prepare the Permit Registration Documents (PRDs), including a complete Storm Water Pollution Prevention Plan (SWPPP), for upload on the State's SMARTS website. A Notice of Intent (NOI) for coverage of projects under the CGP will be filed with the SWRCB. The Waste Discharge Identification (WDID) Number will be issued to the project before any land disturbance may begin. If the project is constructed in multiple phases, a NOI will be filed for each phase of construction.

Accordingly, the Owner will be responsible for the implementation of the SWPPP at the project site, and revised as necessary, as administrative or physical conditions change. The Region 6 Lahontan RWQCB, upon request, must instruct the developer to make the SWPPP available for public review. The SWPPP will fully describe Best Management Practices (BMPs) that address pollutant source reduction and provide measures/controls necessary to mitigate potential pollutant sources. These include, but are not limited to: erosion controls, sediment controls, tracking controls, non-storm water management, materials & waste management, and good housekeeping practices. The above-mentioned BMPs for construction activities are discussed further below. The SWPPP will be prepared by a Qualified SWPPP Developer (QSD) and implemented at the site under the review/direction of a Qualified SWPPP Practitioner (QSP).

3.2.1 Erosion Control BMPs

Erosion Control, also referred to as soil stabilization, is a source control measure designed to prevent soil particles from detaching and becoming transported in storm water runoff. Erosion Control BMPs protect the soil surface by covering and/or binding the soil particles. The scheduling of soil disturbing activities should be minimized during the wet season, which extends from August through April.

If such activities occur in the wet season, all exposed slopes or areas with loose soil will be stabilized. This may involve the application of soil binders, or geotextiles and mats. Due to the flat surface, creating temporary earth dikes or drainage swales may also be employed/installed prior to large, forecasted storm events to divert runoff away from exposed areas and into more suitable locations. If implemented correctly, erosion controls can effectively reduce the sediment loads entrained in storm water runoff from the construction site. Below is a list of anticipated erosion control BMPs that can be implemented for the proposed Project's SWPPP:

- EC-1 Scheduling
- EC-2 Preservation of Existing Vegetation
- EC-5 Soil Binders
- EC-6 Straw Mulch
- EC-7 Geotextiles and Mats
- EC-8 Wood Mulching
- EC-9 Earth Dikes and Swales

- EC-10 Velocity Dissipation Devices
- EC-11 Slope Drains

3.2.2 Sediment Control BMPs

Sediment control BMPs are structural measures that are intended to complement and enhance the soil stabilization/erosion control measures and reduce sediment discharges from construction areas. Sediment controls are designed to intercept and filter out soil particles that have been detached and transported by the force of water. In addition, silt fencing will be installed along the perimeter of work areas upstream of discharge points, and will also be placed around stockpiles, and areas of soil disturbance. Check dams or chevrons will be situated in areas where high velocity runoff is anticipated/potential (such as in drainage ditches/swales). Gravel bag berms or fiber rolls should be used to intercept sheet flows on streets or at the toe of slopes (such as along streets or canal and drain access roads) to minimize sediment mobilization. Street sweeping will also be scheduled in areas where sediment can be tracked from the project site onto paved streets or roads. Below is a list of anticipated sediment control BMPs that can be implemented for the proposed Project's SWPPP:

- SE-1 Silt Fence
- SE-2 Desilting Basin
- SE-3 Sediment Trap
- SE-4 Check Dam
- SE-5 Fiber Rolls
- SE-6 Gravel Bag Berms
- SE-7 Street Sweeping
- SE-8 Sandbag Barrier
- SE-9 Straw Bale Barrier
- SE-10 Storm Drain Inlet Protection
- SE-11 Active Treatment Systems

3.2.3 Tracking Control BMPs

The proposed project site will stabilize all construction entrance/exit points to reduce the tracking of sediments onto paved streets and roads by construction vehicles. Construction roadways should also be stabilized to minimize off-site tracking of mud and dirt. Wind erosion controls will be employed in conjunction with tracking controls. Below is a list of anticipated tracking control BMPs that can be implemented for the proposed Project's SWPPP.

- TC-1 Stabilized Construction Entrance / Exit
- TC-2 Stabilized Construction Roadway
- TC-3 Entrance / Outlet Tire Wash
- WE-1 Wind Erosion Control

3.2.4 Non Storm Water BMPs

Non-storm water discharges consist of all discharges from a municipal storm water conveyance which do not originate from precipitation events (i.e., all discharges from a conveyance system other than storm water).

Paving and grinding operations on the project site, along with any operations which involve using water on landscape are classified as having potential for non-storm water pollutants. This also includes illegal connection and dumping on the construction site, vehicle equipment cleaning, fueling, and maintenance.

The construction of project may involve the use of heavy equipment and hazardous materials. Adequate non stormwater BMPs will be implemented.

- NS-1 Water Conversation Practices
- NS-2 Dewatering Operations
- NS-3 Paving and Grinding Operations
- NS-4 Temporary Stream Crossing
- NS-5 Clear Water Diversion
- NS-6 IC/ID Detection and Reporting
- NS-7 Potable Water / Irrigation
- NS-8 Vehicle & Equipment Cleaning
- NS-9 Vehicle & Equipment Fueling
- NS-10 Vehicle & Equipment Maintenance
- NS-11 Pile Driving Operations
- NS-12 Concrete Curing
- NS-13 Concrete Finishing
- NS-14 Material Use Over Water
- NS-15 Demolition Over Water
- NS-16 Temporary Batch Plants

3.2.5 Materials and Waste Management BMPs

Waste management consists of implementing procedural and structural BMPs for collecting, handling, storing and disposing of waste generated by a construction project to prevent the release of waste materials into storm water discharges. All materials with the potential to contaminate storm water runoff should be delivered and stored in designated areas with secondary containment measures (i.e. covered and bermed). Chemicals, drums, and bagged materials will not be stored directly on soil, but on pallets instead. Personnel will also be trained on the proper use of the materials.

Construction staging areas will be located on the site. These areas will include construction yards that serve as field offices, reporting locations for workers, parking space for vehicles and equipment, and sites for material storage. Facilities will be fenced as necessary. Security guards will be stationed where needed.

A temporary barrier around stockpiles should be installed and a cover provided during the rainy season. Spill cleanup procedures and kits should be made readily available near hazardous materials and waste. Solid waste, such as trash and debris, should be collected on a regular basis and stored in designated areas. Concrete and paint washout areas should be installed and properly maintained in areas conducting the associated activities. Below is a list of anticipated materials and waste management BMPs that can be implemented for the proposed Project's SWPPP:

- WM-1 Material Delivery & Storage
- WM-2 Material Use
- WM-3 Stockpile Management
- WM-4 Spill Prevention and Control
- WM-5 Solid Waste Management
- WM-6 Hazardous Waste
- WM-7 Contaminated Soil
- WM-8 Concrete Waste
- WM-9 Sanitary / Septic Waste

3.2.6 Monitoring Program

A monitoring program will also be included in the SWPPP that outlines storm event inspections of the project site and a sampling plan in accordance with the CGP. The monitoring program will be prepared by a QSD and implemented at the site under the review/direction of a QSP. The goals of the program are:

(1) to identify areas contributing to a storm water discharge;
(2) to evaluate whether measures to reduce pollutant loadings identified in the SWPPP are adequate, properly installed, and functioning in accordance with the terms of the CGP; and
(3) whether additional control practices or corrective maintenance activities are needed. If a discharge is observed during these inspections, a sampling and analysis of the discharge is required.

Any breach, malfunction, leakage, or spill observed which could result in the discharge of pollutants to surface waters that would not be visually detectable in storm water shall trigger the collection of a sample of discharge. The goal of the sampling and analysis is to determine whether the BMPs employed and maintained on site are effective in preventing the potential pollutants from coming in contact with storm water and causing or contributing to an exceedance of water quality objectives in the receiving waters. In any case of breakage and potential for non-visible pollution, sampling and analysis will be required to ensure that the beneficial uses of downstream receiving waters are protected. In addition, sampling is required for any site which directly discharges runoff into a receiving water listed in the CGP listed as impaired for sedimentation.

3.3 Post-Construction BMPs

Because the Project will disrupt more than 1-acre of soils, Post-Construction Standards within the GCP will be met as applicable based on SMARTs Water Balance Calculator. The proposed Project will implement site design BMPs, source control measures, and Low Impact Development (LID) BMPs to meet the Construction General Permit criteria.

3.3.1 Site Design BMPs

The Permit requires the implementation of at least one Site Design BMPs into the Project. Table 3-2 defines how the Project anticipates the incorporation of Site Design Measures into the Site Plan.

Table 3-2 – Anticipated Project Site Design Measures

Permit E.12.b Item	Site Design Measure	Project Implementation
(a)	*Stream Setbacks and Buffers - a vegetated area including trees, shrubs, and herbaceous vegetation, that exists or is established to protect a stream system, lake reservoir, or coastal estuarine area*	A perimeter berm will be incorporated to prevent offsite run-on and runoff from leaving the Project.
(b)	*Soil Quality Improvement and Maintenance - improvement and maintenance soil through soil amendments and creation of microbial community*	Not Applicable
(c)	*Tree Planting and Preservation - planting and preservation of healthy, established trees that include both evergreens and deciduous, as applicable*	Not applicable

Permit E.12.b Item	Site Design Measure	Project Implementation
(d)	*Rooftop and Impervious Area Disconnection - rerouting of rooftop drainage pipes to drain rainwater to rain barrels, cisterns, or permeable areas instead of the storm sewer*	An infiltration basin along the southern boundary of the Project will collect all onsite stormwater runoff. The design will involve the treatment and retention, where feasible, of the 85th percentile storm event volume.
(e)	*Porous Pavement - pavement that allows runoff to pass through it, thereby reducing the runoff from a site and surrounding areas and filtering pollutants*	Not applicable
(f)	*Green Roofs - a vegetative layer grown on a roof (rooftop garden)*	Not applicable
(g)	*Vegetated Swales - a vegetated, open-channel management practice designed specifically to treat and attenuate storm water runoff*	Not applicable
(h)	*Rain Barrels and Cisterns — system that collects and stores storm water runoff from a roof or other impervious surface*	An infiltration basin along the southern boundary of the Project will collect all onsite stormwater runoff. The design will involve the treatment and retention, where feasible, of the 85th percentile storm event volume.

3.3.2 Source Control Measures

As a Regulated Project, the proposed Project will implement the source control measures, as defined in Table 3-3.

Table 3-3 – Anticipated Project Source Control Measures

Permit E.12.d Item	Source Control Measure	Project Implementation
(a)	*Accidental spills or leaks*	Not Applicable
(b)	*Interior floor drains*	All interior flood drains will be diverted to the infiltration basins.
(c)	*Parking/storage areas and maintenance*	All vehicles will be serviced offsite whenever possible. If servicing is required onsite, it must be conducted in an area isolated from storm drain inlets or drainage ditch inlets. The area must be bermed and precluded from run on. Any spillage must be fully contained and captured and disposed of per County of San Bernardino requirements.
(d)	*Indoor and structural pest control*	If any pesticide is required onsite, the need for pesticide use in the project design will be reduced by: • Keeping pests out of buildings using barriers, screens and caulking • Physical pest elimination techniques, such as squashing, trapping, washing or pruning out pests • Relying on natural enemies to eat pests • Proper use of pesticides as a last line of defense
(e)	*Landscape/outdoor pesticide use*	

Permit E.12.d Item	Source Control Measure	Project Implementation
(f)	*Pools, spas, ponds, decorative fountains, and other water features*	Not applicable
(g)	*Restaurants, grocery stores, and other food service operations*	Not applicable
(h)	*Refuse areas*	Not applicable
(i)	*Industrial processes*	Not applicable
(j)	*Outdoor storage of equipment or materials*	Where feasible, outdoor storage will be covered and surrounded by a secondary containment area.
(k)	*Vehicle and equipment cleaning*	Not Applicable
(l)	*Vehicle and equipment repair and maintenance*	
(m)	*Fuel dispensing areas*	
(n)	*Loading docks*	Not applicable
(o)	*Fire sprinkler test water*	not applicable
(p)	*Drain or wash water from boiler drain lines, condensate drain lines, rooftop equipment, drainage sumps, and other sources*	Not Applicable
(q)	*Unauthorized non-storm water discharges*	Illegal dumping educational materials as well as spill response materials will be provided to employees.
(r)	*Building and grounds maintenance*	Materials will be disposed of in accordance with San Bernardino County requirements, and will be sent to appropriate disposal facilities. Under no circumstances shall any waste or hazardous materials be stored outside without secondary containment.

3.3.3 LID BMPs

Permit Item IV.N.4. defines the numeric sizing criteria for Storm Water Retention and Treatment, as follows:

The discharger shall use non-structural and/or structural measures to replicate the preconstruction water balance (for this General Permit, defined as the volume of rainfall that ends up as runoff) for the smallest *storms up to and including the 85th percentile, 24-hour precipitation event (or the smallest precipitation event that generates runoff, whichever is larger).*

Based on the Mojave Watershed Technical Guidance for the Water quality Management Plan and Section E.12.e of the Phase II MS4 Permit shown below, the 85th percentile 24-hour runoff volume can be determined using the Urban Runoff Quality Management Approach or P6 Method.

The volume of annual runoff produced from a 24-hour, 85th percentile storm event determined as the maximum capture storm water volume for the area , from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23 /ASCE Manual of Practice No. 87 (1998).

