NORTHERN PUEBLOS HOUSING AUTHORITY
5 WEST GUTIERREZ, SUITE 10, SANTA FE, NM 87506
PHONE: (505) 455-7973 TOLL FREE: 1-888-347-6360 FAX: (505) 455-3789

Final Report
Pueblo of Picuris
Phase I Community Solar Project

Department of Energy
Office of Indian Energy Policy and Programs
DOE Grant Number DE-IE0000033

May 29, 2020

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prepared for

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Final
05/29/2020

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1.0 EXECUTIVE SUMMARY

The Pueblo of Picuris Community Solar Project (Project) is a 1-megawatt (MW) alternating current (AC) ground mounted, fixed tilt solar photovoltaic system that became operational on December 18th, 2017. The Project, which was partially funded by the DOE (Grant No. DE-IE0000033), generates revenue for the Tribe through a Power Purchase Agreement (PPA) with the electric utility, Kit Carson Electric Cooperative. The PPA revenue provides Tribal members with residential and commercial electric utility bill offsets and also supports critical Tribal programs.

This Final Report provides a technical overview of the Project, documents the Project's development process and outcomes, identifies successes and challenges, and offers recommendations for similarly funded tribal projects.

While the Project was successfully completed and provides an ongoing benefit to the Tribe, challenges faced during development and documented in this Final Report should be viewed as instructive for future tribal energy projects. The specific challenges identified for this Project involved planning, procurement and management of the solar developer, and commissioning and closeout.

2.0 PROJECT OVERVIEW

In August 2014, the U.S. Department of Energy (DOE) facilitated completion of a Strategic Energy Plan for the Pueblo of Picuris. The Pueblo of Picuris Phase I Community Solar Project (Project) was developed to meet the principle goal of Strategic Energy Plan of providing renewable energy for 100% of the Pueblo's electric needs. Under a designation of Tribal organization and a joint venture agreement, development of the Project was managed by Northern Pueblos Housing Authority (NPHA). On behalf of the tribe, on December 4thth, 2015, NPHA executed a 25-year power purchase agreement (PPA) with the local electric utility, Kit Carson Electric Cooperative (KCEC). Under the PPA, which NPHA has since assigned the rights to the Tribe, power generated from Project is purchased by KCEC at a fixed price per kilowatt hour (kWh).

The Project objectives were as follows:

- Develop the first fully solarized Pueblo in New Mexico by covering most of the Pueblo's electricity costs;
- Provide stable income for Tribal government;
- Offset carbon emissions from the utility's conventional energy supply;
- Contribute to the renewable energy transition in northern New Mexico; and
- Create a replicable model for Indian Country using an innovative financial structure that combines conventional financing with grant funding.

2.1 Site Description

The Project occupies approximately 7 acres of a 10-acre parcel owned by the Pueblos on Tribal trust land in southern Taos County, NM. The Project site is located on the *Peñasco,* New Mexico US Geological Survey 7.5 minute topographical map (NE ¼ Section 32 of Township 32 North, Range 12 East, New Mexico). The Project site elevation ranges between 7,540 and 7,560 feet above sea level. The site and surrounding land is characterized by the piñon-juniper, sagebrush, and native grass vegetation.

As illustrated in Figure 1, the Project is interconnected with an existing KCEC transmission line that runs parallel to New Mexico State Road 75. The project site is located approximately 1 mile north of an existing KCEC substation.

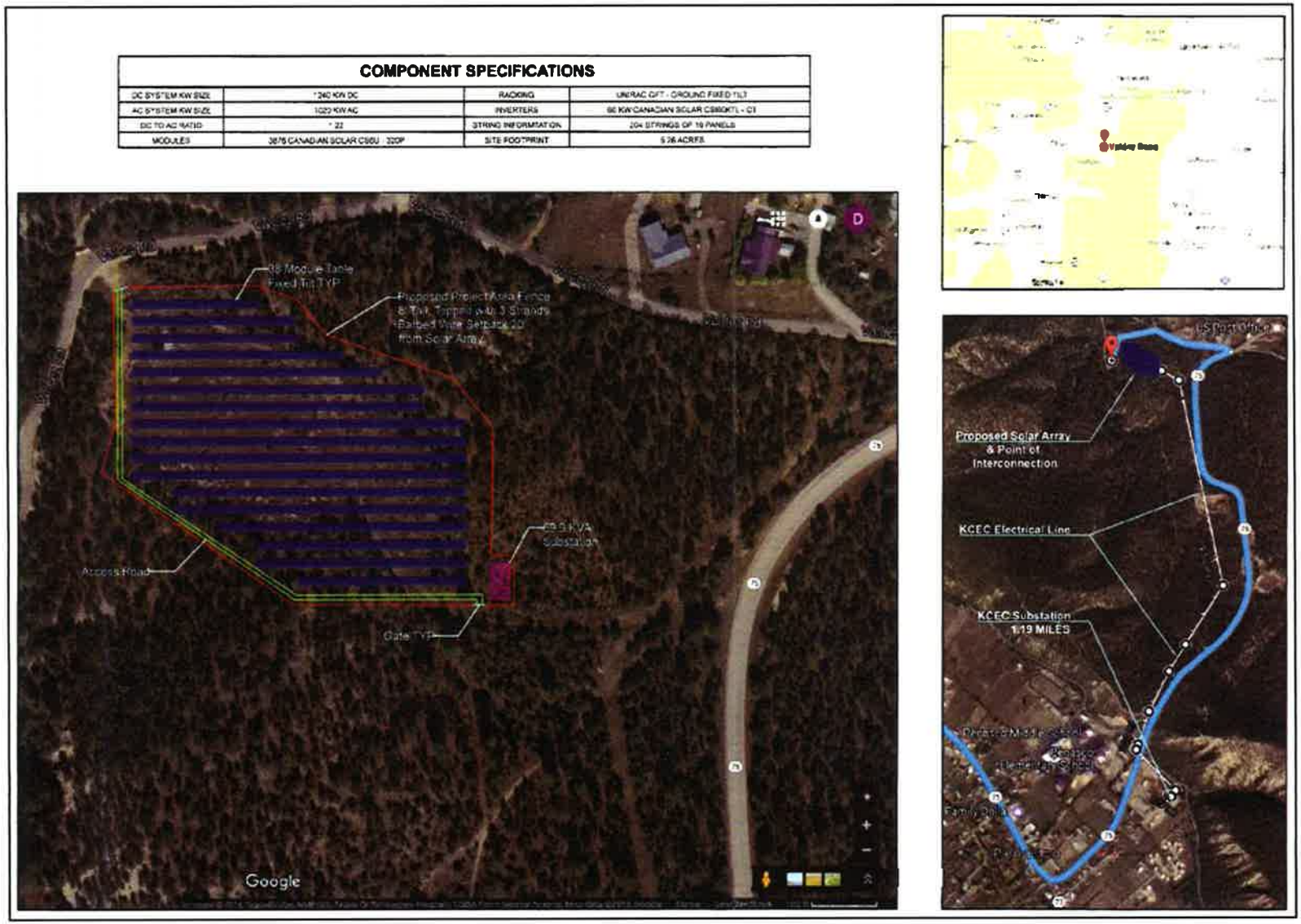


Figure 1. Project Location and Layout

2.2 Enabling Legislation and Agreements

2.2.1 Pueblo of Picuris Resolution

On July 28th, 2015, the Pueblo of Picuris adopted Resolution No. 2015-24, paraphrased below:

- Designated 10 acres of Tribal trust land for development of the Project (along with Travel Center and RV Park);
- Authorized NPHA to engage in fundraising for the Project and enter into negotiations with private investors to assist in Project financing; and
- Approved a Power Purchase Agreement (PPA) between NPHA and KCEC for the Project on behalf of the Pueblo.

2.2.2 NPHA Resolution

On November 3rd, 2016, NPHA adopted Resolution 2016-06, paraphrased below:

- Affirming NPHA's previous actions for the Project that include entering into the PPA with KCEC and applying for and securing the DOE grant;
- Authorizes NPHA to continue to pursue Project financing and provide services related to the Project, including but not limited to Project design; and
- Requiring NPHA to consult legal counsel on all such services.

2.2.3 Power Purchase Agreement

For the Project, a Power Purchase Agreement (PPA) between NPHA and KCEC was executed on December 4th, 2015. On June 29th, 2016, NPHA provided KCEC a notice of a 180-day extension of the Conditions Precedent Deadline and Commercial Operation Deadline; this extension notice was acknowledged and agreed by KCEC on July 18th, 2016. On December 7th, 2016, NPHA provided KCEC a second notice of a 180-day extension of the Conditions Precedent Deadline and Commercial Operation Deadline; this extension notice was acknowledged and agreed by KCEC on February 2nd, 2017. Per the second extension:

- Conditions Precedent Deadline is extended from December 27th, 2016, to July 30th, 2017; and
- Commercial Operations Deadline is extended from June 29th, 2017, to the end of 2017.

Subsequently, a third extension was agreed to by KCED, extending the Commercial Operations Deadline to the end of 2018.

2.3 Project Financing

To finance the planning and development of the Project, two federal grants were secured in addition to securing matching funds through conventional financing.

2.3.1 BIA Grant

On January 4th, 2017, BIA awarded a $61,000 grant to NPHA for the "Picuris Renewable Energy Planning Study" (Grant No. A16AP00004). The grant's period of performance is from March 30th, 2016 through June 30th, 2017.

2.3.2 DOE Grant

On October 27th, 2016, NPHA executed a Grant Agreement with the U.S. Department of Energy's (DOE) Office of Indian Energy (OIE) to provide $1 million in federal funds to partially finance development of the Project (Award No. DE-IE0000033). The Grant Agreement has a Cost Share requirement of $1,221,000, based on an estimated total project cost of $2,221,000.

2.3.3 Matching Funding through Conventional Financing

The Tribe secured a $1,300,00 loan Peoples Bank as matching funding to the DOE grant.

2.4 Procurement of the Solar Developer

NPHA advertised a Request for Proposals (RFP) to solicit design-build proposals from solar developers from December 5th through 7th, 2016. The RFP was advertised in the Española-based Rio Grande Sun newspaper. On December 8th & 9th, 2016, NPHA and Picuris Pueblo held a non-mandatory site-visit meeting for prospective solar developers. Six proposals were received by NPHA by the submittal deadline, December 16, 2016. Interviews of the six proponents by NPHA were conducted on January 19th and 20th, 2017. Based on the proposals and interviews, NPHA established a preliminary ranking of the proponents. A request for supplemental information was then provided to the four top-ranked proponents. Each of the four top-ranked proponents submitted supplemental information by the deadline, February 2nd, 2017. Based on the proposals, interviews, and supplemental information, on February 6th, 2016, NPHA conducted a final ranking of the proponents to select the solar developer for the Project.