Using the Urban Runoff Quality Management Approach outlined in the California Stormwater BMP Handbook for New Development and Redevelopment, a runoff coefficient for the site is calculated using the following regression equation:

$$C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$$

Where:

i is the impervious fraction of the Drainage Management Area and equals 0.50 for this project

The design capture volume, DCV, is then calculated as:

$$DCV = (Area)*(a_2 * C) * P6/12$$

Where:

a_2 = regression constant = 1.963 for a 48 hour draw down time

P6 = mean annual runoff-producing rainfall depth, in watershed inches

The value for P6 is determined the 2-year 1-hour precipitation depth multiplied by the appropriate coefficient(a1) for the Mojave Watershed climatic region. The complete NOAA Atlas 14 precipitation output is included in Appendix A.

$$P6 = (a_1) * P(2\text{-year, } 1\text{-hour})$$

Where: a_1 = 1.2371 for the desert climatic regions

The initial impervious area fraction used is 0.50 based on the area of the solar array and the surrounding roadwork/landscaping. The resulting DCV, otherwise known as the maximized Water Quality Control Volume (WQCV), is 51,162 square-ft or 1.18 acre-ft. The results of this method are summarized in the table below.

Table 3-4 Urban Runoff Quality Management Approach Results

Drainage Area (acres)	40.7
Impervious Fraction	0.50
Runoff Coefficient	0.339
P6 (in)	0.520
DCV (CF)	51,162

A review of the NRCS web soil survey determined that the onsite soils are of Hydrologic Soil Group A with considerable infiltration potential. The complete NRCS report is included in Appendix B. This resulted in a measured infiltration rate of 3.5 inch/hour as shown in the site geotechnical report included in Appendix C. With a safety factor of 3, the design infiltration rate is equal to 1.17 inch/hour. A stage storage table is included below for the basin design. The depth of the DCV was determined using linear interpolation between values in the table to produce 1.62 ft from a DCV of 1.18 acre-ft. We anticipate the WQCV will be infiltrated completely in the infiltration basin.

Stage (FT)	Storage (AF)
0	0
1	0.70
2	1.46
3	2.28
4	3.15
5	4.08
6	5.08

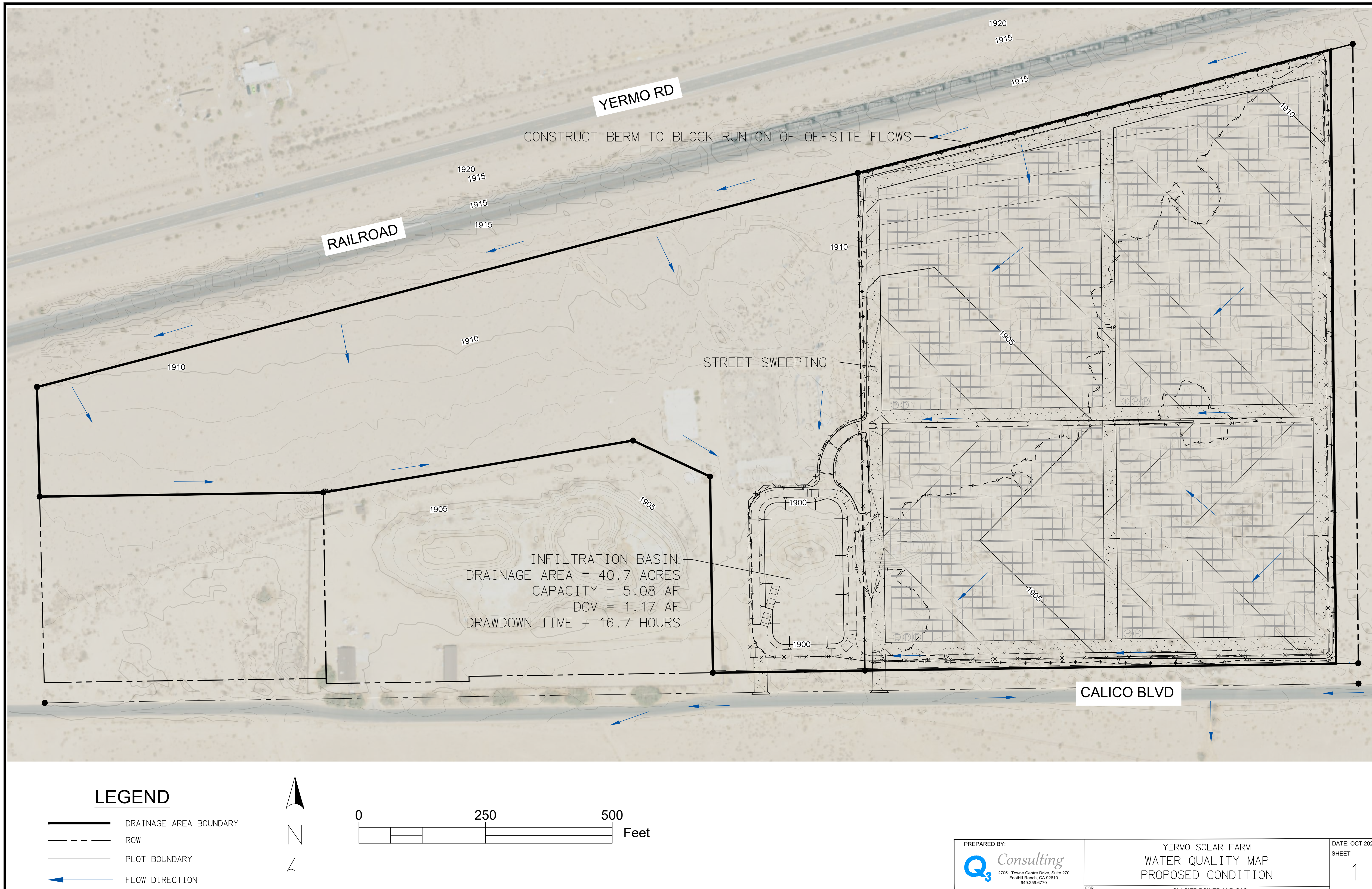
The WQCV is anticipated to infiltrate on average in 16.7 hours. These results are summarized in Table 3.2.

Table 3-5 BMP Infiltration/Drawdown Results

Infiltration (in/hr)	3.5
Safety Factor	3
DCV (AF)	1.17
Depth (ft)	1.62
Drawdown (hrs)	16.7

Based on the above results, the default drawdown time of 48 hours from the Mojave Watershed Technical Guidance for the Water Quality Management Plan is anticipated to be met with the proposed infiltration basin design pending final design. The full onsite runoff stormwater volume for the 85th percentile 24-hour event will be infiltrated. A Water Quality Map has been prepared to define how onsite flows will be captured and retained for infiltration.

Figure 3-1 Water Quality Map with Post Construction BMPs



3.4 Long-Term BMP Maintenance

The project owner will maintain all onsite site design BMPs, source control measures, post-construction BMPs, and retention basins during the lifetime of the project. It shall be noted that preventative maintenance such as removal of trash and debris from the site will help ensure proper function of the BMPs.

The owners of the project are required to perform maintenance in perpetuity, keeping maintenance records for submittal to San Bernardino County and Regional Water Quality Control Board, if requested. In addition, the following maintenance activities will be conducted

- Continued education of staff responsible for hazardous material hauling, loading, and use.
- Periodic visual monitoring to ensure materials are not contaminating areas exposed to storm water.

If a transfer of ownership takes place, the owner will notify San Bernardino County, and the Region 6 Lahontan Regional Water Quality Control Board. The new owner will assume all responsibilities for BMP maintenance.

4 CONCLUSION

The proposed project is subject to the Construction General Permit (CGP) which requires postconstruction BMPs for projects which disrupt one or more acres of soil. The CGP requires postconstruction runoff to match preconstruction runoff for 85th percentile 24-hour storm events and smaller. Based on the Urbon Runoff Quality Management Approach, the proposed basin grading is sufficient to capture and infiltrate the full design capture volume. Additional water quality management methods, such as street sweeping and berm construction to prevent run-on will be implemented to meet CGP post construction requirements. Additionally, a SWPPP and NOI will be completed for the project prior to the beginning of any soil disturbing activities. With the completion of all actions outlined within this report, the proposed project will meet all applicable requirements under the CGP, the CWA, and the California Water Code.