On behalf of the Pueblo, NPHA selected Albuquerque-based Osceola Energy to construct the Project. NPHA subsequently executed a design-build agreement with Osceola Energy on March 13th, 2017. The agreement called for construction of a for a 1.2 MW DC fixed-tilt solar PV system for $2,109,000, with Project completion on August 9th, 2017.

Osceola Energy stipulated in their bid, which was incorporated into the contract documents, that cost and schedule were contingent on the geotechnical analysis. Notably, a geotechnical analysis of onsite subsurface conditions was not conducted prior to the procurement of the solar developer.

2.5 Project Authorizations and Compliance

2.5.1 Electric Utility Interconnection

Under the design-build agreement, the solar developer was responsible for facilitating Project interconnection with KCEC. This involved preparing the interconnection application and submittal to KCEC, paying interconnection fees, providing required technical information, and otherwise making all other reasonable efforts to facilitate interconnection of the solar project.

2.5.2 N.M. Construction Industries Division

As part of the design-build agreement, the solar developer was responsible for obtaining a permit from the New Mexico Construction Industries (& Manufactured Housing) Division (NMCID). The state agency conducted construction and electrical code inspections of the Project.

2.5.3 New Mexico Department of Transportation

As part of the design-build agreement, the solar developer was responsible for obtaining a New Mexico Department of Transportation (NMDOT) temporary construction permit and driveway permit for access to New Mexico State Highway 75 (NM 75). In addition, Osceola Energy was expected to develop a Transportation Safety Plan.

2.5.4 Clean Water Act, National Pollution Discharge Elimination System

As part of the design-build agreement, the solar developer was responsible for developing Stormwater Pollution Prevention Plan (SWPPP) and submit a Notice of Intent (NOI) to the EPA, as required by NPDES.

Section 401 of the CWA (See also 40 CFR §122.44(d)(3)) and §124.53(a)) provides that no Federal license or permit, including NPDES permits, to conduct any activity that may result in any discharge into navigable waters shall be granted until the State/Tribe in which the discharge originates certifies that the discharge will comply with the applicable provisions of sections 301, 302, 303, 306, and 307 of the CWA.

2.5.5 National Environmental Policy Act

The DOE grant for the Project required that DOE must comply with the National Environmental Policy Act (NEPA) prior to authorizing the use of Federal funds. DOE made a conditional NEPA determination for this Project award, and federal funding for certain tasks under this award were contingent upon the final NEPA determination.

The DOE grant authorized NPHA to proceed with pre-construction activities, including securing Project finance, procurement of engineering and construction services, project management, reporting, and Project design.

To facilitate issuance of the DOE's final NEPA determination for the Project, NPHA hired Marron and Associates to prepare an Environmental Assessment (EA) of the Project, which was completed in November, 2016.

On March 15, 2017, the BIA Northern Pueblos Agency issued a notice to proceed with the project based on the January 27, 2017 Finding of No Significant Impact which received no appeals during the 30-day advertisement period.

2.5.6 Federal Wage Requirements

Federal Wage Rates (Davis-Bacon Prevailing wages) were not required by the DOE for this Project (Principal Engineer/Team Lead, Allegheny Science and Technology, Contractor to the U.S. Department of Energy, Office of Indian Energy, personal communication, February 13, 2017).

2.5.7 Cultural Resources

On September 15, 2016, the New Mexico Historic Preservation Office (SHPO) concurred with the findings of the cultural resources report with the recommended measures for the Project. The solar developer was responsible for adhere to these recommendations.

2.5.8 NM Gross Receipts Tax Exemption

The 2007 New Mexico legislative session declared 2007 as the Year of Clean Energy. The New Mexico Comprehensive Clean Energy Legislative Package includes the enactment of the Solar Gross Receipts Tax (GRT) Deduction, a tax deduction for businesses from the sale and installation of solar energy systems. The Solar Gross Receipts Tax (GRT) Deduction (7-9-112 NMSA 1978) became effective July 1, 2007 (EMNRD, 2017).

The solar developer was responsible for obtaining a signed copy of Form RPD-41341 to claim the deduction or other evidence acceptable to EMNRD that the service or equipment was purchased for the sole use of the sale and installation of a qualified energy system.

3.0 TECHNICAL OVERVIEW

3.1 Description

The completed Project consists of a 1.2 MW DC (1.0 MW AC) ground mounted, fixed-tilt PV system with the following major components:

- Jinko 72 solar PV modules, 325 watt, 1500 volt, JKM325P-V
- GE 1.1 MW central inverter, 1,500 volt, LV5-1511-30-UL-SLR
- Eaton 1500 VDC PV Collection Systems (combiner boxes)
- PTI Step-up transformer (n = 1)
- Unirac ground-fixed-tilt (GFT) racking

3.2 Component Warranties

The Project's major components have the following warranties:

Table 1. Major Component Warranties

System Component	Warranty
Jinko 72 solar PV modules, 325 watt	25 year production warranty; 10 year warranty on materials and workmanship (replacement labor not included)
GE 1.1 MW central inverter	5 year product warranty; 10, 15, & 20 year extended warranty available at additional cost
PTI Step-up transformer	12 month standard warranty; 5 year extended warranty available at additional cost
Unirac GFT racking	10 year product warranty

3.3 PV System Design and Layout

The PV system is configured to have approximately 18 modules per string and approximately 199 strings in parallel. The fixed-tilt PV system is oriented on an azimuth of 180 degrees, with a tilt-angle of 30 degrees. Refer to Appendix A for construction photos and to Appendix B for Project design drawings.

3.4 Project Construction Cost

The original design-build agreement values, change order value, and work delay penalty value are summarized in Table 2. Construction costs summarized in Table 2 do not include Project planning and management costs, including feasibility assessment, geotechnical analysis, legal services, and project management support.

Table 2. Project Construction Cost

Category	Value
Engineering	$60,000.00
Permitting	$12,000.00
Interconnection	$96,000.00
Mobilization / Equipment	$60,000.00
PV Modules	$636,000.00
Inverters	$220,000.00
Transformers	$125,000.00
Electrical materials (conduit, fittings, couplings, wire, connectors)	$120,000.00
Unirac GFT Racking	$180,000.00
Labor	$600,000.00
Subtotal	$2,109,000.00
Change Order No. 1: excavation and concrete foundation for racking system (4/14/17)	$145,456.34
Subtotal	$145,456.34
Work Stoppage Cost (6/2/17 through approx. 7/2/17)	$30,000.00
Subtotal	$30,000.00
Total	$2,284,456.34

4.0 PROJECT DEVELOPMENT

4.1 Geotechnical Analysis

The geotechnical engineering analysis was completed by GeoTest on March 10th, 2017, with the final geotechnical report provided to NPHA on March 23rd, 2017.

The geotechnical analysis determined that the soils encountered at the test boring locations consisted of a surface layer comprised of clay with various amounts of fine sand. These soils, which extended to depths of about 1½ to 2 feet at the boring locations, are of medium plasticity, and ranged from soft to moderately firm. Directly underlying the surficial clay layer, clayey gravels with various amounts of sand and occasional cobbles were encountered and extended to auger refusal at depths of between 5 to 6 feet below existing site grade. It was determined that the auger refused on cobbles and/or possibly boulders, at the refusal depth. These soils ranged from non-plastic to low in plasticity and ranged from medium dense to very dense.

Based on the geotechnical profile underlying the site and the results of the standard penetration tests, it was anticipated that driving the piles would be very difficult, or impossible, to depths greater than about 5 or 6 feet, at least throughout most of the site. Thus, pre-drilling or heavier gauge piling would be required, or the piles could be placed in short straight, drilled, cast-in-place concrete piers.

4.2 Construction

Based on input from the geotechnical consultant, NPHA and the solar developer negotiated Change Order No. 1, dated 4/14/17 ($145,456.34) to pay for additional construction costs for the concrete foundations of the solar PV array racking system.

NPHA issued the Notice to Proceed to the solar developer on April 14, 2017.

As shown in construction photos included in Appendix A, the solar developer excavated trenches for the concrete piers using an excavator and backhoe.

Due to a delay in securing matching funding from Peoples Bank for the Project, NPHA was unable to process the solar developer's initial pay application. This situation resulted in the solar developer issuing a Stop Work Notice on May 26th, 2017, effective on June 2nd, 2017. Once the Tribe secured the loan from Peoples Bank, NPHA processed the outstanding pay application and the solar developer subsequently returned to the Project site. Under the terms of the design-build agreement, NPHA was obligated to pay additional costs associated with the solar developer demobilizing/remobilizing, delay, and startup, plus interest.

Once the solar developer recommenced onsite construction, the Project development proceeded through completion without any significant issues.

The Project construction period lasted 249 days (8 months, 5 days), from the solar developer's Notice to Proceed (4/14/17) to beginning commercial operation (12/18/17). Putting aside the interim period when the solar developer stopped work, given the remote Project location and the additional time to complete the concrete foundations, the total construction duration was not excessive.

4.3 Local Workforce Training

Under the design-build agreement, the solar developer was responsible for hiring and training local workers from the Pueblo and Peñasco area as part of Project construction. During construction, NPHA and the Tribe indicated that the solar developer did not hire sufficient numbers of local workers, the workers were paid less than the prevailing wage rates, and the workers were not trained beyond the level required for manual labor.

5.0 PROJECT PERFORMANCE AND MONITORING

5.1 PV System Electrical Production

Using the modeling software PVsyst, the solar developer estimates that their proposed PV system will generate 2,293,000 kWh in year 1.

As part of the feasibility analysis for the Project, SMA developed financial and performance projections using the National Renewable Energy Laboratory (NREL) System Advisor Model (SAM). SMA projected that the solar developer's proposed PV system would produce approximately 2,207,465 kWh in year one, which is only 3.7% less than the solar developers estimate (SMA, 2017). This is difference likely due to the solar developer's use of different model than SAM (NREL, 2014), and because the selected developer used data from a NREL NSRDB Station other than Peñasco, NM.

For this report, the Tribe provided Project power generation records from January 2018 through March 2020, summarized in Table 3.

Table 3. Project Power Generation and Revenue, January though October, 2018

Month	kWh	PPA Revenue ($0.09/kWh)
Jan-18	53,451	$ 4,811.00
Feb-18	98,853	$ 8,897.00
Mar-18	137,280	$ 12,355.00
Apr-18	214,689	$ 19,322.00
May-18	235,691	$ 21,212.00
Jun-18	83,745	$ 7,537.00
Jul-18	128,927	$ 11,603.00
Aug-18	200,514	$ 18,046.00
Sep-18	195,997	$ 17,640.00
Oct-18	149,142	$ 13,423.00
Nov-18	140,677	$ 12,661.00
Dec-18	103,348	$ 9,301.00
Jan-19	96,186	$ 8,657.00
Feb-19	90,733	$ 8,166.00
Mar-19	149,337	$ 13,440.33
Apr-19	176,355	$ 15,871.95
May-19	203,726	$ 18,335.34
Jun-19	203,956	$ 18,356.04
Jul-19	50,786	$ 4,570.74
Aug-19	190,542	$ 17,148.78
Sep-19	156,388	$ 14,074.92
Oct-19	65,623	$ 5,906.07
Nov-19	32,301	$ 2,907.09
Dec-19	25,496	$ 2,294.64
Jan-20	76,276	$ 6,864.84
Feb-20	45,829	$ 4,124.61
Mar-20	173,951	$ 15,655.59

The first two months or operation, January and February, 2018, the Project was not generating power every day due to startup testing and issues with the GE central inverter. The GE central inverter faulted again in June and July, 2018, in July, 2019, and September through February, 2019, causing additional days with no generation. In 2018, NPHA and the solar developer coordinated with GE regarding these issues, resulting in GE service technicians visiting the Project and correcting the faults. In 2019 and in 2020, the Tribe coordinated directly with GE to address the reoccurring inverter issues.

Based on the assumed full production months from both 2018 and 2019, and assuming 200,000 kWh were generated in July, the Project generates approximately 1,988,390 kWh per year. This value is approximately 200,000 kWh less than the solar developer's and feasibility study estimated annual power generation. Clearly, the Tribe needs to closely monitor Project performance to address issues as they arise and limit periods of non-production. Project power generation data should routinely be compared to the feasibility study's annual and monthly power generation.

5.2 PV System Performance Monitoring

For at least the first year after Project completion, a redundant production meter owned by the Tribe was not in-place. Therefore, the Tribe was reliant on KCEC's Project production data from the KCEC-owned meter. As specified in the PPA, the Tribe should independently monitor Project production to ensure that the Tribe is compensated for all Project generation and to resolve any discrepancies between production records.

Under the design-build agreement, the solar developer was responsible for providing NPHA and the Tribe with remote, real-time performance monitoring of the Project. There were protracted issues with NPHA and the Tribe's infrastructure to accommodate this monitoring capability through the central inverter. NPHA was able to remotely monitor the inverter status for several months in 2018. The Tribe coordinated with GE in 2019 to resolve technical issues, resulting in the Tribe being able to remotely monitor Project status sometime in 2019.

SMA is not aware of the current status of the Tribe's production meter or the Tribe's monitoring or recording production data.

6.0 CONCLUSION AND RECOMMENDATIONS

Despite several challenges, the Project was successfully completed and provides the opportunity for the Tribe to generate long-term revenue to offset the Pueblo's electric utility costs and support critical Tribal programs. To ensure that the Project continues to provide benefits to the Tribe, it is incumbent on the Tribe to actively maintain the Project.

It is critically important that the Tribe install a redundant Tribally-owned production meter to record Project power generation. The power generation data from this meter will be used to calculate the invoices under the PPA and reconcile any discrepancies between the Tribe's meter and KCEC's meter.

The Tribe should pay for PV system operation and maintenance (O&M) training for several Tribal employees who can be consistently relied upon to perform Project O&M. These Tribal employees should be responsible for: 1) operating and maintaining the Tribally-owned production meter and remote monitoring equipment; and 2) ensuring production data is recorded and maintained. Monitoring Project performance is critical to ensure that the PV system is operating normally and that any issues are addressed in a timely manner.

As discussed in the feasibility assessment, the Tribe should contribute a portion of the PPA revenues to reserve fund to pay for O&M expenses, including central inverter replacement. It is anticipated that the central inverter would need to be replaced or undergo significant upgrade every 10-15 years.

7.0 LESSONS LEARNED

Through the course of developing the Project, there were several important lessons learned that should be viewed as instructive for all future tribal energy projects:

1. The Project would have benefitted from having the RFP advertised more broadly and for a longer period of time. Because the RFP was only advertised in a local paper for three days, very few firms requested the RFP from NPHA. This resulted in having to choose from less competitive proposals from experienced contractors and relatively cost competitive proposal from less qualified firms.
2. The geotechnical analysis should have been completed before the Project procurement process began. The completed geotechnical analysis report should have been included in the RFP document. Not performing geotechnical analysis before advertising the RFP resulted in technical and cost proposals that did not take into account problematic subsoil conditions and additional costs associated with concrete foundations for racking. At the point that geotechnical analysis was completed, NPHA had already selected the solar developer, so the Project did not benefit from competitive costs proposals from multiple

solar developers that took into account the additional work required for the concrete foundations.

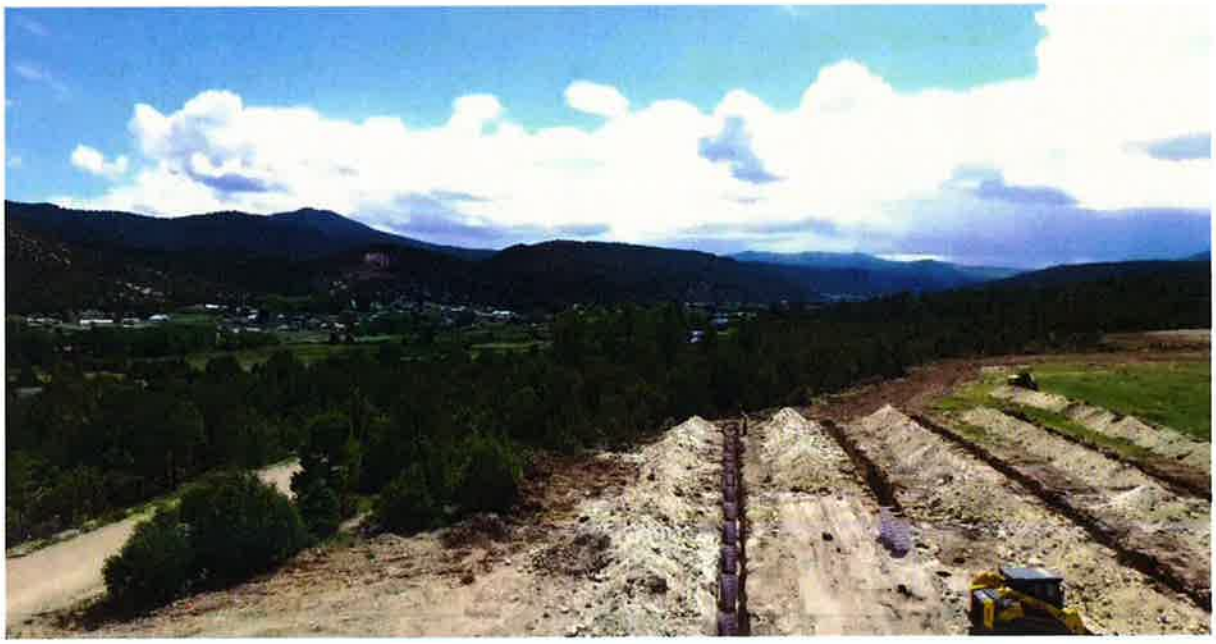
3. By issuing the notice to proceed to the solar developer before the matching funding (conventional financing) was secured, The Pueblo of Picuris put the project in (1) grave danger of not being completed timely and (2) not being completed at all. This was due to the Pueblo's lack of financial commitment to honor cost sharing requirements for the administration of the grant. Additionally, the Pueblo had committed to NPHA, cost share funds through a Tribal Resolution(s) and a letter from the Governor. This issue resulted in a significant period of time when the solar developer stopped work due to delay in payment of the solar developer's first pay application and also caused additional Project costs associated with the solar developer's demobilization/remobilization and incurred interest. To avoid this problem in the future, all projects should resolve funding matters before initiating construction.
4. The design-build agreement did not sufficiently detail the solar developer's responsibilities for Project start-up, testing, commissioning, and provision of remote system monitoring. To avoid this problem in the future, all agreements with contractors should be explicit about the contractor's responsibilities for construction and start-up, testing, commissioning, and monitoring.

8.0 REFERENCES

Souder, Miller and Associates (SMA). 2017. Final Feasibility Study of Economics, Development and Performance of Solar Photovoltaics at the Pueblo of Picuris for the Northern Pueblos Housing Authority, Pojoaque, NM., March 15, 2017.