5 REFERENCES

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Technical Appendix

Appendix A

NOAA Atlas 14 Precipitation Data

NOAA Atlas 14, Volume 6, Version 2
Location name: Yermo, California, USA*
Latitude: 34.9097°, Longitude: -116.7879°
Elevation: 1903 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.089** (0.073-0.110)	**0.131** (0.107-0.162)	**0.190** (0.155-0.235)	**0.240** (0.194-0.300)	**0.313** (0.245-0.404)	**0.373** (0.287-0.490)	**0.437** (0.328-0.588)	**0.507** (0.371-0.700)	**0.608** (0.427-0.873)	**0.691** (0.471-1.03)
10-min	**0.127** (0.104-0.157)	**0.188** (0.154-0.232)	**0.272** (0.222-0.337)	**0.344** (0.278-0.430)	**0.449** (0.352-0.578)	**0.535** (0.411-0.703)	**0.626** (0.470-0.843)	**0.726** (0.531-1.00)	**0.871** (0.613-1.25)	**0.991** (0.674-1.47)
15-min	**0.154** (0.126-0.190)	**0.227** (0.186-0.281)	**0.329** (0.268-0.408)	**0.416** (0.337-0.520)	**0.543** (0.426-0.700)	**0.646** (0.497-0.850)	**0.758** (0.569-1.02)	**0.879** (0.643-1.21)	**1.05** (0.741-1.51)	**1.20** (0.816-1.78)
30-min	**0.211** (0.173-0.261)	**0.312** (0.255-0.385)	**0.451** (0.368-0.559)	**0.571** (0.462-0.713)	**0.744** (0.584-0.959)	**0.886** (0.681-1.16)	**1.04** (0.780-1.40)	**1.20** (0.881-1.66)	**1.44** (1.02-2.08)	**1.64** (1.12-2.44)
60-min	**0.285** (0.233-0.352)	**0.420** (0.343-0.520)	**0.608** (0.496-0.754)	**0.770** (0.623-0.962)	**1.00** (0.787-1.29)	**1.20** (0.919-1.57)	**1.40** (1.05-1.88)	**1.62** (1.19-2.24)	**1.95** (1.37-2.80)	**2.22** (1.51-3.29)
2-hr	**0.367** (0.300-0.453)	**0.510** (0.417-0.631)	**0.708** (0.577-0.878)	**0.877** (0.710-1.10)	**1.12** (0.878-1.44)	**1.32** (1.01-1.73)	**1.53** (1.15-2.05)	**1.75** (1.28-2.42)	**2.07** (1.46-2.98)	**2.34** (1.59-3.47)
3-hr	**0.426** (0.349-0.527)	**0.582** (0.475-0.719)	**0.796** (0.648-0.986)	**0.977** (0.790-1.22)	**1.24** (0.969-1.59)	**1.45** (1.11-1.90)	**1.67** (1.25-2.24)	**1.90** (1.39-2.63)	**2.24** (1.58-3.22)	**2.52** (1.71-3.73)
6-hr	**0.513** (0.420-0.634)	**0.689** (0.563-0.851)	**0.927** (0.756-1.15)	**1.13** (0.913-1.41)	**1.41** (1.11-1.82)	**1.64** (1.26-2.16)	**1.88** (1.41-2.53)	**2.14** (1.56-2.95)	**2.49** (1.75-3.58)	**2.78** (1.89-4.13)
12-hr	**0.563** (0.460-0.695)	**0.756** (0.618-0.935)	**1.02** (0.829-1.26)	**1.24** (0.999-1.54)	**1.54** (1.21-1.99)	**1.78** (1.37-2.34)	**2.04** (1.53-2.74)	**2.30** (1.68-3.18)	**2.67** (1.88-3.84)	**2.96** (2.02-4.40)
24-hr	**0.699** (0.620-0.804)	**0.951** (0.843-1.10)	**1.29** (1.14-1.49)	**1.57** (1.37-1.82)	**1.95** (1.66-2.35)	**2.26** (1.88-2.77)	**2.57** (2.08-3.24)	**2.90** (2.28-3.75)	**3.34** (2.53-4.51)	**3.70** (2.70-5.16)
2-day	**0.815** (0.723-0.937)	**1.12** (0.991-1.29)	**1.52** (1.34-1.76)	**1.86** (1.63-2.16)	**2.31** (1.96-2.78)	**2.67** (2.22-3.28)	**3.04** (2.46-3.82)	**3.42** (2.70-4.43)	**3.95** (2.98-5.32)	**4.36** (3.19-6.09)
3-day	**0.863** (0.766-0.993)	**1.19** (1.06-1.37)	**1.63** (1.44-1.88)	**1.99** (1.74-2.31)	**2.48** (2.10-2.98)	**2.86** (2.38-3.52)	**3.25** (2.64-4.09)	**3.66** (2.88-4.74)	**4.21** (3.19-5.69)	**4.65** (3.40-6.49)
4-day	**0.894** (0.793-1.03)	**1.24** (1.10-1.43)	**1.70** (1.50-1.96)	**2.07** (1.82-2.41)	**2.58** (2.19-3.11)	**2.98** (2.47-3.66)	**3.38** (2.74-4.26)	**3.80** (2.99-4.92)	**4.36** (3.30-5.89)	**4.81** (3.51-6.71)
7-day	**0.956** (0.848-1.10)	**1.34** (1.19-1.54)	**1.84** (1.62-2.12)	**2.24** (1.96-2.61)	**2.78** (2.36-3.35)	**3.20** (2.65-3.93)	**3.61** (2.93-4.55)	**4.04** (3.18-5.23)	**4.61** (3.49-6.22)	**5.05** (3.69-7.05)
10-day	**1.02** (0.901-1.17)	**1.43** (1.27-1.65)	**1.96** (1.74-2.27)	**2.40** (2.10-2.79)	**2.97** (2.52-3.58)	**3.41** (2.83-4.19)	**3.84** (3.12-4.84)	**4.29** (3.38-5.55)	**4.88** (3.69-6.58)	**5.33** (3.89-7.44)
20-day	**1.16** (1.03-1.34)	**1.65** (1.46-1.90)	**2.28** (2.02-2.64)	**2.79** (2.44-3.25)	**3.46** (2.94-4.17)	**3.98** (3.30-4.88)	**4.48** (3.64-5.65)	**5.00** (3.94-6.47)	**5.68** (4.30-7.66)	**6.19** (4.53-8.65)
30-day	**1.29** (1.14-1.48)	**1.84** (1.63-2.11)	**2.54** (2.25-2.94)	**3.11** (2.73-3.62)	**3.88** (3.29-4.67)	**4.46** (3.70-5.48)	**5.04** (4.08-6.35)	**5.63** (4.44-7.28)	**6.40** (4.84-8.64)	**6.99** (5.11-9.76)
45-day	**1.46** (1.30-1.68)	**2.07** (1.83-2.38)	**2.87** (2.53-3.31)	**3.52** (3.08-4.09)	**4.40** (3.73-5.29)	**5.07** (4.21-6.23)	**5.75** (4.66-7.24)	**6.44** (5.07-8.33)	**7.35** (5.56-9.92)	**8.05** (5.88-11.2)
60-day	**1.60** (1.42-1.84)	**2.25** (1.99-2.59)	**3.12** (2.75-3.60)	**3.83** (3.35-4.46)	**4.80** (4.07-5.77)	**5.55** (4.61-6.82)	**6.31** (5.12-7.95)	**7.09** (5.59-9.18)	**8.13** (6.15-11.0)	**8.93** (6.52-12.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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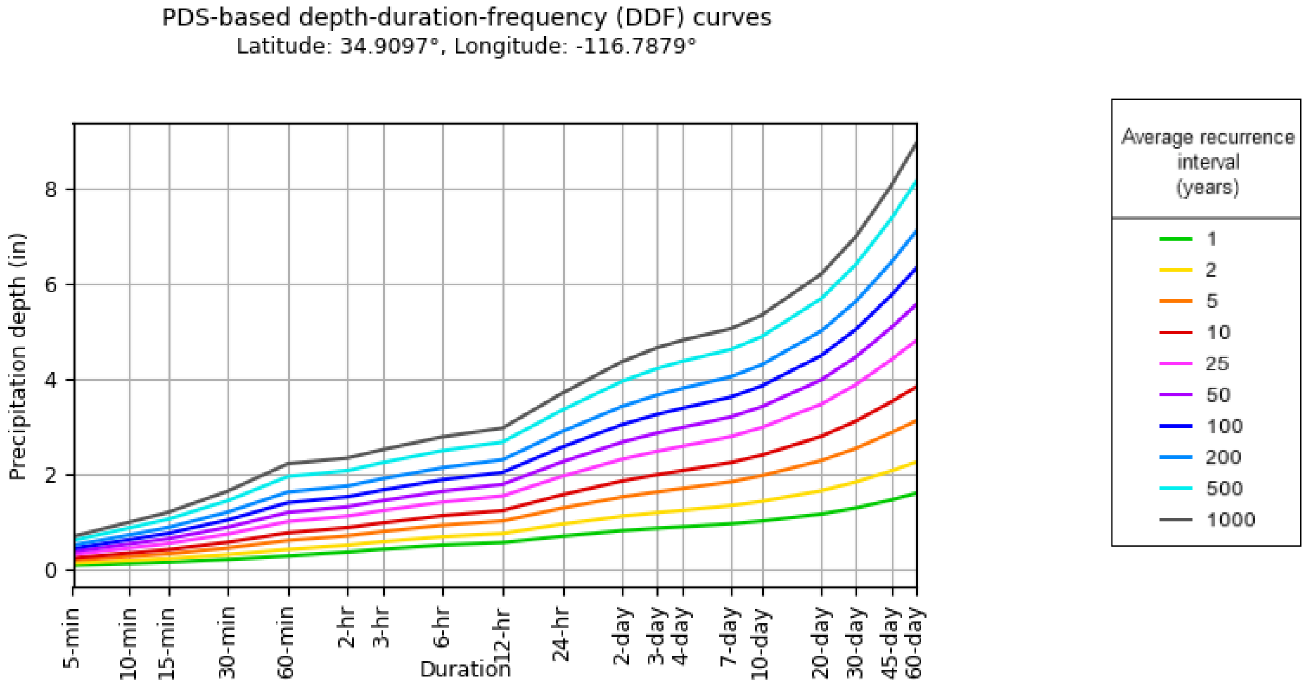
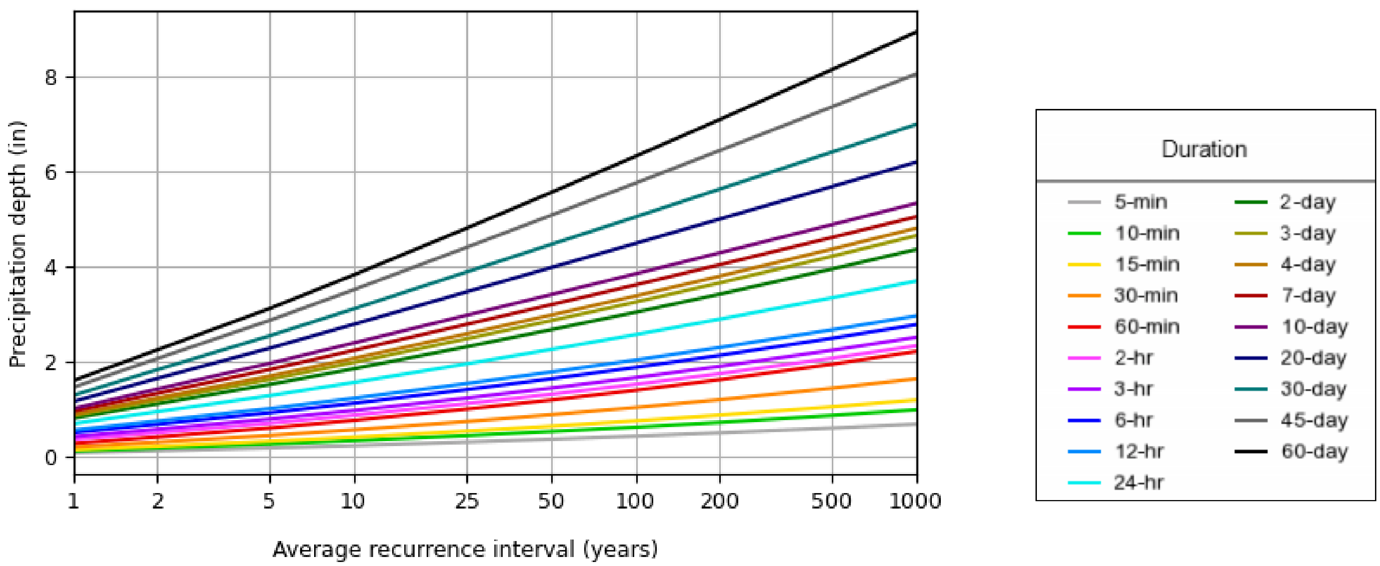
PF graphical





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Created (GMT): Fri Oct 25 17:15:09 2024

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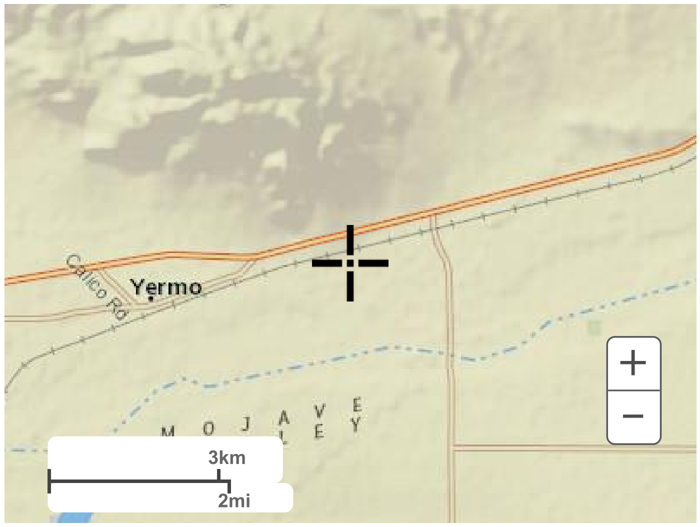
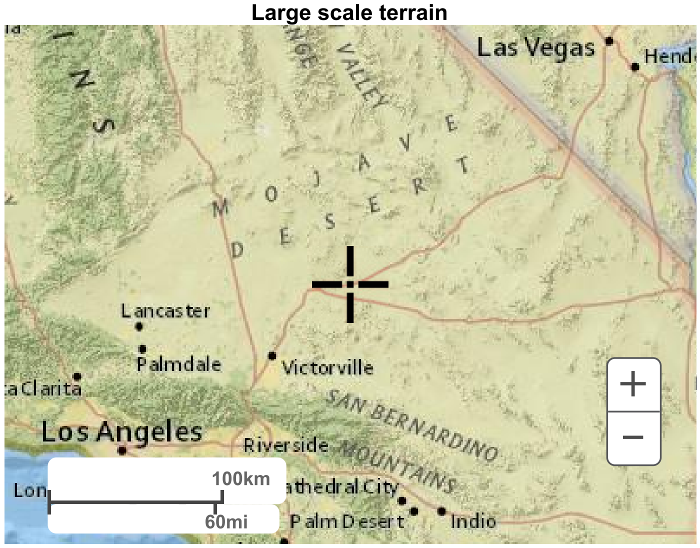
Maps & aerials

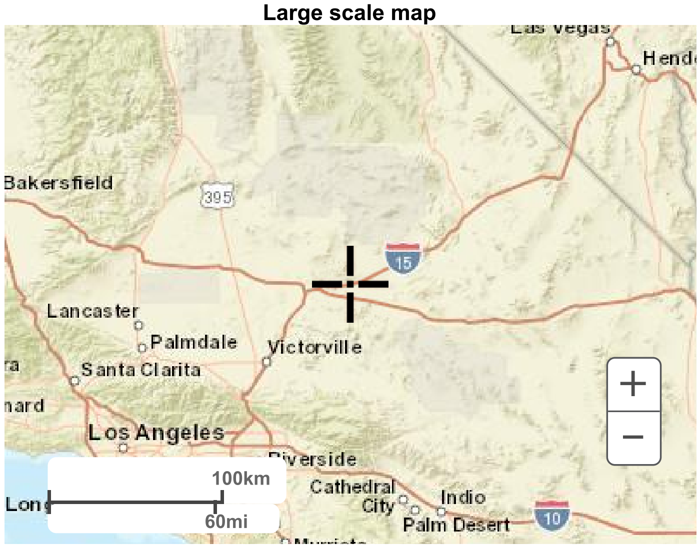
Small scale terrain



Large scale terrain



Large scale map



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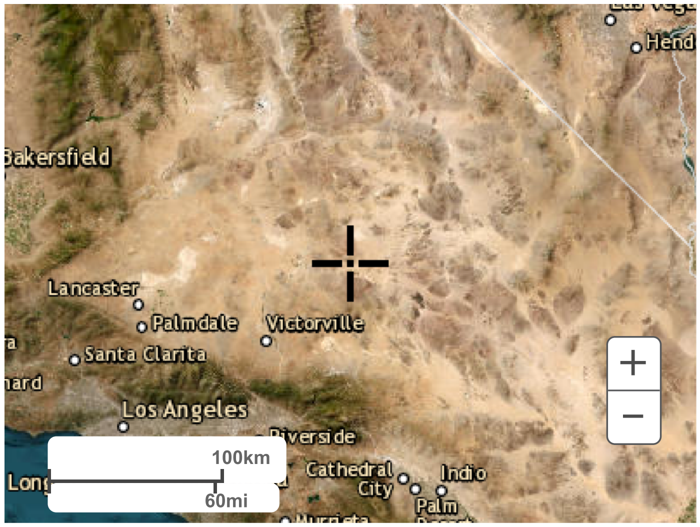

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Questions?: HDSC.Questions@noaa.gov