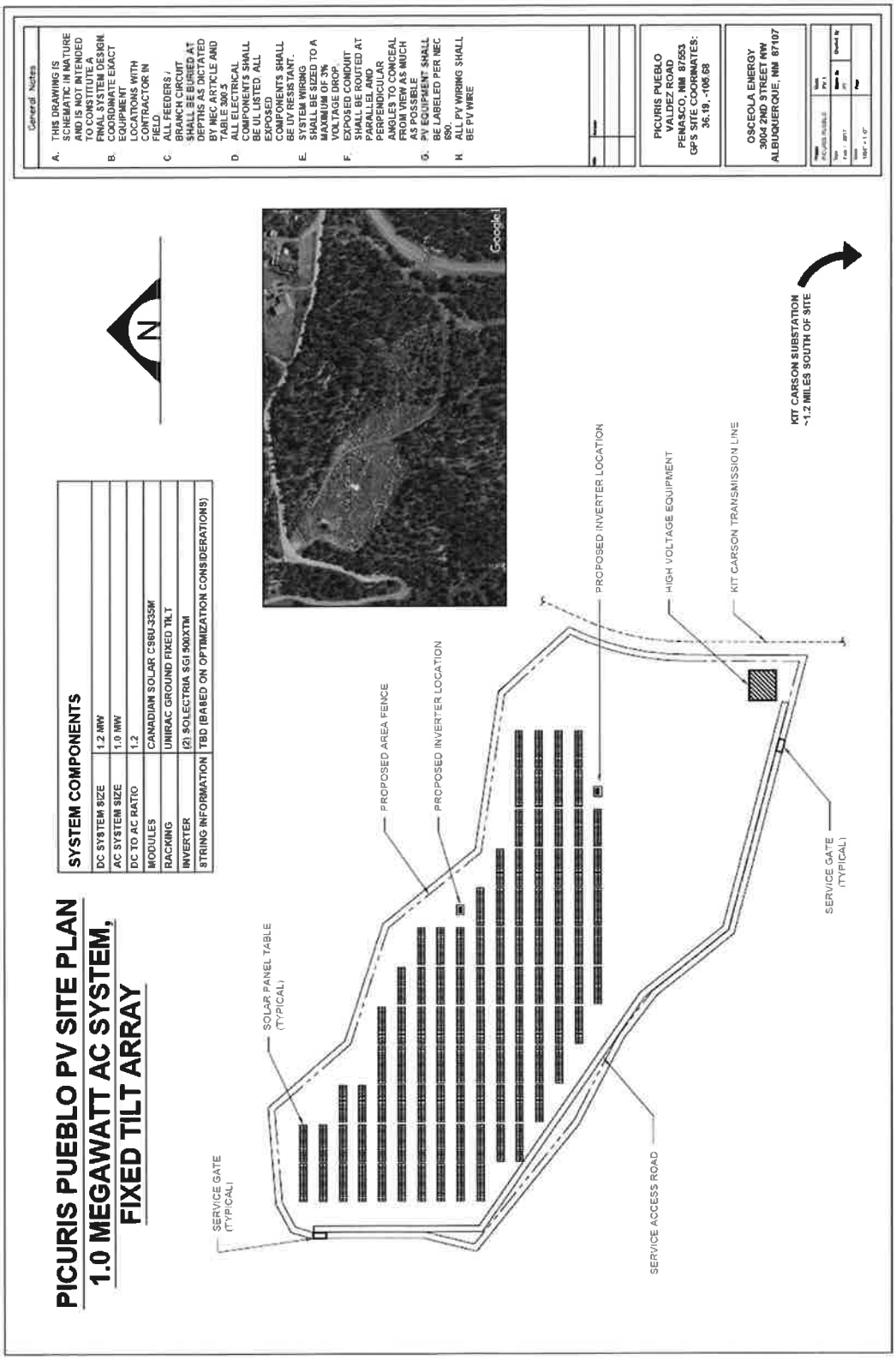
9.0 APPENDICIES

Appendix A - Construction Photos

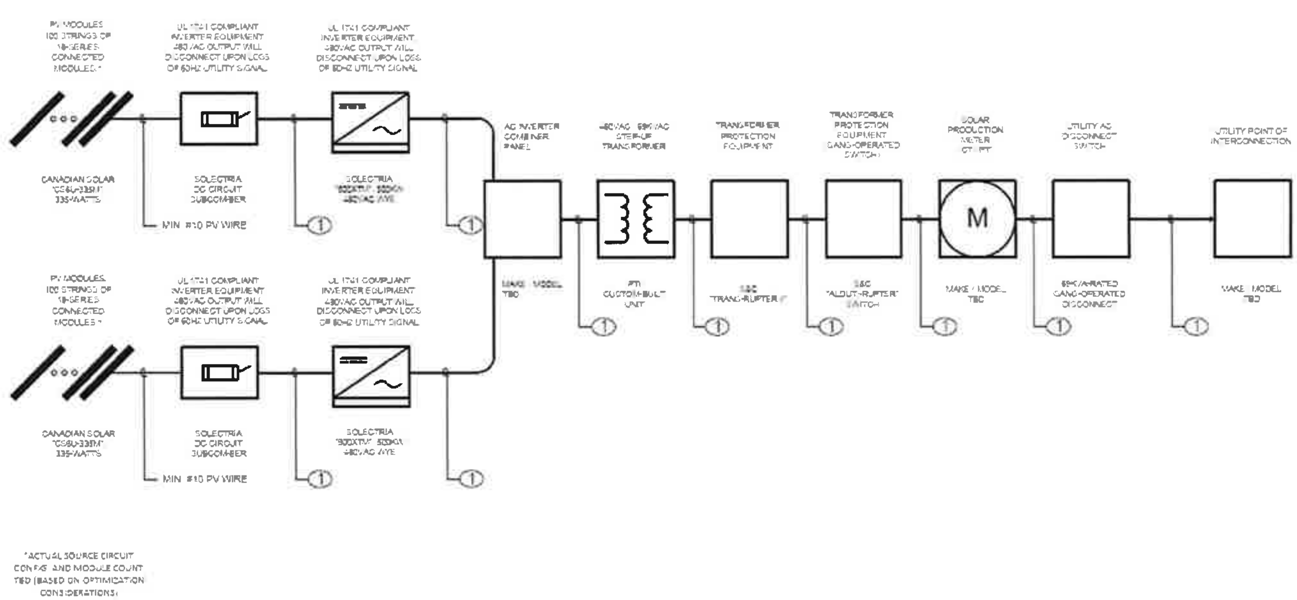


Appendix B - Project Design Drawings

OPTION A - PV SYSTEM DESIGN:



PICURIS PUEBLO PV LINE DIAGRAM
1.0 MEGAWATT AC SYSTEM



General Notes

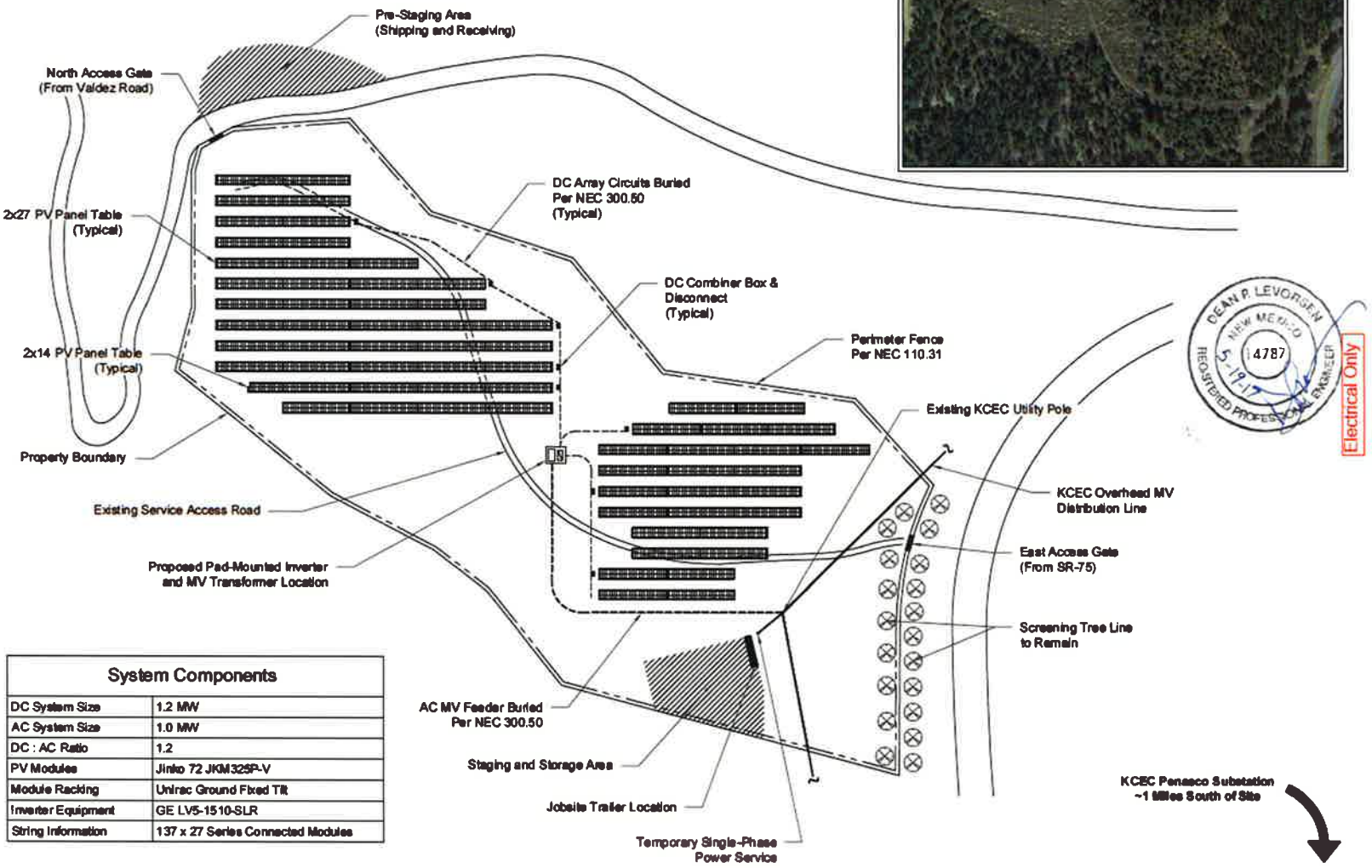
A. THIS DRAWING IS SCHEMATIC IN NATURE AND IS NOT INTENDED TO CONSTITUTE A FINAL SYSTEM DESIGN.
B. ALL ELECTRICAL COMPONENTS SHALL BE UL LISTED. ALL EXPOSED COMPONENTS SHALL BE UV RESISTANT.
C. SYSTEM WIRING SHALL BE SIZED TO A MAXIMUM OF 3% VOLTAGE DROP.
D. EXPOSED CONDUIT SHALL BE ROUTED AT PARALLEL AND PERPENDICULAR ANGLES TO CONCEAL FROM VIEW AS MUCH AS POSSIBLE.
E. PV EQUIPMENT SHALL BE LABELED PER NEC 690.
F. ALL PV WIRING SHALL BE PV WIRE.

KEYED NOTE:
1. TBD, BASED ON EQUIPMENT SPECIFICATIONS AND VOLTAGE DROP CONSIDERATIONS

PICURIS PUEBLO
VALDEZ ROAD
PENASCO, NM 87553
GPS SITE COORINATES: 36.19, -105.68

OSCEOLA ENERGY
3004 2ND STREET NW
ALBUQUERQUE, NM 87107

PICURIS PUEBLO PV SITE PLAN



System Components	
DC System Size	1.2 MW
AC System Size	1.0 MW
DC : AC Ratio	1.2
PV Modules	Jinko 72 JKM325P-V
Module Racking	Unirac Ground Fixed Tilt
Inverter Equipment	GE LV5-1510-SLR
String Information	137 x 27 Series Connected Modules

Electrical Only

General Notes

A. Coordinate exact equipment locations with contractor in field.
B. All feeder circuits shall be buried at depth as directed by NEC 300.50.
C. Contractor shall provide working space clearances as directed by NEC 110.26.
D. Contractor shall provide all labeling and signage as directed by NEC 690 Part VI, Article 110, Article 225, & Article 480.

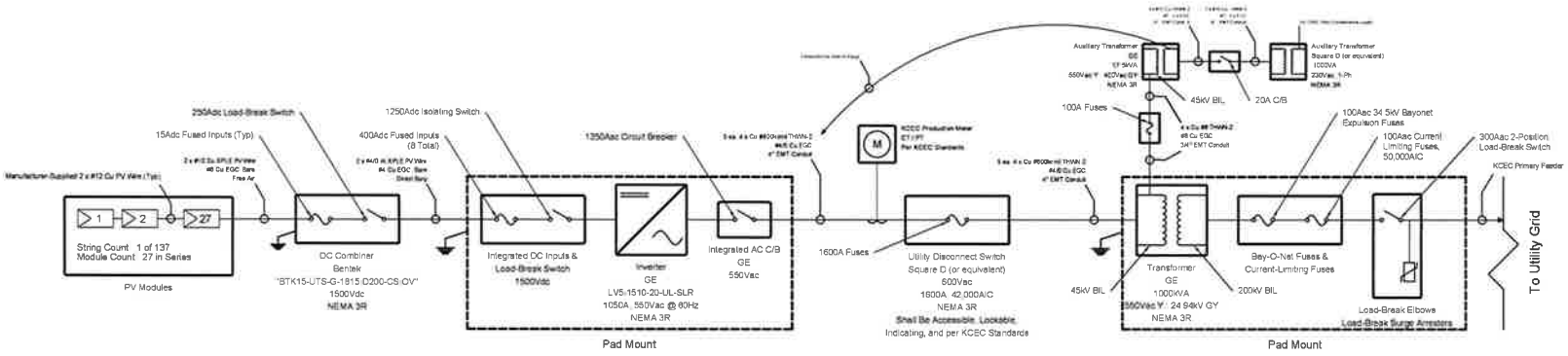
OSCEOLA ENERGY
DESIGN. BUILD. MAINTAIN.

PICURIS PUEBLO
VALDEZ ROAD
PENASCO, NM 87553
GPS SITE COORDINATES
36.19, -105.58

OSCEOLA ENERGY
3004 2ND STREET NW
ALBUQUERQUE, NM 87107

One-Line Diagram

OSCEOLA ENERGY
DESIGN. BUILD. MAINTAIN.



Module Specification	
3,699 x Jinko "72 JKM325PV"	
Max Power Rating	325 W (1500Vdc)
Vmp	37.6 V
Imp	8.89 A
Voc	46.7 V
Isc	7.4 A

Inverter Specification	
GE "LV5-1510-20-UL-SLR	
Max AC Power Rating	1000 kW
Max Input Voltage	1500 Vdc
Min Input Voltage	850 Vdc

Wire Schedule		
Tier	Wire	Max Length
PV Source Cir.	2 x #10 Cu PV Wire	~350'
PV Output Cir.	2 x #4/0 Al PV Wire	~550'
Inverter Output Cir.	5 ea #600kcmil Cu THWN-2	~50'

General Notes

A. Refer to Site Plan for equipment location details.
B. All feeder circuits shall be buried at depth as directed by NEC 300.50.
C. Contractor shall provide working space clearances as directed by NEC 110.26.
D. Contractor shall provide all labeling and signage as directed by NEC 690 Part VI, Article 110, Article 225, & Article 450.
E. PV modules are UL 1703 compliant.
F. DC combiners are UL 1741 compliant.
G. Array racking system is UL 2703 compliant (not shown).
H. Inverter is UL 1741 compliant.
I. Utility Disconnect switchboard is UL 891 compliant.
J. MV Transformer equipment is UL certified to IEEE Standards.

Date	Revision	

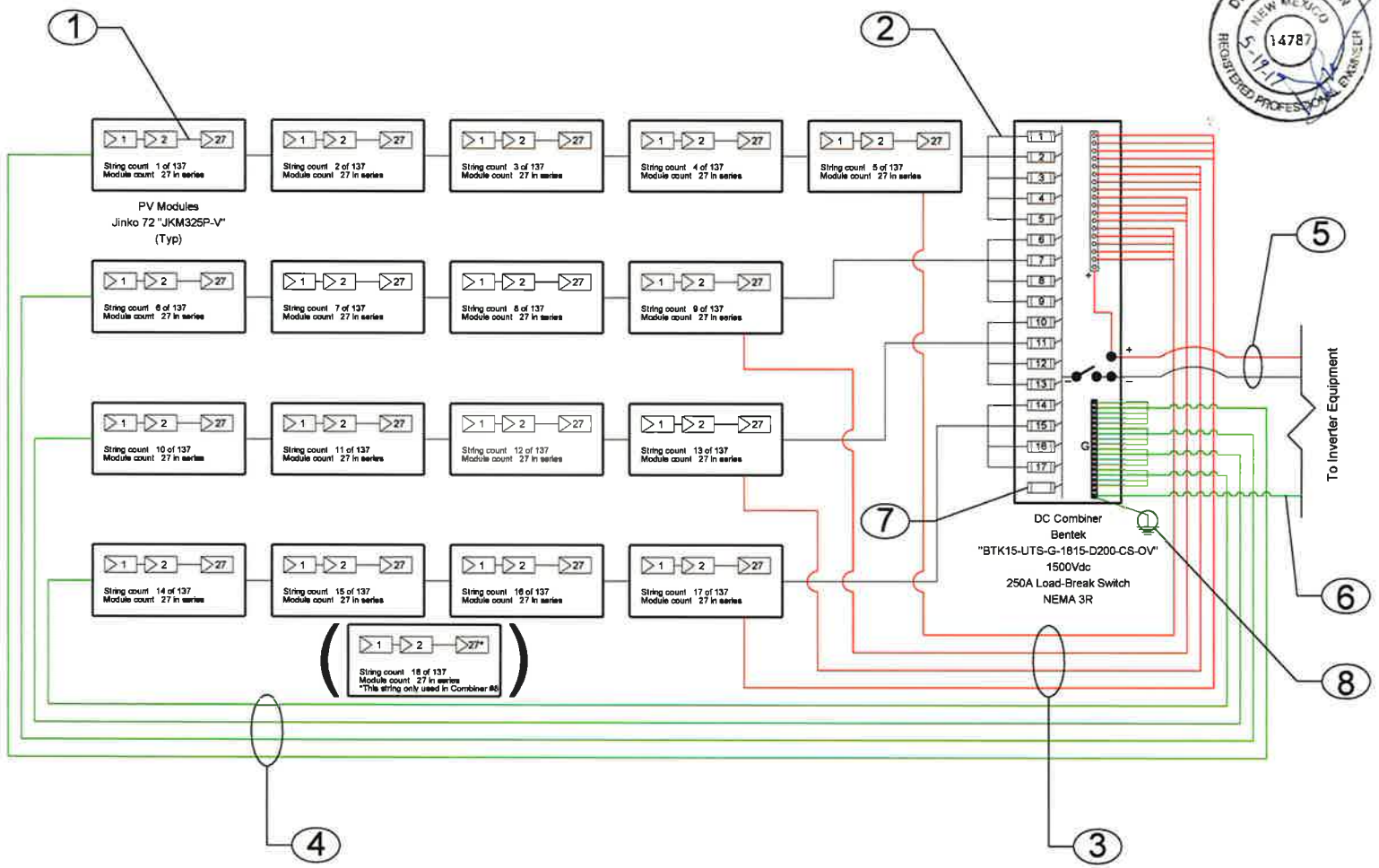
PICURIS PUEBLO
VALDEZ ROAD
PENASCO, NM 87553
GPS SITE COORINATES:
36.19, -105.68

OSCEOLA ENERGY
3004 2ND STREET NW
ALBUQUERQUE, NM 87107

Project: Picuris Pueblo	Sheet: PV-2.1	
Date: May 17, 2017	Drawn By: PT	Checked By: DF
Scale: NTS	Page: 1	

Line Diagram: PV Source Circuit Detail

OSCEOLA ENERGY
DESIGN. BUILD. MAINTAIN.



DEAN P. LEVORSEN
NEW MEXICO
14787
5-19-17
REGISTERED PROFESSIONAL ENGINEER

General Notes

A. Refer to Site Plan for equipment location details.
B. All feeder circuits shall be buried at depth as directed by NEC 300.50.
C. Contractor shall provide working space clearances as directed by NEC 110.26.
D. Contractor shall provide all labeling and signage as directed by NEC 690 Part VI, Article 110, Article 225, & Article 450.
E. PV modules are UL 1703 compliant.
F. DC combiners are UL 1741 compliant.
G. Array racking system is UL 2703 compliant (not shown).