Disclaimer

NOAA Atlas 14, Volume 6, Version 2
Location name: Yermo, California, USA*
Latitude: 34.9097°, Longitude: -116.7879°
Elevation: 1903 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**1.07** (0.876-1.32)	**1.57** (1.28-1.94)	**2.28** (1.86-2.82)	**2.88** (2.33-3.60)	**3.76** (2.94-4.85)	**4.48** (3.44-5.88)	**5.24** (3.94-7.06)	**6.08** (4.45-8.40)	**7.30** (5.12-10.5)	**8.29** (5.65-12.3)
10-min	**0.762** (0.624-0.942)	**1.13** (0.924-1.39)	**1.63** (1.33-2.02)	**2.06** (1.67-2.58)	**2.69** (2.11-3.47)	**3.21** (2.47-4.22)	**3.76** (2.82-5.06)	**4.36** (3.19-6.02)	**5.23** (3.68-7.51)	**5.95** (4.04-8.83)
15-min	**0.616** (0.504-0.760)	**0.908** (0.744-1.12)	**1.32** (1.07-1.63)	**1.66** (1.35-2.08)	**2.17** (1.70-2.80)	**2.58** (1.99-3.40)	**3.03** (2.28-4.08)	**3.52** (2.57-4.85)	**4.22** (2.96-6.05)	**4.80** (3.26-7.12)
30-min	**0.422** (0.346-0.522)	**0.624** (0.510-0.770)	**0.902** (0.736-1.12)	**1.14** (0.924-1.43)	**1.49** (1.17-1.92)	**1.77** (1.36-2.33)	**2.08** (1.56-2.79)	**2.41** (1.76-3.33)	**2.89** (2.03-4.15)	**3.29** (2.24-4.88)
60-min	**0.285** (0.233-0.352)	**0.420** (0.343-0.520)	**0.608** (0.496-0.754)	**0.770** (0.623-0.962)	**1.00** (0.787-1.29)	**1.20** (0.919-1.57)	**1.40** (1.05-1.88)	**1.62** (1.19-2.24)	**1.95** (1.37-2.80)	**2.22** (1.51-3.29)
2-hr	**0.183** (0.150-0.226)	**0.255** (0.208-0.315)	**0.354** (0.288-0.439)	**0.438** (0.355-0.548)	**0.560** (0.439-0.721)	**0.658** (0.506-0.865)	**0.763** (0.573-1.03)	**0.875** (0.640-1.21)	**1.04** (0.729-1.49)	**1.17** (0.795-1.74)
3-hr	**0.141** (0.116-0.175)	**0.193** (0.158-0.239)	**0.265** (0.215-0.328)	**0.325** (0.263-0.406)	**0.411** (0.322-0.530)	**0.481** (0.369-0.632)	**0.555** (0.416-0.746)	**0.634** (0.463-0.875)	**0.746** (0.524-1.07)	**0.837** (0.569-1.24)
6-hr	**0.085** (0.070-0.105)	**0.115** (0.094-0.142)	**0.154** (0.126-0.191)	**0.188** (0.152-0.235)	**0.236** (0.185-0.304)	**0.274** (0.210-0.360)	**0.314** (0.235-0.422)	**0.356** (0.260-0.492)	**0.416** (0.292-0.598)	**0.464** (0.315-0.689)
12-hr	**0.046** (0.038-0.057)	**0.062** (0.051-0.077)	**0.084** (0.068-0.104)	**0.102** (0.082-0.128)	**0.127** (0.100-0.164)	**0.148** (0.113-0.194)	**0.168** (0.126-0.227)	**0.190** (0.139-0.263)	**0.221** (0.155-0.318)	**0.246** (0.167-0.365)
24-hr	**0.029** (0.025-0.033)	**0.039** (0.035-0.045)	**0.053** (0.047-0.061)	**0.065** (0.057-0.076)	**0.081** (0.069-0.098)	**0.094** (0.078-0.115)	**0.107** (0.086-0.134)	**0.120** (0.095-0.156)	**0.139** (0.105-0.188)	**0.154** (0.112-0.215)
2-day	**0.016** (0.015-0.019)	**0.023** (0.020-0.026)	**0.031** (0.028-0.036)	**0.038** (0.033-0.044)	**0.048** (0.040-0.057)	**0.055** (0.046-0.068)	**0.063** (0.051-0.079)	**0.071** (0.056-0.092)	**0.082** (0.062-0.110)	**0.090** (0.066-0.126)
3-day	**0.011** (0.010-0.013)	**0.016** (0.014-0.019)	**0.022** (0.019-0.026)	**0.027** (0.024-0.032)	**0.034** (0.029-0.041)	**0.039** (0.033-0.048)	**0.045** (0.036-0.056)	**0.050** (0.040-0.065)	**0.058** (0.044-0.078)	**0.064** (0.047-0.090)
4-day	**0.009** (0.008-0.010)	**0.012** (0.011-0.014)	**0.017** (0.015-0.020)	**0.021** (0.018-0.025)	**0.026** (0.022-0.032)	**0.031** (0.025-0.038)	**0.035** (0.028-0.044)	**0.039** (0.031-0.051)	**0.045** (0.034-0.061)	**0.050** (0.036-0.069)
7-day	**0.005** (0.005-0.006)	**0.007** (0.007-0.009)	**0.010** (0.009-0.012)	**0.013** (0.011-0.015)	**0.016** (0.014-0.019)	**0.019** (0.015-0.023)	**0.021** (0.017-0.027)	**0.024** (0.018-0.031)	**0.027** (0.020-0.037)	**0.030** (0.021-0.041)
10-day	**0.004** (0.003-0.004)	**0.005** (0.005-0.006)	**0.008** (0.007-0.009)	**0.009** (0.008-0.011)	**0.012** (0.010-0.014)	**0.014** (0.011-0.017)	**0.016** (0.012-0.020)	**0.017** (0.014-0.023)	**0.020** (0.015-0.027)	**0.022** (0.016-0.031)
20-day	**0.002** (0.002-0.002)	**0.003** (0.003-0.003)	**0.004** (0.004-0.005)	**0.005** (0.005-0.006)	**0.007** (0.006-0.008)	**0.008** (0.006-0.010)	**0.009** (0.007-0.011)	**0.010** (0.008-0.013)	**0.011** (0.008-0.015)	**0.012** (0.009-0.018)
30-day	**0.001** (0.001-0.002)	**0.002** (0.002-0.002)	**0.003** (0.003-0.004)	**0.004** (0.003-0.005)	**0.005** (0.004-0.006)	**0.006** (0.005-0.007)	**0.006** (0.005-0.008)	**0.007** (0.006-0.010)	**0.008** (0.006-0.011)	**0.009** (0.007-0.013)
45-day	**0.001** (0.001-0.001)	**0.001** (0.001-0.002)	**0.002** (0.002-0.003)	**0.003** (0.002-0.003)	**0.004** (0.003-0.004)	**0.004** (0.003-0.005)	**0.005** (0.004-0.006)	**0.005** (0.004-0.007)	**0.006** (0.005-0.009)	**0.007** (0.005-0.010)
60-day	**0.001** (0.000-0.001)	**0.001** (0.001-0.001)	**0.002** (0.001-0.002)	**0.002** (0.002-0.003)	**0.003** (0.002-0.004)	**0.003** (0.003-0.004)	**0.004** (0.003-0.005)	**0.004** (0.003-0.006)	**0.005** (0.004-0.007)	**0.006** (0.004-0.008)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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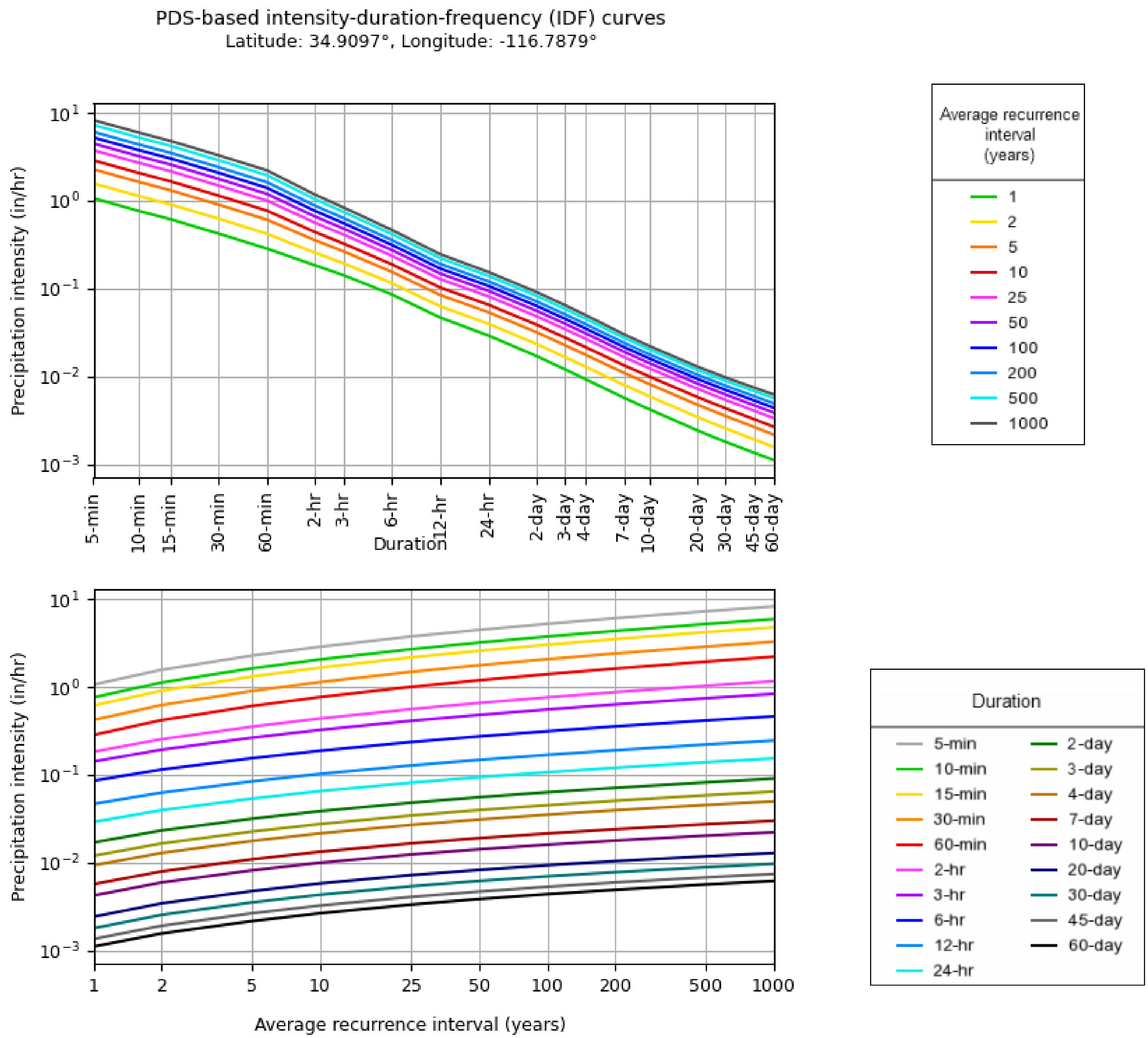
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Fri Oct 25 17:16:20 2024

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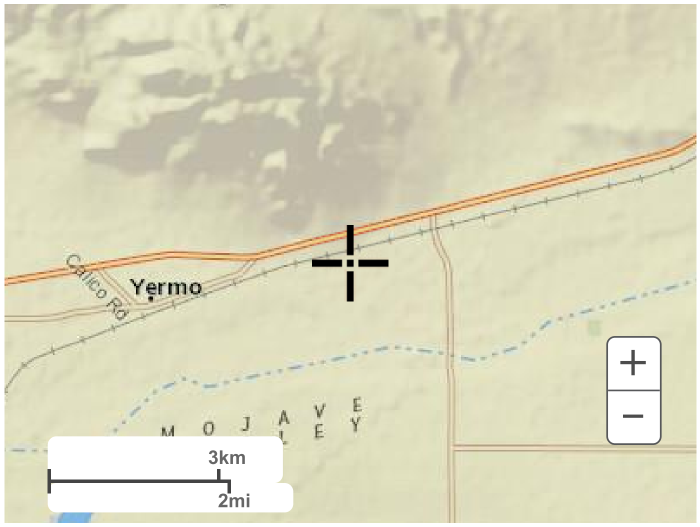
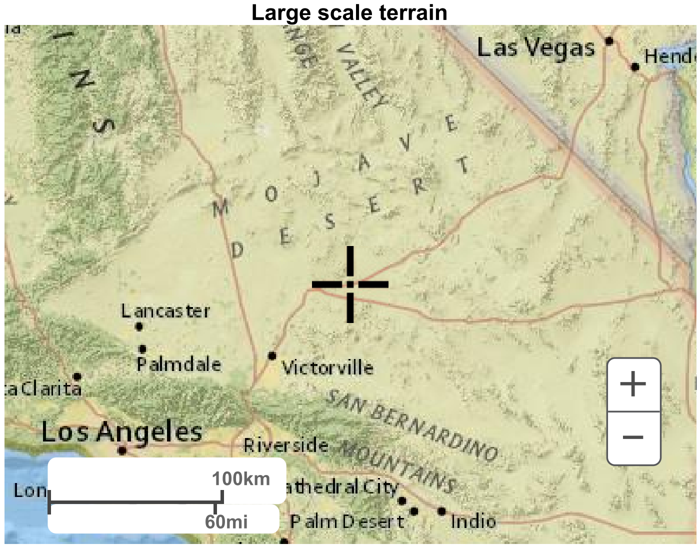
Maps & aerials