Keyed Notes

1. Manufacturer-Supplied #12 Cu PV Wire XLPE, Free air (Typ)
2. #10 Cu PV Wire XLPE, Free air (Typ)
3. #10 Cu PV Wire XLPE, Free air
4. #6 Cu Solid / Stranded (EGC)
5. #4/0 Al PV Wire XLPE, Direct bury
6. #4 Cu Solid / Stranded (EGC), Direct bury
7. Input #18 only used in dc combiner #8, and in no other dc combiners
8. #6 (min.) Solid / Stranded (GEC), Bare, to grounding electrode rod

Mark	Revision	

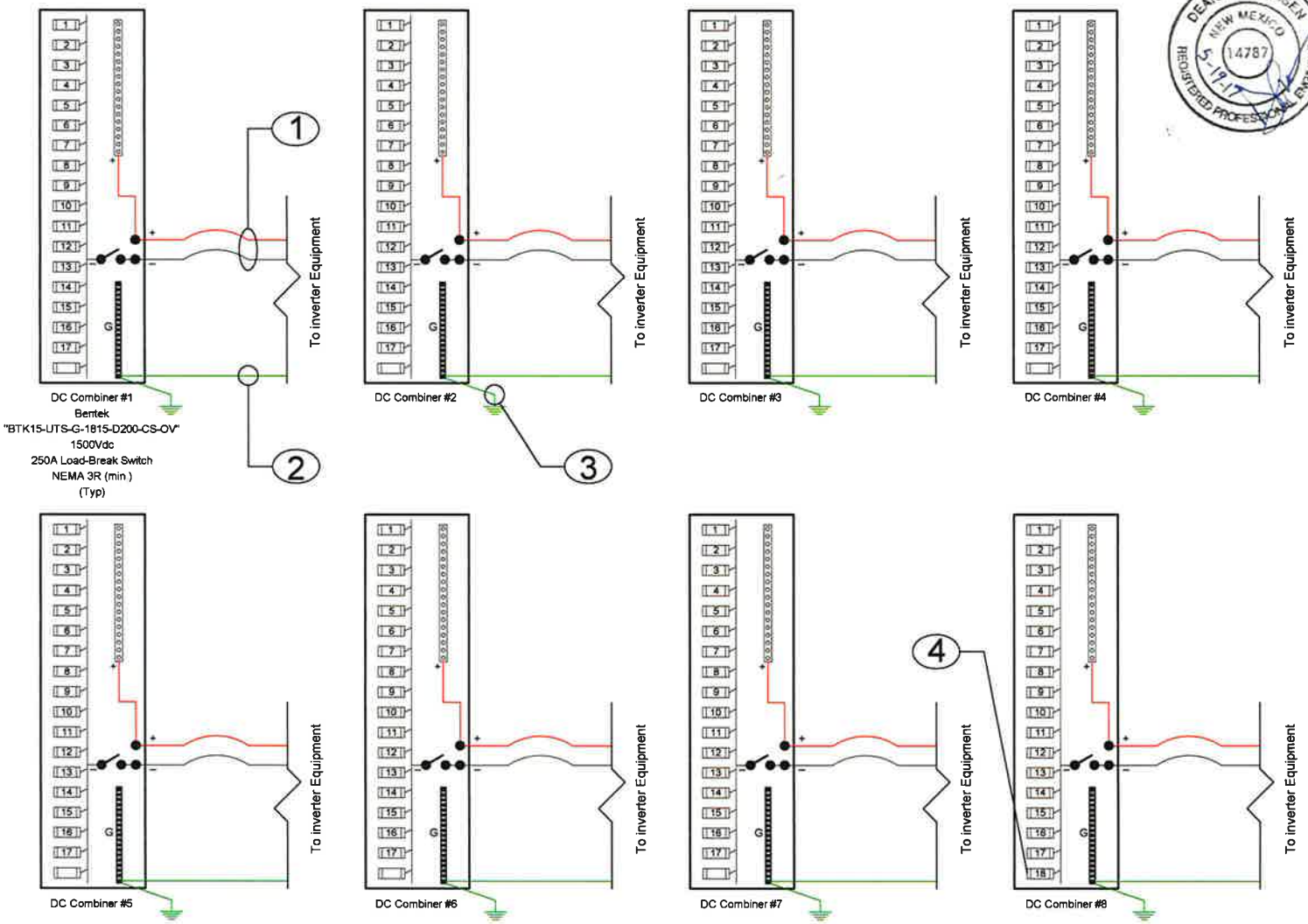
PICURIS PUEBLO
VALDEZ ROAD
PENASCO, NM 87553
GPS SITE COORINATES
36.19, -105.68

OSCEOLA ENERGY
3004 2ND STREET NW
ALBUQUERQUE, NM 87107

Project	Sheet
P curis Pueblo	PV 2.2
Date: May 11 2017	Drawn By: P / Checked By: DF
Scale: N S	Page: 2

Line Diagram: PV Output Circuit Detail

OSCEOLA ENERGY
DESIGN. BUILD. MAINTAIN.



DEAN P. LEVORSEN
NEW MEXICO
14787
5-19-17
REGISTERED PROFESSIONAL ENGINEER

General Notes

1. Refer to Site Plan for equipment location details.
2. All feeder circuits shall be buried at depth as directed by NEC 300.50.
3. Contractor shall provide working space clearances as directed by NEC 110.26.
4. Contractor shall provide all labeling and signage as directed by NEC 690 Part VI, Article 110, Article 225, & Article 450.
5. DC combiners are UL 1741 compliant.

Keyed Notes

1. #4/0 Al PV Wire XLPE, Direct bury, Above ground to underground in 1 1/2" PVC conduit (Typ)
2. #4 Cu Solid / Stranded (EGC), Bare, Above ground to underground in 1 1/2" Sch. 80 PVC conduit (Typ)
3. #6 (min.) Solid / Stranded (GEC), to grounding electrode rod (Typ)
4. DC Source circuit input #18 only used in dc combiner #8, and in no other dc combiners

Date	Revision

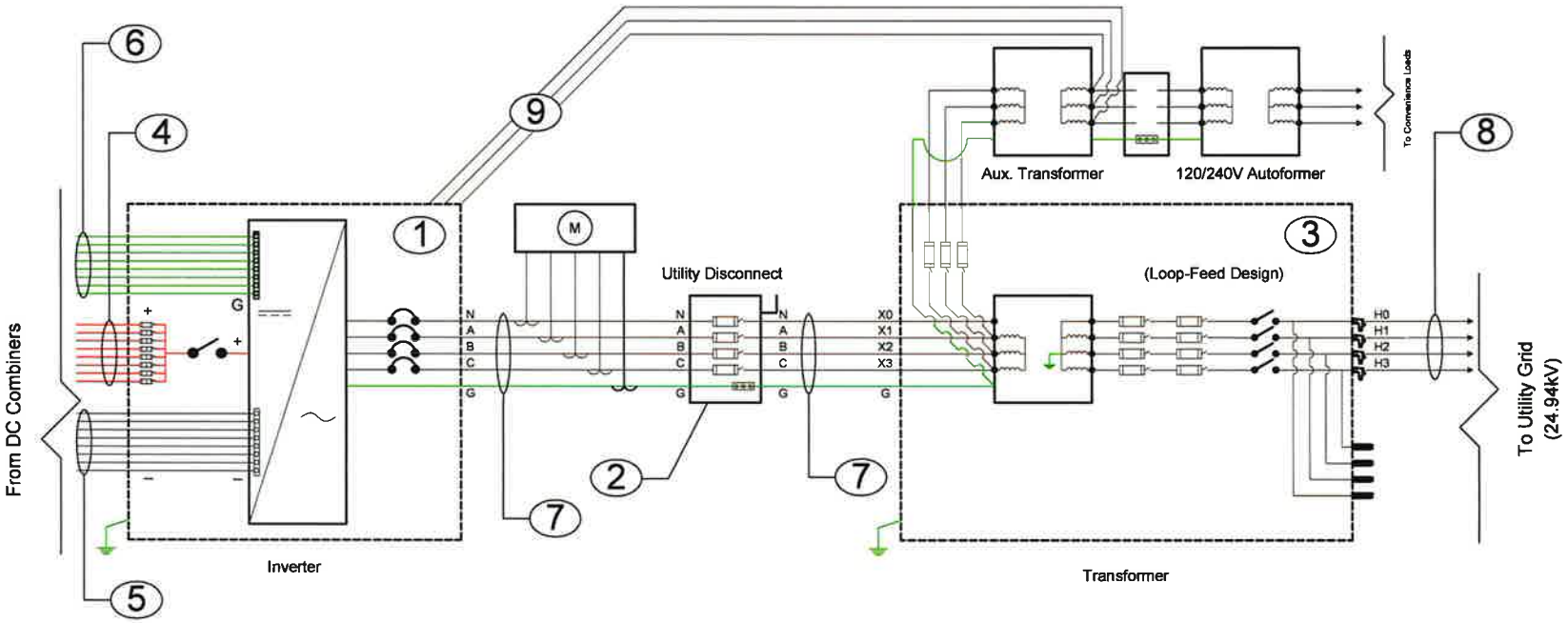
PICURIS PUEBLO
VALDEZ ROAD
PENASCO, NM 87553
GPS SITE COORINATES
36.19, -105.68

OSCEOLA ENERGY
3004 2ND STREET NW
ALBUQUERQUE, NM 87107

Project: P curis Pueblo	Sheet: PV 2.3	
Date: May 11 2017	Drawn By: P	Checked By: DP
Scale: N S	Page: 3	

Line Diagram: Inverter, Utility Disconnect, & Transformer Details

OSCEOLA ENERGY
DESIGN. BUILD. MAINTAIN.



DEAN P. LEVORSEN
NEW MEXICO
14787
5-19-17
REGISTERED PROFESSIONAL ENGINEER

General Notes

A. Refer to Site Plan for equipment location details.
B. Refer to PV 2.1 One Line for additional information.
C. All feeder circuits shall be buried at depth as directed by NEC 300.50.
D. Contractor shall provide working space clearances as directed by NEC 110.26.
E. Contractor shall provide all labeling and signage as directed by NEC 690 Part VI, Article 110, Article 225, & Article 450.
F. Inverter is UL 1741 compliant.
G. Utility Disconnect Switch is UL 891 compliant.
H. MV Transformer equipment is UL certified to IEEE standards.