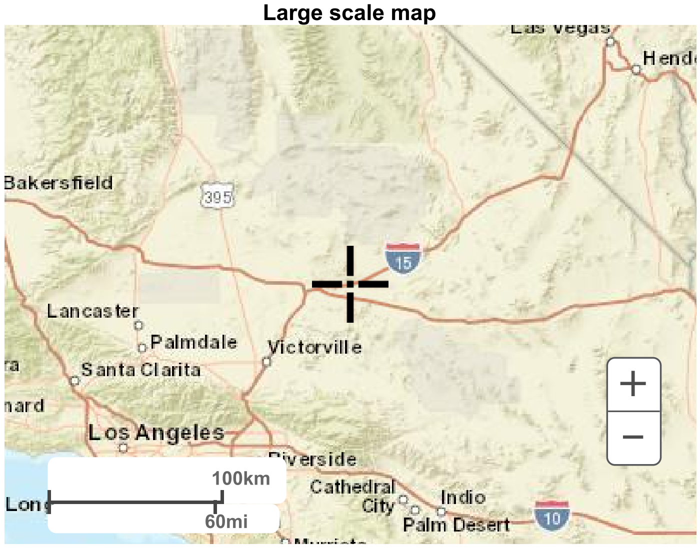
Small scale terrain



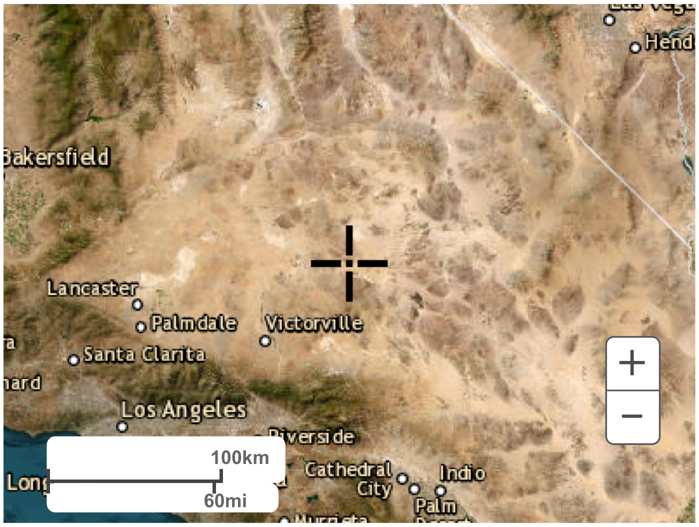
Large scale terrain



Large scale map



Large scale aerial



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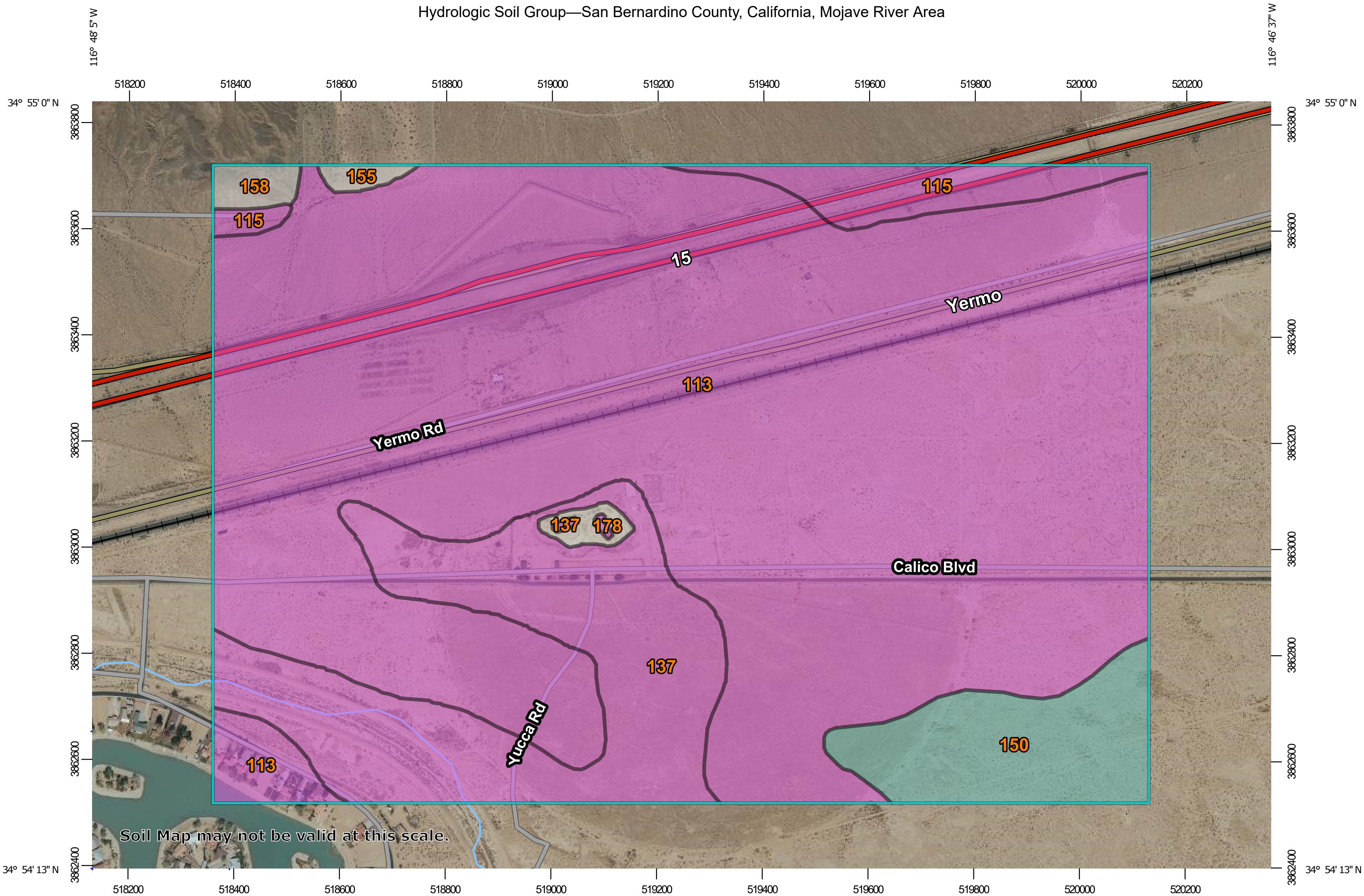
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Appendix B

NRCS Soil Resource Report for Solar Farm Project



Map Scale: 1:10,200 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 150, 300, 600, 900

Feet: 0, 450, 900, 1800, 2700

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 15, Aug 30, 2023

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

Date(s) aerial images were photographed: Feb 27, 2021—May 27, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
113	CAJON SAND, 2 TO 9 PERCENT SLOPES	A	402.6	76.2%
115	CAJON GRAVELLY SAND, 2 TO 15 PERCENT SLOPES	A	15.5	2.9%
137	KIMBERLINA LOAMY FINE SAND, COOL, 0 TO 2 PERCENT SLOPES	A	73.9	14.0%
150	MOHAVE VARIANT LOAMY SAND, 0 TO 2 PERCENT SLOPES	C	29.5	5.6%
155	PITS		1.7	0.3%
158	ROCK OUTCROP-LITHIC TORRIORTHENTS COMPLEX, 15 TO 50 PERCENT SLOPES*		3.2	0.6%
178	WATER		2.2	0.4%
Totals for Area of Interest			**528.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix C

Glacier Solar and Gas Solar Farm – Preliminary Geotechnical Engineering Report

Glacier Solar and Gas Solar Farm

Preliminary Geotechnical Engineering Report

November 14, 2023 | Terracon Project No. LA235050

Prepared for:

Sol-Gen Corporation

39952 Calico Blvd
Yermo, California 92398

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November 14, 2023

Sol-Gen Corporation
39952 Calico Blvd
Yermo, California 92398

Attn: Mr. Paul Lampert
Email: **paul@sol-gencorp.com**

Re: Preliminary Geotechnical Engineering Report
Glacier Solar and Gas Solar Farm
Yermo, San Bernardino County, California
Terracon Project No. LA235050

Dear Mr. Lampert:

We have completed the preliminary Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PLA235050 dated May 4, 2023. This report provides a description of subsurface exploration and laboratory testing. Based on field and laboratory test results, this report provides geotechnical engineering recommendations concerning earthwork and the design and construction of the foundations for the proposed Glacier Solar and Gas Solar Farm project.

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

REGISTERED PROFESSIONAL ENGINEER
JOSHUA R. MORGAN
C 86032
CIVIL
STATE OF CALIFORNIA

Mohamed Mohamed
Staff Engineer

Joshua R. Morgan P.E.
Geotechnical Regional 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**.

Introduction

This report presents the results of our geotechnical engineering services performed for the proposed Glacier Power and Gas Solar Farm facility located Yermo, San Bernardino County, California.

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

- 4 soil test boring to depths of approximately 21½ feet below ground surface (bgs) in the proposed solar PV array area
- Corrosion testing on soil sample obtained from 1 location
- Laboratory testing of soil samples
- Geotechnical engineering analysis

Maps of the soil test boring locations are shown on the attached Exploration Plans in **Field Exploration Results** section of this report. A log of each boring is included in **Field Exploration Results** section of this report.

The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are summarized in part on the boring logs and are provided in graphical and tabular form in the **Laboratory Test Results** section of this report.

The purpose of these services was to provide information and preliminary geotechnical engineering recommendations relative to the proposed solar development.

- Subsurface soil conditions
- Site preparation and earthwork
- Unpaved access roads
- Corrosion considerations
- Groundwater conditions
- Seismic considerations
- Foundation design and construction

Project Description

Our final understanding of the project conditions is as follows:

Item	Description
Project Description	▪ The Project will be within an approximate area of 24 acres illustrated in our site location plan.

Item	Description
	■ Based on the information provided, the proposed construction is currently planned to be a power plant with PV modules aligned in arrays and affixed to single-axis tracking systems or fixed arrays.
Proposed Structures	■ Ground-mounted, single axis tracker with photovoltaic modules ■ Other various project components could include electric cable/conduit laid in trenches, equipment and appurtenances (e.g., invertors, meteorological stations, and combiner boxes)
Proposed Construction	Photovoltaic (PV) arrays: ■ Driven wide flange piles (W6x9 or similar) Inverters, transformers, and other appurtenant equipment: ■ Shallow spread footings, mat slabs, driven piles, or drilled straight shafts
Grading/Slopes	Finished grades are expected to be within two feet of existing grades. A site grading plan has not been developed at this time.
Access Roads	Unpaved access roads are planned for the site as described below: ■ Low-volume access roads that will have a maximum vehicle load of 75,000 lbs. and will travel over the access roads once per week ■ We understand it is acceptable for the access roads to require ongoing maintenance throughout their design life.

Terracon should be notified if any of the above information is inconsistent with the planned construction, 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 topographic maps.

Item	Description
Parcel Information	The project site is located in Yermo, San Bernardino County, California. The center of the site is at the following coordinates: ■ Latitude: 34.9093 (approximate) ■ Longitude: -116.7893 (approximate) See Site Location map in the **Field Exploration Results** section of this report for additional site location information.
Existing Improvements	The site is currently undeveloped
Current Ground Cover	The current ground cover consists of exposed soils and sparse desert vegetation

Item	Description
Existing Topography (From USGS)	Relatively flat with approximate elevations ranging from 1,904 to 1,910 feet

Geotechnical Characterization

Soil Conditions from the Exploration

Subsurface soils encountered in exploratory borings generally consisted of medium dense to very dense silty sand to a maximum explored depth of 21.5 feet. A clayey sand layer was encountered in B-3 from an approximate depth of 2½ to 5 feet bgs. Specific conditions encountered at each boring are indicated on the individual boring logs presented in the **Field Exploration Results** section of this report.

General laboratory tests were conducted on selected soil samples and the test results are presented in the **Laboratory Test Results** section of this report. Test results indicate the majority of sandy soils exhibit non-plastic to low plasticity characteristics. The thin layer of clayey sand soils exhibit medium plasticity characteristics.

Groundwater Observations

Groundwater was not observed in any of the test borings at the time of our field exploration, nor when checked upon completion of drilling and excavation. These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations. Groundwater conditions can change with varying seasonal and weather conditions, and other factors.

According to the Sustainable Groundwater Management Act (SGMA) – Groundwater Data website, State Well No. 345418116455001 (located approximately 1.5 miles southeast of the site), the shallowest historical groundwater level since 1987 was reported deeper than 100 feet bgs.

Laboratory Corrosion Testing

One (1) bulk sample were tested for laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH testing. 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.

Results of soluble sulfate testing indicate that samples of the on-site soils tested classify as "Severe" (S1) according to Table 19.3.1.1 of Section 318 of the American Concrete Institute (ACI) Building Code Requirements for Structural Concrete. Concrete should be designed in accordance with the provisions of the ACI Building Code Requirements for Structural Concrete, Section 318, Chapter 19. The table can be found in the **Laboratory Test Results** section of this report.

Stormwater Management

Terracon reviewed the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey. It is our opinion that the saturated hydraulic conductivity, specifically the *"Capacity of the most limiting layer to transmit water",* associated with these mapped soils can be used as preliminary values needed at this stage of the project.

Based on the review of the referenced maps, the site has a Ksat value ranging from approximately 3.5 inches per hour to 13 inches per hour (high to very high).

Based on the soils encountered in our borings, we expect the percolation rates of the soils could be different when measured in the field due to variations in fines and gravel content. The above provided values can be used by the design team for preliminary planning purposes associated with the project. An appropriate factor of safety (FOS) of 3 should considered for any preliminary basin sizing. These values should not be used for final design or cost/contract estimating purposes.

Infiltration testing should be performed for the final design stages of the project once more precise locations of basins are known.

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 Ss 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 (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 determined using the site coefficients (Fa and Fv) 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)	34.9093
Site Longitude (°W)	116.7893
S_s Spectral Acceleration for a 0.2-Second Period	1.682
S_1 Spectral Acceleration for a 1-Second Period	0.6
F_a Site Coefficient for a 0.2-Second Period	1.0
F_v Site Coefficient for a 1-Second Period	1.7

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 21½ feet, and this seismic site class definition considers that similar or denser soils continue below the maximum depth of the subsurface exploration. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration.

Typically, a site-specific ground motion study will generate less conservative coefficients and acceleration values which may reduce construction costs. We recommend consulting with a structural engineer to evaluate the need for such study and its potential impact on construction costs. Terracon should be contacted if a site-specific ground motion study is desired.

Faulting and Estimated Ground Motions

The site is located in 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, the Calico-Hidalgo [15] fault is considered to have the most significant effect at the site from a design standpoint with a magnitude of 7.20 at a distance of approximately 1.76 kilometers from the site.

Based on the USGS Design Maps Summary Report, using the American Society of Civil Engineers (ASCE 7-16) standard, the design peak ground acceleration (PGA_M) for the project site is 0.831g. Based on the USGS Unified Hazard Tool, the project site seismicity for the 2% chance of exceedance hazard is defined by a modal magnitude of 7.51.

The site is not located within an Alquist-Priolo Earthquake Fault Zone for fault rupture hazard based on our review of the California State Fault Hazard Maps. [1]

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, and is typically a hazard where loose sandy soils exist below groundwater. The site has not been mapped for liquefaction hazard by the California Geological Survey. The County of San Bernardino has geologic hazard maps for certain areas throughout the county, including liquefaction hazard. Based on our review of these maps the site is not located within a County designated liquefaction hazard zone.

Based on the review of County maps, depth to groundwater, we anticipate liquefaction potential is low. Furthermore, other hazards associated with liquefaction, such as lateral spreading are also considered low.

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 recommend that electrical equipment associated with the inverters and other self-contained electrical equipment within the solar arrays be supported on shallow foundations bearing on engineered fill. Alternatively, electrical equipment and skids within the solar arrays can be supported on driven piles.

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

The proposed electrical equipment within the solar array fields areas may be supported on mat foundations and/or support slabs with thickened edges. Shallow foundations should bear on engineered fill extending to a minimum depth of 2 feet below the bottom of foundations, or 4 feet below existing site grade, whichever is greater. Structural fill placed beneath the entire footprint of the proposed structures should extend horizontally a minimum distance of 2 feet beyond the outside edge of perimeter footings. Recommendations for the design and construction of shallow foundations are provided in **Shallow Foundations.**

PV solar panels can be supported by driven W-section steel piles. Considerations for driven piles are provided in **Deep foundations – PV Arrays** section of this report.

The recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

Earthwork will include clearing and grubbing, excavations, and placement of engineered fills on the project. The recommendations presented for design and construction of earth supported elements, including foundations, are contingent upon following the recommendations outlined in this section.

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

Grading plans were not reviewed as part of the scope of work for this report. Terracon can be retained to evaluate the grading plans upon client request and can provide updated geotechnical engineering recommendations based on such a review.

Site Preparation

The earthwork described in the following paragraphs and sections is generally intended for the access roadways, drainage, equipment stations and ancillary structure areas. In the proposed solar array field, stripping of topsoil and vegetation may not be necessary if final grades are the same as the existing grades. Keeping existing topsoil and vegetation at the array field could minimize storm water erosion during construction and maintain overall ground surface stability for the solar-energy development.

Strip and remove existing vegetation, debris, and other deleterious materials from proposed development areas except for the on-grade solar array fields. Exposed surfaces within the project area 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 re-vegetate 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.

If fill is placed in areas of the site where existing slopes are steeper than 5:1 (horizontal: vertical), the area should be benched to reduce the potential for slippage between existing slopes and fills. Benches should be wide enough to accommodate compaction and earth moving equipment, and to allow placement of horizontal lifts of fill. Any soft/loose, dry, and low-density soil should either be removed, or moisture conditioned and compacted in place prior to placing fill.

Subgrade Preparation

The proposed electrical equipment within the solar array fields as well as self-contained electrical equipment areas, may be supported on mat foundations and/or support slabs with thickened edges and should bear on engineered fill extending to a minimum depth of 2 feet below the bottom of foundations, or 4 feet below existing site grade, whichever is greater. On-site soils are considered suitable to be used as structural fill materials. Structural fill placed beneath the entire footprint of the proposed structures should extend horizontally a minimum distance of 2 feet beyond the outside edge of perimeter footings. Recommendations for the design and construction of shallow foundations are provided in **Shallow Foundations.**

Roadway sections may be supported on a minimum of 10 inches of scarified, moisture conditioned, and compacted native soils. The moisture content and compaction of subgrade soils should be maintained until construction. The compaction requirements provided in the **Fill Compaction Requirements** section of this report should be adhered to.

Care should be taken to prevent wetting or drying of the bearing materials during construction. Wet, dry, or loose/disturbed material in the bottom of the footing excavations should be removed before foundation concrete is placed. Place a lean concrete mud-mat over the bearing soils if the excavations must remain open for an extended period of time.

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.

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 Material Types

Earthen materials used for engineered fill should meet the following material property requirements:

Soil Type	Acceptable Parameters
On-site soils	▪ Low plasticity soils, free of debris, organic matter, and oversized particles (greater than 3 inches in nominal dimension)
Import Soils [1]	Gradation (ASTM D6913) — Percent Finer by Weight ▪ 3” ....100 ▪ No. 4 Sieve...............50-100 ▪ No. 200 Sieve...............10-40 ▪ Maximum liquid limit (LL)...............30 ▪ Maximum plasticity index (PI)...............15 ▪ Maximum Expansion Index[2]...............20

1. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. Tested in general accordance with ASTM D4829.

Compaction Requirements

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

Material Type and Location	Per the Modified Maximum Density Test (ASTM D1557) [1]			Recommended Test Frequency [2]
	Minimum Compaction Requirement (%)	Range of Moisture Contents for Compaction (% over optimum)		
		Minimum	Maximum	
Approved on-site native soils or imported fill (if necessary):				
Fill placed in array areas:	85	-1%	+4%	1 test per 5,000 SF per lift
Beneath foundations:	90	-1%	+4%	1 test per 2,000 SF per lift
Miscellaneous backfill:	85	-1%	+4%	1 test per 5,000 SF per lift
Compacted native soils for roadways:	90	-1%	+4%	1 test per 1,000 LF
Utility trench subgrade and backfill[1]:	85	-1%	+4%	1 test per 300 LF per lift
Aggregate base (pavements):	95	-2%	+2%	1 test per 1,000 LF

1. Compaction requirements may be increased by the electrical engineer based on thermal resistivity analyses. Upper 12 inches should be compacted to 90% within structural areas. ASTM D6938 Backscatter Method may be used for compaction testing in trenches in order to avoid damage to conductors. If trenchless technologies, are utilized during construction, then verification tests should be performed to verify the compaction level near the cable. Due to the controlled nature of the trenchless systems, the Engineer of Record may decrease the recommended test frequency at their discretion based on observations and tests results on-site.
2. Frequency of tests may be increased or decreased at the discretion of the Geotechnical Engineer of Record. The on-site materials testing and inspection company, if other than Terracon, shall assume the role of Geotechnical Engineer of Record.

Utility Trench Backfill

Care should be taken that utility trenches are properly backfilled. Backfilling should be accomplished with properly compacted suitable soils with loose lift thicknesses of generally 9 inches except for the first lift above the utility pipes that can be lowered to

12 inches. On-site soils or imported fill materials should be compacted to at least 85% Modified Proctor maximum dry density (ASTM D1557) in the range of -1 and +4 percentage points of the optimum moisture for the material. The on-site soils are susceptible to erosion and may require protection.

Compaction requirements may be increased by the electrical engineer based on thermal resistivity analyses. Upper 12 inches should be compacted to 90% within structural areas. ASTM D6938 Backscatter Method may be used for compaction testing in trenches in order to avoid damage to conductors. If trenchless technologies, are utilized during construction, then verification tests should be performed to verify the compaction level near the cable.

Frequency of tests may be increased or decreased at the discretion of the Geotechnical Engineer of Record. The on-site materials testing and inspection company, if other than Terracon, shall assume the role of Geotechnical Engineer of Record.

Earthwork Construction Considerations

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

At the time of our geotechnical exploration of the site, moisture contents of the surface and near-surface native soils ranged from about 3 to 27 percent. Based on these moisture contents, some moisture conditioning of the soils may be needed during construction and grading/engineered fill placement on the project. On-site soils are generally considered suitable for use as engineered fill for this project.

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

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

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 and backfilling of excavations to the completed subgrade.

Shallow Foundation

The proposed self-contained electrical elements within the solar areas can be supported by mat foundations and/or support slabs with thickened edges. Design recommendations for mat foundations are presented in the following sections.

Design Parameters

DESCRIPTION	RECOMENDATION
Bearing Material[3]	Engineered fill extending to a minimum depth of 2 feet below the bottom of foundations, or 4 feet below existing site grade, whichever is greater
Maximum Net Allowable Bearing pressure (1-inch Settlement) [1,7]	3,000 psf for mat foundation (Up to 10 feet wide by 20 feet long)
Minimum Dimensions	12 inches
Ultimate Coefficient of Sliding Friction [4]	0.35
Ultimate Passive Resistance [5] **(equivalent fluid pressures)**	360 psf/ft
Minimum Embedment Depth Below Finished Grade	12 inches
Estimated Total Settlement from Structural Loads [2]	As-noted above
Estimated Differential Settlement [2,6]	About ½ of total settlement

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.
2. Unsuitable or loose/soft, dry, and low-density soils should be removed and replaced per the recommendations presented in the **Earthwork**.
3. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.

DESCRIPTION	RECOMENDATION

4. 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.
5. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure. The designer should select an appropriate factor of safety during design.
6. Differential settlements are as measured over a span of 40 feet.
7. Maximum width is based on settlement analysis

Settlement calculations were performed utilizing Westergaard and Hough's methods[5] to estimate the static settlement and allowable bearing pressure for various foundation widths. Since there are several factors that will control the design of mat foundations besides vertical load, Terracon should be consulted when the final foundation depth and width are determined to assist the structural designer in the evaluation of anticipated settlement.

For structural design of mat foundations, a modulus of subgrade reaction (K_{v1}) of 200 pounds per cubic inch (pci) may be used. Other details including treatment of soft foundation soils, superstructure reinforcement and observation of foundation excavations as outlined in the Earthwork section of this report are applicable for the design and construction of a mat foundation at the site.

The subgrade modulus (K_v) for the mat is affected by the size of the mat foundation and would vary according the following equation:

$$K_v = K_v \frac{(\mathrm{b}+1)^2}{4b^2}$$

Where: K_v is the modulus for the size footing being analyzed
b is the width of the mat foundation.

Our engineer can provide refined estimates of K_c if provided more detailed information regarding the loads and application area to conduct settlement analysis.

5 FHWA Geotechnical Engineering Circular No. 6 – Shallow Foundations, FHWA-SA-02-054.

Shallow Foundation Design Considerations

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. The use of joints at openings or other discontinuities in masonry walls is recommended.

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

Deep Foundations

Driven Foundations – PV Arrays

Proposed solar PV panels and inverters can be supported on driven steel W-section foundations (assumed to be W6x9 or similar) in general accordance with the following sections.

Driven Pile Considerations

The proposed solar PV panels and inverters may be supported on a driven pile foundation system. The design capacity of a single-driven pile is a function of several factors including:

- Size and type of pile;
- Type and capacity of pile installation equipment;
- Pile integrity after installation; and
- Engineering properties of the subsurface soils.

Based on specific conditions encountered on site, the soils are generally considered drivable for pile installation. The most effective means of verifying pile drivability and capacities for either tension or lateral loads is through pile load tests. Preliminary pile foundation design parameters have been based upon correlated capacities utilizing soil strength criteria determined from the field and laboratory testing conducted during exploration.

The tables below neglect a depth of 2 feet for axial and lateral resistance. This neglect is due to depth of topsoil, scour and/or disturbance from utilities near the piles. Depth of neglect should be verified by the design engineer.

The allowable axial parameters of the pile in compression and tension were determined by dividing the ultimate axial capacity by a minimum factor-of-safety (FOS) of 2.0 for skin friction and 3.0 for end bearing. The allowable unit skin friction was determined using the soil strengths based on our field and laboratory testing. The following geotechnical design parameters can be used to determine the capacity of driven W-section pile foundations. Pile capacity calculations and an example calculation are provided below the table.

Description	Top Depth / Bottom Depth	Total Unit Weight (pcf)	Allowable Compression Unit Skin Friction (psf)[A]	Allowable Bearing Pressure (psf)[B,C]
Stratum 1	1 / 8	100	50	3,000
Stratum 2	8 / 16	110	200	8,000

[A] Allowable uplift capacity is on the order of 70% of the compression capacity values in the table. The values provided should be multiplied by the box perimeter of the pile times the depth. The box perimeter is considered two times the width of the flange plus two times the depth of the web.
[B] The values provided should be multiplied by the box area of the pile and be used for compression resistance only.
[C] Terracon recommends a minimum embedment depth of 5 feet.

Recommended Pile Capacity Calculations:

$$F_{total}\,(lbs) = F_{skin\ axial}\,(lbs) + F_{bearing}\,(lbs)$$

$$F_{skin\ axial}\,(lbs) = F_{s1} \times P \times (h_{1b} - h_{1t}) + F_{s2} \times P \times (h_{2b} - h_{2t}) + \ldots$$

$$F_{bearing}(lbs) = F_b \times A_P$$

Where:
$Fs1$ = Allowable Unit Skin Friction for layer 1 (psf)
P = Pile perimeter = 2 * Flange Width + 2 * Depth (ft)
h_{1b} = bottom depth of embedment of pile (ft) into or bottom of zone
h_{1t} = depth of top of zone (ft)
F_b = allowable bearing pressure at the embedded stratum (psf)
A_P = Box perimeter Area = Flange Width x Web Depth (ft^2)

Recommended soil parameters for lateral load analysis of driven pile foundations have been developed for use in LPILE computer programs. Engineering properties have been estimated as outlined below:

Description	Top Depth Bottom Depth	Effective Unit Weight (pcf)	L-PILE/ GROUP Soil Type	Sand(deg)
Stratum 1	1 8	100	Reese Sand	30
Stratum 2	8 16	110	Reese Sand	35

Note: LPILE default values can be used for the K modulus

Drilled shaft Design Parameters

The proposed structure end/turning poles and bus supports can be supported on drilled shafts. Total required embedment of the drilled shafts should be determined by the structural engineer based on structural loading and parameters provided in this report.