Keyed Notes

1. Nominal 550Vac output @ 60Hz. Inverter will internally disconnect upon loss of utility grid signal.
2. Service entrance rated. Shall be accessible, manually operable, lockable, indicating, and per KCEC standards.
3. MV 550Vac : 25kVac Step up transformer equipment.
4. #4/0 Al PV Wire XLPE, Direct bury, Underground to above ground in 1 1/2" PVC conduit (Typ)
5. #4/0 Al PV Wire XLPE, Direct bury, Underground to above ground in 1 1/2" PVC conduit (Typ)
6. #4 Cu Solid / Stranded (EGC), Bare, Underground to above ground in 1 1/2" PVC conduit (Typ)
7. 5 ea. 4 x 600kcmil THWN 2 and #4/0 Cu EGC in 3" EMT conduit (Typ)
8. Utility feeders, installed by KCEC
9. Conductors from Auxiliary transformer to inverter equipment

Date	Revision

PICURIS PUEBLO
VALDEZ ROAD
PENASCO, NM 87553
GPS SITE COORINATES
36.19, -105.68

OSCEOLA ENERGY
3004 2ND STREET NW
ALBUQUERQUE, NM 87107

Project	Sheet
P curis Pueblo	PV 2.4
Date: May 11 2017	Drawn By: P / Checked By: DF
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GENERAL NOTES

1. ALL CONSTRUCTION FOR UNIRAC'S "GROUND FIXED TILT" (GFT) RACKING SYSTEM AND FOUNDATION REQUIREMENTS SHALL CONFORM TO THE 2009, 2012, AND 2015 EDITION OF THE INTERNATIONAL BUILDING CODE (IBC).
2. WHEREVER THE TERM CONTRACTOR IS USED IN THE CONSTRUCTION DOCUMENTS, IT SHALL BE DEFINED TO MEAN THE GENERAL CONTRACTOR AND ANY SUB-CONTRACTOR COLLECTIVELY AS APPLICABLE AND AS REQUIRED.
3. THE CONTRACT "STRUCTURAL RACKING" DRAWINGS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE MEANS, METHOD, OR SEQUENCE OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR AND PROVIDE ALL MEASURES NECESSARY TO PROTECT THE RACKING SYSTEM FROM THE POINT OF MATERIAL DELIVERY THROUGH THE COMPLETION OF CONSTRUCTION. UNIRAC AND THE ENGINEER OF RECORD WILL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S MEANS, METHODS, TECHNIQUES, SEQUENCES OR PROCEDURES OF CONSTRUCTION. UNIRAC AND THE ENGINEER OF RECORD WILL NOT BE RESPONSIBLE FOR CONSTRUCTION SITE SAFETY, OR SAFETY PRECAUTIONS AND PROGRAMS INCIDENT HERETO.
4. IT IS THE CONTRACTOR'S RESPONSIBILITY TO INSPECT AND ENSURE THAT ALL WORK IS IN CONFORMANCE WITH THE CONTRACT DOCUMENTS. ANY STRUCTURAL INSPECTION/OBSERVATION PROVIDED BY OTHERS DOES NOT RELIEVE THE CONTRACTOR OF THIS RESPONSIBILITY.
5. ANY DEVIATIONS FROM THE CONTRACT DOCUMENTS THAT ARE ENCOUNTERED AT A LATER DATE AND ARE DECLARED TO BE SIGNIFICANT BY THE RACKING DISTRIBUTOR SHALL BE CORRECTED BY THE CONTRACTOR (AT THE CONTRACTOR'S EXPENSE).
6. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND COORDINATE SITE CONDITIONS WITH THESE DRAWINGS PRIOR TO BIDDING OR THE START OF CONSTRUCTION. ANY CONFLICTS, DISCREPANCIES, OR OMISSIONS SHALL BE RESOLVED THROUGH YOUR RACKING DISTRIBUTOR PRIOR TO PROCEEDING.
7. DO NOT SCALE OFF OF THESE DRAWINGS. WRITTEN DIMENSIONS SHALL BE USED OR WHERE NO DIMENSION IS PROVIDED, CONSULT WITH YOUR RACKING DISTRIBUTOR FOR CLARIFICATION BEFORE PROCEEDING WITH THE BID OR THE WORK.
8. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT THE EQUIPMENT AND INSTALLATION PROCESS (MEANS AND METHODS) ARE APPROPRIATE FOR THE FOUNDATIONS AND THAT THE PILES ARE INSTALLED TO THE SPECIFIED TOLERANCES. UNIRAC IS NOT RESPONSIBLE FOR DAMAGED AND/OR OUT-OF-TOLERANCE PILES DUE TO IMPROPER INSTALLATION EQUIPMENT AND METHODS.
9. WHERE ANY DISCREPANCIES OCCUR BETWEEN PLANS, DETAILS, STRUCTURAL NOTES AND SPECIFICATIONS, THE GREATER (MOST CONSERVATIVE) REQUIREMENTS SHALL GOVERN. WHERE NO SPECIFIC DETAIL IS SHOWN, CONSTRUCTION SHALL CONFORM TO SIMILAR WORK ON THE PROJECT, OR IF THERE IS NO SIMILAR WORK, THEN CONSTRUCTION SHALL CONFORM TO INDUSTRY STANDARDS. CONTRACTOR MUST INFORM UNIRAC OF ANY DISCREPANCIES.
10. REFER TO SITE PLAN, PILE LAYOUT DRAWING, ELECTRICAL DRAWINGS AND/OR OTHER CIVIL DRAWINGS FOR SPECIFIC PILE LOCATIONS, NORTH-SOUTH PILE SPACING, LOCATION AND DETAILS OF CURBS, INVERTER/EQUIPMENT PADS, TRENCHING/CONDUIT LOCATIONS, JUNCTION BOXES, SITE WORK ITEMS, ETC. AND DIMENSIONS NOT SHOWN ON STRUCTURAL RACKING DRAWINGS.
11. CONTRACTOR SHALL INVESTIGATE THE SITE DURING CLEARING AND EARTHWORK OPERATIONS FOR FILLED EXCAVATIONS OR BURIED STRUCTURES, SUCH AS CESSPOOLS, CISTERNS, FOUNDATIONS, ETC.
12. ASTM SPECIFICATIONS ON THE DRAWINGS SHALL BE OF THE LATEST ASTM STANDARD SPECIFICATION.
13. ANY ENGINEERING DESIGN PROVIDED BY OTHERS AND SUBMITTED FOR REVIEW SHALL BEAR THE SEAL OF A PROFESSIONAL CIVIL OR STRUCTURAL ENGINEER REGISTERED IN THE STATE OF NEW MEXICO.
14. THE FOLLOWING DESIGN CRITERIA IS EXCLUDED FROM THE RACKING AND FOUNDATION DESIGN: FLOOD LOADING, DEBRIS LOADING, DYNAMIC ANALYSIS, ACTS OF GOD (TORNADO, HURRICANE, WATER INUNDATION LOADING, ETC.), EROSION, EXPANSIVE SOILS, FROST HEAVE, SOIL LIQUEFACTION, DYNAMIC LOADING FROM SEISMIC EVENTS AND CONDITIONS. IF REQUIRED, THESE SERVICES CAN BE PERFORMED AT AN ADDITIONAL EXPENSE TO THE CLIENT.
15. DESIGN CRITERIA PER ASCE 7-10
    - DESIGN WIND SPEED = 105 MPH
    - GROUND SNOW LOAD = 40 PSF
    - ICE THICKNESS = 0.5 INCHES
    - ICE LOAD WIND SPEED = 40 MPH
    - SEISMIC Ss = 1.5
    - SEISMIC S1 = 0.5
    - SOIL SITE CLASS = D
    - WIND EXPOSURE CATEGORY = C
    - HURRICANE ZONE = NO
    - OCCUPANCY CATEGORY = I
    - MINIMUM OF 20' OFFSET FROM NEAREST ADJACENT BUILDING (TO AVOID SNOW DRIFT.)

    IMPORTANCE FACTORS BASED ON OCCUPANCY CATEGORY I.
    "DESIGN WIND PRESSURES PER ASCE 7-10, SECTION 27.4.3, "WIND LOAD ON OPEN BUILDING WITH MONOSLOPE, PITCHED OR TROUGHED ROOFS", AND SECTION 30.8.2, "COMPONENTS AND CLADDING" FOR MONOSLOPED PITCHED OR TROUGHED ROOFS.
16. SOLAR REQUIREMENTS (FROM OWNER). SEE SHEET SR-200
17. CORROSION PROTECTION REQUIREMENTS
    - COLD-FORMED STEEL MEMBERS = G180 MINIMUM (ASTM A653)
    - HARDWARE = STAINLESS STEEL/DELTA PROTEKT
18. ABOVE GRADE CORROSION PROTECTION WILL SUFFICE FOR MOST ENVIRONMENTAL CONDITIONS. BELOW GRADE CORROSION PROTECTION WILL SUFFICE FOR MOST SOILS WITH RESISTIVITY VALUES GREATER THAN 10,000 OHM/CM. IT IS THE OWNER'S RESPONSIBILITY TO DETERMINE IF THE SOILS ARE MORE CORROSIVE AND FURTHER CORROSION PROTECTION WILL BE REQUIRED.
19. IT IS THE CONTRACTOR'S RESPONSIBILITY TO SPICE EAST-WEST BEAMS (AS REQUIRED) TO COMPLETE THE TABLE AND AVOID SPLICE CONFLICTS SPECIFIED IN DETAIL 502 ON SHEET SD-500

SPECIAL INSPECTION

STRUCTURAL ONLY: SPECIAL INSPECTION IS TO BE PROVIDED FOR THE ITEMS LISTED BELOW IN ADDITION TO THE INSPECTIONS CONDUCTED BY THE BUILDING JURISDICTION. "SPECIAL STRUCTURAL INSPECTION" SHALL NOT RELIEVE THE OWNER OR THEIR AGENT FROM REQUESTING THE BUILDING JURISDICTION INSPECTIONS REQUIRED.

1. FOUNDATIONS ELEMENTS: PERIODICALLY DURING THE PLACEMENT OF ALL PLACED FOUNDATION ELEMENTS ON STRUCTURAL DRAWINGS.
   - A. VERIFICATION OF ELEMENT MATERIALS, SIZES AND LENGTHS
   - B. PERIODIC OBSERVATION AND DOCUMENTATION OF OPERATIONS. PERIODIC DEFINED AS AT LEAST ONE VISIT ON EACH DAY OF WORK. A MINIMUM OF 10% OF PILE INSTALLATIONS SHALL BE INSPECTED.
   - C. VERIFICATION OF PLACEMENT LOCATIONS AND PLUMBNESS, SIZE AND TYPE OF HAMMER, ELEVATION OF TIP AND BUTT, ANY DAMAGE TO FOUNDATION ELEMENT, ETC.