The allowable side friction and end bearing components of resistance were evaluated and are presented in the below table. The allowable total downward capacity is based on a minimum factor of safety of 2.5. The allowable uplift capacities should be based on 70% of the below skin friction values only. The depth below ground surface indicated in the attached graphs is referenced from the existing ground surface at the site at the time of the field exploration.

Recommended geotechnical parameters for lateral load analyses of drilled shaft foundations have been developed for use in the L-PILE computer program. Based on our review of the subsurface conditions within the outline of the substation the Standard Penetration Test (SPT) results, engineering properties have been estimated for the soils conditions as shown in the following table for the substation. Lateral and axial capacity of soils within the upper 2 feet should be neglected due to utilities and anticipated disturbance or scour around shafts. We recommend that Terracon review the final drilled shaft design to verify that sufficient embedment is achieved.

Lateral Load Analyses Estimated Engineering Properties of Soils						
Top Depth Bottom Depth	Effective Unit Weight (pcf)	L-PILE/ GROUP Soil Type	Internal Angle of Friction (Degrees)	Un-drained Shear Strength (ksf)	End Bearing (psf)	Skin Friction (psf)

2 **8**	120	Sand (Reese)	30	--	3,000	80
8 **21**	115	Sand (Reese)	35	--	10,000	300

LPILE default values can be used for the K modulus. The depth below ground surface indicated in the table above is referenced from the existing ground surface at the site at the time of the field exploration. If fill is placed to raise the site grades, the depths shown in the 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 coefficients 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 load 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 free-head condition).

Drilled Shaft Construction Considerations

Drilling to design depths should be possible with conventional single flight power augers. Due to the presence of sand on the site, caving of soils within the drilled shaft excavations should be anticipated. For drilled shaft depths above the depth of groundwater, temporary steel casing will likely be required to properly drill and clean shafts prior to concrete placement.

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 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 contractor should check for gas and/or oxygen deficiency prior to any workers entering the excavation for observation and manual cleanup. All necessary monitoring and safety precautions as required by OSHA, State or local codes should be strictly enforced by the owner and the EPC.

Access Roads

Compacted Native Soils Access Road Design Recommendations

Based upon the soil conditions encountered in the test borings, the use of on-site soils for construction of on-site roads is considered acceptable. Without the use of asphalt concrete or other hardened material to surface the roadways, there is an increased potential for erosion and deep rutting of the roadway to occur, however, post construction traffic is anticipated to only consist of pickup trucks for operations and maintenance personnel. Therefore, construction of the un-surfaced native roadways should consist of a minimum of 10-inches of compacted on-site soils.

It is our understanding that proposed compacted native roadway grades will match adjacent existing grades so that the existing natural drainage patterns are generally unchanged. The un-surfaced roads are expected to function with periodic maintenance.

Aggregate Surface Roadway Design Recommendations

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). We anticipate vehicles within this traffic class will not exceed wheel loads of 12,500 lbs. Based on the Category and Road Class, a Design Index of 1 was utilized, along with a CBR of 10 based on laboratory testing. 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 D 1557.

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.

It is our understanding that aggregate surfaced roads and parking areas will be utilized during the construction of this project. 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 Surfaced Road 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 affect 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.

Site Location and Exploration Plans

Contents:

Note: All attachments are one page unless noted above.

Site Location

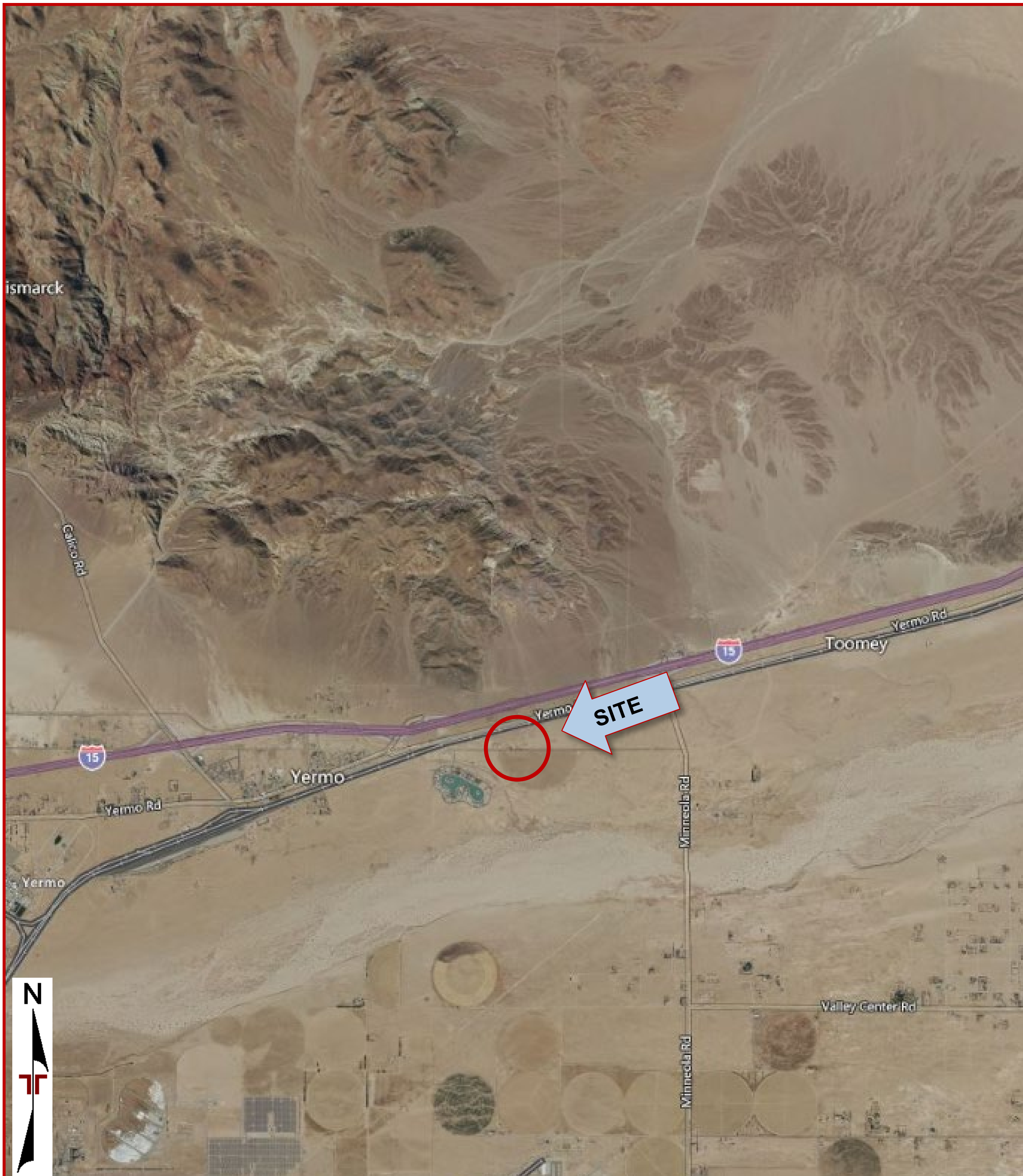


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

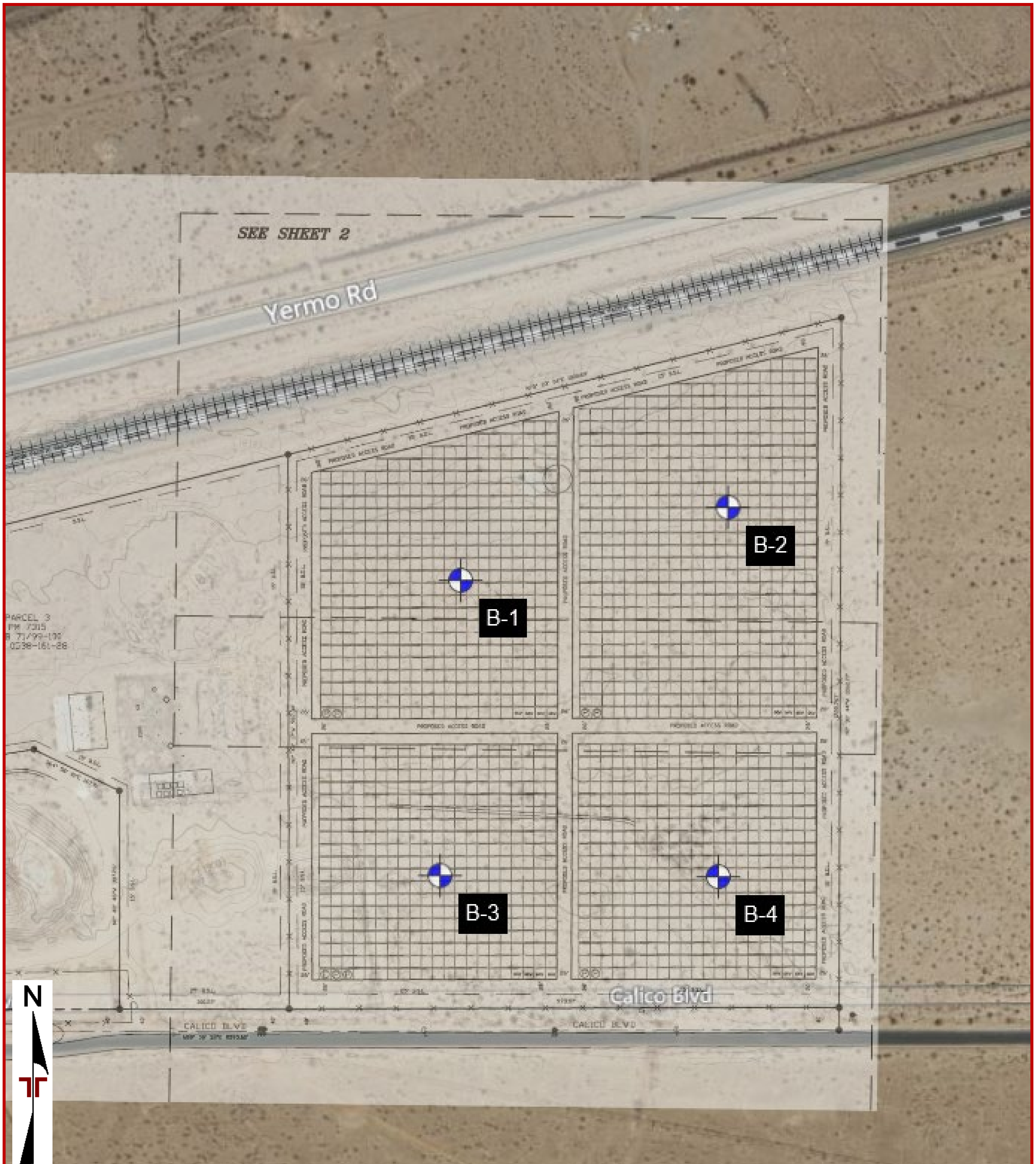


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES   MAP PROVIDED BY MICROSOFT BING MAPS

Field Exploration Results

Exploration and Testing Procedures

Field Exploration

Number of Explorations	Boring/Test Pit ID Nos.	Approximate Boring Depth (feet)	Location
4 Borings	B-1 through B-4	21½	PV Array Areas

Boring Layout and Elevations: Terracon personnel provided the boring and test pit layout using handheld GPS equipment (estimated horizontal accuracy of about ±20 feet) and referencing existing site features. Approximate ground surface elevations were obtained using Google Earth Pro. If a more precise boring and test pit layout or elevations are desired, we recommend borings and test pits be surveyed.

Standard Penetration Test Borings: We advanced the borings with track-mounted drill rigs using hollow stem augers. Four samples were obtained in the upper 10 feet of the borings and at intervals of 5 feet thereafter. A standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch O.D. split-barrel sampling spoon with 2.5-inch I.D. ring lined sampler was also used for sampling. Ring-lined, split-barrel sampling procedures are similar to standard split spoon sampling procedure; however, blow counts are typically recorded for 6-inch intervals for a total of 18 inches of penetration. We observed and recorded groundwater levels during drilling and sampling.

For safety purposes, all borings were backfilled with auger cuttings after their completion. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our field engineer prepared field boring logs as part of the excavation operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final 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.

Boring Log Recording: The sampling depths, penetration distances, and other sampling information was recorded on the field boring 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 and excavation operations. These field logs included visual classifications of the materials observed during drilling and excavation, and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring 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.

Glacier Power and Gas Solar Farm
39952 Calico Boulevard | Yermo, CA
Terracon Project No. LA235050

Terracon
145 W Walnut St
Carson, CA

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 34.9110° Longitude: -116.7880°

Depth (Ft.)	Material Description	Sample Depth (Ft.)	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
0.0–2.5	**SILTY SAND (SM)**, light tan						
2.5–7.5	**CLAYEY SAND (SC)**, trace gravel, medium dense	2.5–4	5-9-11 N=20				
		5–6.5	5-10-10 N=20	27.4			21
7.5–15.0	**SILTY SAND (SM)**, medium dense	7.5–9	5-10-15 N=25				
	dense	10–11.5	7-15-15 N=30			NP	
15.0–21.5	**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, light tan, dense	15–16.5	5-20-22 N=42	9.3			9
	very dense	20–21	6-50/6"				

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
Elevation Reference: Elevations were obtained from Google Earth Pro

Water Level Observations
Not encountered

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
Track

Hammer Type
Automatic

Driller
2R

Logged by
AS

Boring Started
09-19-2023

Boring Completed
09-19-2023

Glacier Power and Gas Solar Farm
39952 Calico Boulevard | Yermo, CA
Terracon Project No. LA235050

Terracon
145 W Walnut St
Carson, CA

Boring Log No. B-2

Location: See Exploration Plan

Latitude: 34.9113° Longitude: -116.7864°

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
	SILTY SAND (SM), light brown								
	medium dense				8-11-11 N=22				
5.0	**POORLY GRADED SAND (SP)**, light brown to white, medium dense	5			4-10-10 N=20				5
					4-9-9 N=18				
	trace gravel, light tan	10			5-8-5 N=13				
15.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, light tan, dense	15			8-16-15 N=31	7.5			7
		20			4-10-25 N=35				
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
Elevation Reference: Elevations were obtained from Google Earth Pro

Water Level Observations
Not encountered

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
Track

Hammer Type
Automatic

Driller
2R

Logged by
AS

Boring Started
09-19-2023

Boring Completed
09-19-2023

Glacier Power and Gas Solar Farm
39952 Calico Boulevard | Yermo, CA
Terracon Project No. LA235050

145 W Walnut St
Carson, CA

Boring Log No. B-3

Location: See Exploration Plan

Latitude: 34.9095° Longitude: -116.7882°

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
	SILTY SAND (SM), light tan								
2.5	**CLAYEY SAND (SC)**, brown to light brown, medium dense				3-4-6 N=10			33-16-17	
5.0	**POORLY GRADED SAND (SP)**, with trace silt, light tan, loose	5			8-6-12	3.0	97		5
7.5	**POORLY GRADED SAND WITH SILT (SP-SM)**, light brown, medium dense				5-11-12 N=23				
	dense	10			7-20-27				
	very dense	15			10-25-25				
		20			25-50				
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

Elevation Reference: Elevations were obtained from Google Earth Pro

Water Level Observations
Not encountered

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
Track

Hammer Type
Automatic

Driller
2R

Logged by
AS

Boring Started
09-19-2023

Boring Completed
09-19-2023

Terracon
145 W Walnut St
Carson, CA

Boring Log No. B-4

Location: See Exploration Plan

Latitude: 34.9095° Longitude: -116.7865°

Graphic Log	Depth (Ft.) / Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
	SILTY SAND (SM), trace gravel, light brown								
	medium dense				5-10-12 N=22				
		5			8-14-15 N=29				16
					6-14-10 N=24				
	dense	10			6-18-17 N=35	17.3			15
		15			7-18-20 N=38				
	medium dense	20			5-11-9 N=20				
	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

Elevation Reference: Elevations were obtained from Google Earth Pro

Water Level Observations
Not encountered

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
Track

Hammer Type
Automatic

Driller
2R

Logged by
AS

Boring Started
09-19-2023

Boring Completed
09-19-2023

Laboratory Test Results

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 of soil by mass
- In-situ dry density (unit weight)
- Atterberg Limits
- Sieve Analysis

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 general accordance with the Unified Soil Classification System.

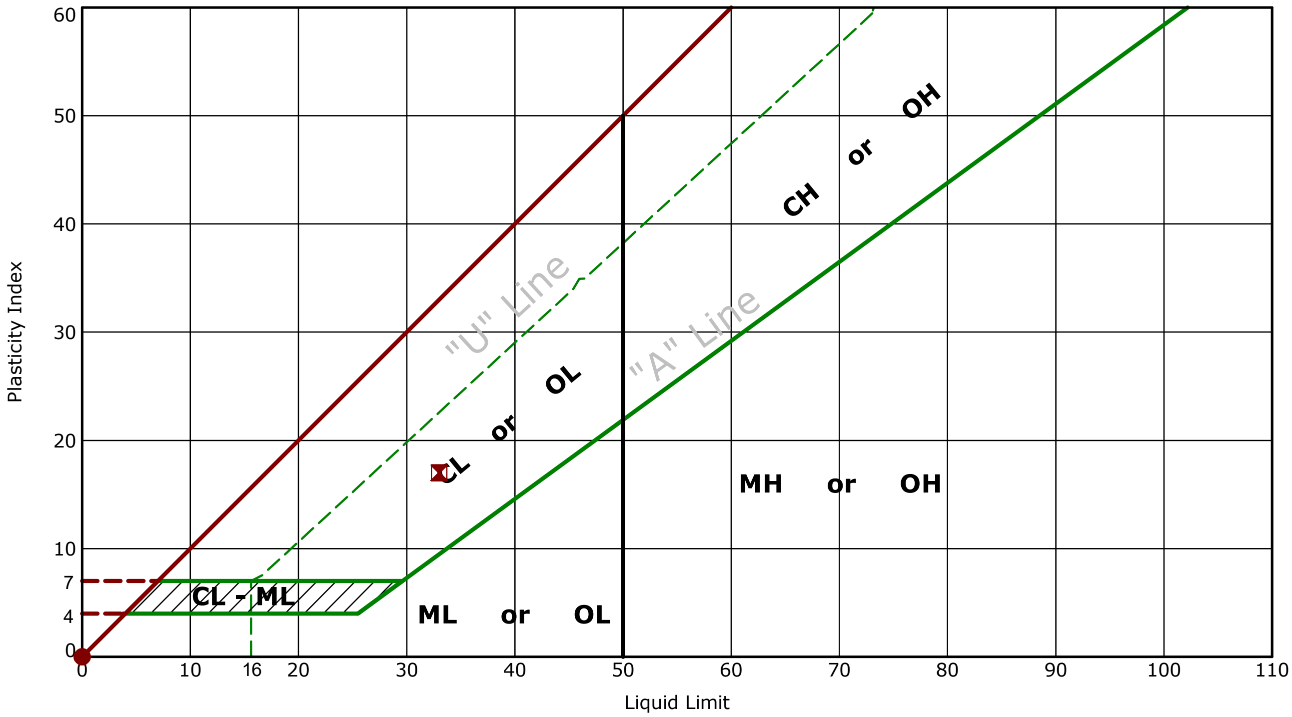
Corrosivity Testing: Bulk samples of near surface soils were tested in the laboratory for the following properties in general accordance with the corresponding standards:

- pH Analysis (ASTM G51)
- Chloride (ASTM D512)
- Sulfate (ASTM C1580)
- Sulfide Content (AWWA 4500-S D)
- Oxidation-Reduction Potential (ASTM G200)
- Total Salts (AWWA 2520 B)
- Minimum Electrical Resistivity Testing (ASTM G187)
- Moisture Content (ASTM D2216)

145 W Walnut St
Carson, CA

Atterberg Limit Results

ASTM D4318

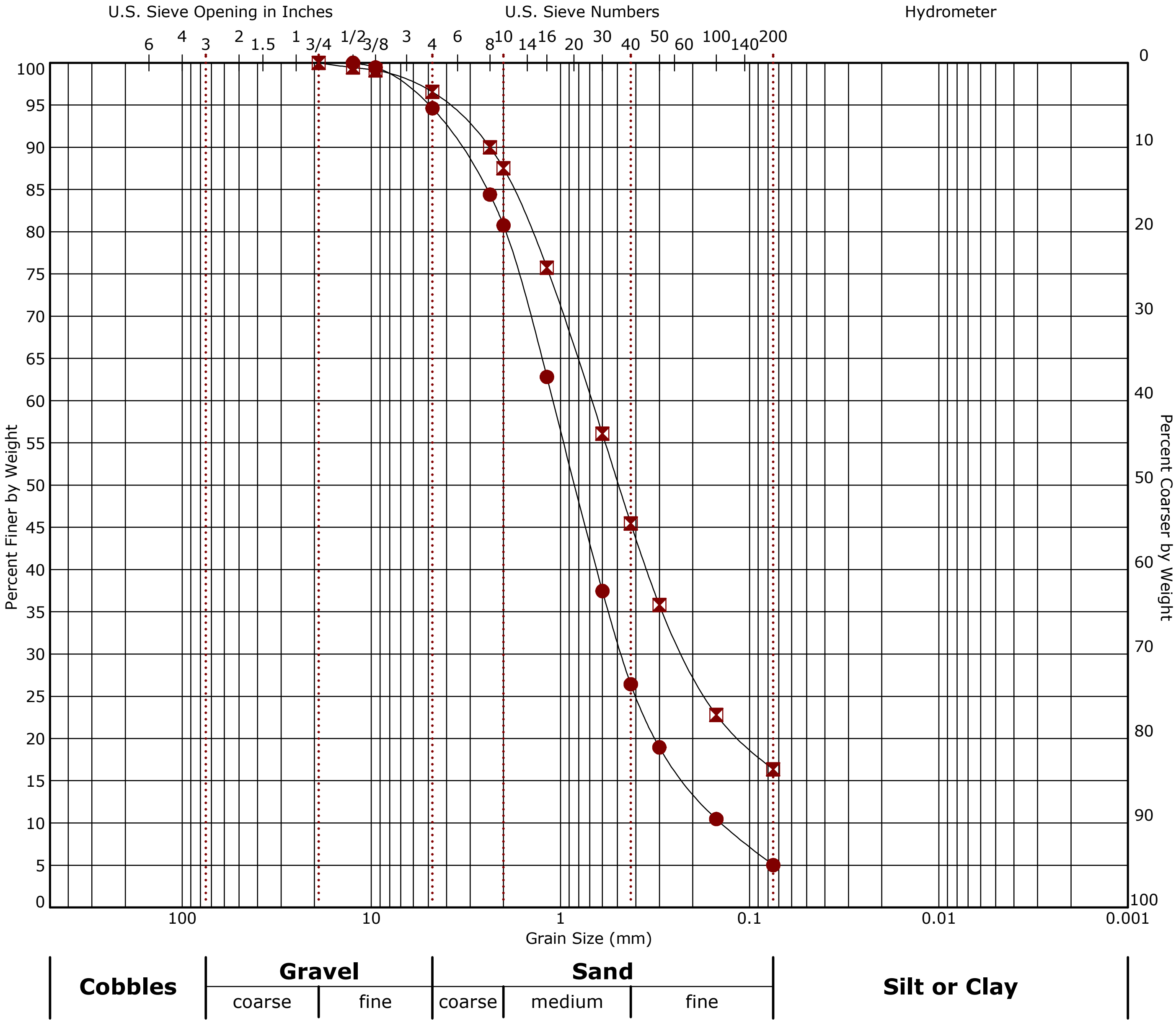


	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	B-1	10 - 11.5	NP	NP	NP		SM	SILTY SAND
⊠	B-3	2.5 - 4	33	16	17		SC	CLAYEY SAND

145 W Walnut St
Carson, CA

Grain Size Distribution

ASTM D422 / ASTM C136



Boring ID		Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
●	B-2	5 - 6.5	POORLY GRADED SAND	SP				1.46	7.74
⊠	B-4	5 - 6.5	SILTY SAND	SM					

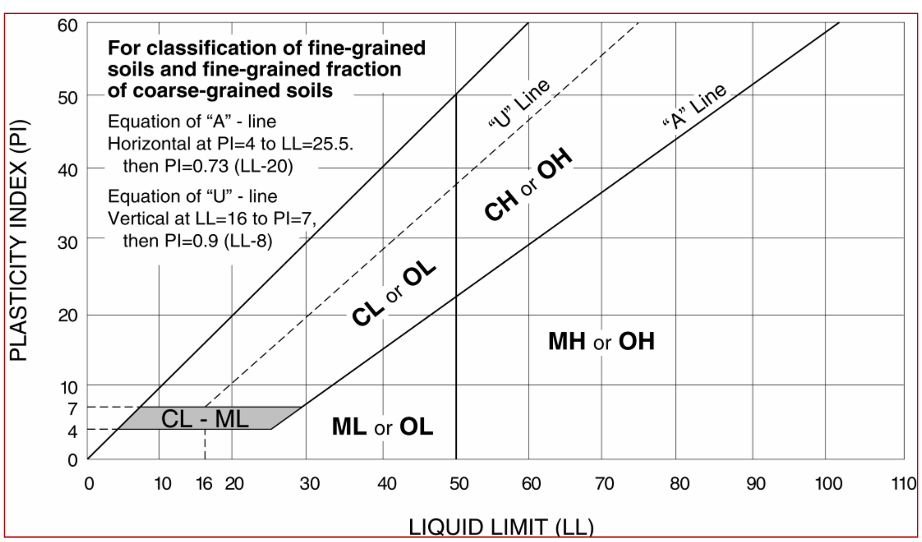
Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	B-2	5 - 6.5	12.5	1.095	0.475	0.141	0.0	5.4	89.6	5.0		
⊠	B-4	5 - 6.5	19	0.686	0.22		0.0	3.4	80.2	16.4		

Terracon

Unified Soil Classification System

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

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



Glacier Power and Gas Solar Farm
39952 Calico Boulevard | Yermo, CA
Terracon Project No. LA235050

Terracon
145 W Walnut St
Carson, CA

General Notes

Sampling

- Auger Cuttings
- Modified California Ring Sampler
- No Recovery
- 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.