2. HIGH STRENGTH BOLTING: VERIFICATION OF TORQUE PER TORQUE TABLE SHOWN

ALUMINUM

1. ALL ALUMINUM EAST-WEST BEAM MEMBERS HAVE BEEN DESIGNED IN ACCORDANCE WITH THE "ALUMINUM DESIGN MANUAL" BY THE ALUMINUM DESIGN ASSOCIATION, CURRENT ADDITION
2. ALL ALUMINUM EAST-WEST BEAMS CONFORM TO ONE OF THE FOLLOWING
   - ALLOY 6005A TEMPER T61 (Ftu = 38 KSI, Fcy = 35 KSI)
   - ALLOY 6351 TEMPER T5 (Ftu = 38 KSI, Fcy = 35 KSI)
   - ALLOY 6061 TEMPER T6 (Ftu = 38 KSI, Fcy = 35 KSI)
3. ALL ALUMINUM EAST-WEST BEAMS HAVE A MILL FINISH
4. WELDING IS NOT REQUIRED OR PERMITTED UNLESS SPECIFICALLY APPROVED BY UNIRAC AND THE ENGINEER OF RECORD.
5. FIELD CUTTING OF ALUMINUM MEMBERS IS PERMITTED WHEN REQUIRED TO ACCOMMODATE PROJECT SPECIFIC MODULE WIDTHS

HARDWARE

1. ALL 1/4"Ø HARDWARE SHALL CONFORM TO 18/8 STAINLESS STEEL (AISI 300 SERIES STAINLESS, 304) OF DIMENSIONS PER ASME B18.2.1
2. ALL 1/4"Ø SELF DRILLING SCREW HARDWARE SHALL CONFORM TO GRADE 5 SAE J429 AND ASTM A449.
3. ALL 5/8"Ø AND 3/4"Ø BOLTS SHALL CONFORM TO GRADE 2 SAE J429 OR ASTM A307.
4. ALL 5/8"Ø AND 3/4"Ø SERRATED FLANGE NUTS SHALL CONFORM TO ASME B.18.16.4
5. ALL 5/8"Ø AND 3/4"Ø WASHERS SHALL CONFORM TO USS TYPE A WIDE OR ANSI TYPE A WIDE
6. UNIRAC T-BOLTS, MID CLAMPS, AND END CLAMPS ARE PROPRIETARY. TECHNICAL DATA SHEETS WITH TESTED CAPACITIES CAN BE PROVIDED UPON REQUEST
7. CORROSION PROTECTION FOR HARDWARE CAN BE FOUND IN THE GENERAL NOTES SECTION OF THIS DOCUMENT, NOTE 15.
8. ALL HARDWARE RECEIVED ON SITE SHALL BE CHECKED BY CONTRACTOR AGAINST THE SPECIFICATIONS ON THIS SHEET SD-100, DIAMETERS AND LENGTHS CALLED OUT ON RACKING DETAILS SHEET SD-500, AS WELL AS THE PROJECT BILL OF MATERIAL. ANY CONFLICTS, DISCREPANCIES, OR OMISSIONS MUST BE RESOLVED WITH THE RACKING DISTRIBUTOR AS SOON AS POSSIBLE AND PRIOR TO PROCEEDING

TORQUE REQUIREMENTS FOR THIS SPECIFIC PROJECT	
1/4"Ø HARDWARE =	9 - 11 FT-LBS
5/8"Ø HARDWARE =	54 - 66 FT-LBS
3/4"Ø HARDWARE =	99 - 121 FT-LBS

UNIRAC
GFT

GROUND
FIXED
TILT

COLD FORMED STEEL

1. ALL COLD FORMED STRUCTURAL STEEL MEMBER CONSTRUCTION SHALL BE IN ACCORDANCE WITH AISI "SPECIFICATIONS FOR DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS" CURRENT EDITION
2. ALL COLD-FORMED STRUCTURAL MEMBERS SHALL BE PER ICC-ER-4943P.
3. ALL COLD-FORMED STEEL CONFORMS TO ONE OF THE FOLLOWING
   - A653 HSLAS 50 (Fy = 50 KSI, Fu = 60 KSI)
   - A653 SS 50 CLASS 4 (Fy = 50 KSI, Fu = 60 KSI)
4. ALL COLD-FORMED STEEL MEMBERS ARE GALVANIZED PER ASTM A653 (MOST RECENT EDITION)
5. WELDING IS NOT REQUIRED OR PERMITTED UNLESS SPECIFICALLY APPROVED BY UNIRAC AND/OR THE ENGINEER OF RECORD.
6. FIELD CUTTING OF COLD-FORMED STEEL MEMBERS IS NOT REQUIRED OR PERMITTED UNLESS SPECIFICALLY APPROVED BY UNIRAC AND/OR THE ENGINEER OF RECORD
7. ALL CALCULATED COLD-FORMED MEMBER PROPERTIES PER AISI SPECIFICATIONS ARE BASED ON THE FOLLOWING MINIMUM THICKNESSES
   - 14 GAGE (0.070" OR 70 MILS)
   - 11 GAGE (0.120" OR 120 MILS)

SOLAR DESIGN

UNIRAC IS NOT THE SOLAR DESIGN ENGINEER OF RECORD AND IS NOT RESPONSIBLE FOR ANY SOLAR DESIGN, OUTPUT EFFICIENCIES, SHADING, ETC.

ELECTRICAL DESIGN

UNIRAC IS NOT THE ELECTRICAL ENGINEER OF RECORD AND IS NOT RESPONSIBLE FOR THE ELECTRICAL DESIGN FOR THIS PROJECT. THE UNIRAC GFT RACKING SYSTEM IS CERTIFIED TO UL-2703 WHEN PROPERLY INSTALLED. SEE THE GFT INSTALLATION GUIDE FOR MORE DETAIL

UNIRAC CUSTOM RACKING MEMBER SECTIONS					
RACKING MEMBER		DEPTH	WIDTH	THICKNESS	MIN. CORROSION PROTECT
	ALUMINUM BEAM	3.25 IN	2.0 IN	0.063-0.125 IN	AAMA 611-12
	ALUMINUM SPLICE	3.061 IN	1.818 IN	0.800-0.110 IN	AA-M12
	TOP CHORD CHANNEL	4.1 IN	3.42 IN	14 GAGE	G180
	DIAGONAL BRACE	3 IN	2 IN	14 GAGE	G180
	C-PILE	6 IN	4.5 IN	11 GAGE	G235

CIVIL/GRADING/SITE WORK

UNIRAC IS NOT THE CIVIL ENGINEER OF RECORD FOR THIS PROJECT AND IS NOT RESPONSIBLE FOR ANY SITE, GRADING, OR EROSION CONTROL PLANS

MATERIAL MANAGEMENT

PRIOR TO INSTALLATION, ALL MATERIALS MUST BE STORED PROPERLY. THIS MEANS MATERIALS REMAINING IN ONE PLACE FOR MORE THAN ONE WEEK MUST BE IN OPEN AIR CONDITIONS (I.E. UP AND ABOVE THE GROUND AND WATER TABLE). IF TARPS OR OTHER PROTECTIVE COVERS ARE USED, THEN ENDS SHALL BE LEFT OPEN FOR VENTILATION. TIGHT FITTING COVERINGS ARE NOT RECOMMENDED, SINCE THEY CAN TRAP MOISTURE. IF LONG GOODS ARE TO BE STORED HORIZONTALLY FOR MORE THAN ONE WEEK, PLACE BLOCKING OF SUFFICIENT HEIGHT BENEATH THE STACK ON PROPER INTERVALS TO MINIMIZE DEFORMATION AND TO LESSEN MOISTURE GAIN FROM THE GROUND

FOUNDATION NOTES:

1. THE FOLLOWING DESIGN CRITERIA IS EXCLUDED FROM DESIGN: FLOOD LOADING, DEBRIS LOADING, DYNAMIC ANALYSIS, ACTS OF GOD (TORNADO, HURRICANE, WATER INUNDATION LOADING, ETC.), EROSION, EXPANSIVE SOILS, FROST HEAVE, SOIL LIQUEFACTION, SOIL DYNAMIC LOADING FROM SEISMIC EVENTS AND CONDITIONS
2. SEE THE "COLD FORMED STEEL" SECTION FOR STEEL AND GALVANIZATION REQUIREMENTS FOR FOUNDATIONS.
3. UNIRAC SHALL NOT BE HELD LIABLE FOR ANY UTILITY LINES DAMAGED DURING FOUNDATION INSTALLATION. IT SHALL BE THE RESPONSIBILITIES OF OTHERS TO DETERMINE THE PLACEMENT OF EXISTING AND NEW UTILITY LINES.
4. PILES ARE DESIGNED TO SOIL CONDITIONS STATED IN IBC 2012. IT IS THE CLIENTS RESPONSIBILITY TO VERIFY SOILS MEET THE MINIMUM REQUIREMENTS. UNIRAC AND OR THE ENGINEER OF RECORD WILL NOT BE HELD RESPONSIBLE FOR FOUNDATIONS INSTALLED IN SOILS WITH LOWER CAPACITY OR FOR IMPROPER FOUNDATION INSTALLATION OR CHOICE

NOTE: SEE GFT INSTALLATION GUIDE FOR SYSTEM ADJUSTMENTS AND TOLERANCES

DRIVEN STEEL PILE NOTES:

1. STEEL PILES HAVE BEEN DESIGNED IN ACCORDANCE WITH THE DESIGN CRITERIA STATED IN THE GENERAL NOTES.
2. PILES SHALL BE INSTALLED SO THAT PILE TOLERANCES ARE MET (SEE UNIRAC GFT INSTALLATION GUIDE), AND THE PILE DOES NOT DEFORM EXCESSIVELY. EXCESSIVE DEFORMATION IS DEFINED AS DISTORTION SO THAT THE RACKING CANNOT CONNECT TO THE PILE.
3. FOUNDATIONS MUST NOT BE INSTALLED IN ORGANIC SOILS OR IN AREAS WITH GROUND WATER NEAR THE SURFACE.
4. IT IS THE OWNER OR CONTRACTORS RESPONSIBILITY TO DETERMINE WHICH FROST ZONE THEIR PROJECT IS LOCATED IN.
5. IF PILE REFUSAL IS ENCOUNTERED, AN ALTERNATE FOUNDATION DESIGN ON SHEET SR-400 SHALL BE UTILIZED.
6. DRAINAGE SHALL BE DIRECTED AWAY FROM PILES. PILES SHALL NOT BE PLACED IN SWALES, DRAINAGE AREAS OR WHERE WATER MAY BE ALLOWED TO FLOW OR STAND. ALL POSSIBLE EFFORTS SHALL BE MADE TO PREVENT WATER FROM FLOWING OR PONDING AROUND OR NEAR TO THE PILES.
7. PILES MAY NOT BE PAINTED PRIOR TO INSTALLATION OF THE RACKING SYSTEM. AFTER INSTALLATION OF THE COMPLETE RACKING SYSTEM, PILES MAY BE PAINTED AT THE CONTRACTOR'S/CLIENT'S DISCRETION. NO ADJUSTMENTS MAY BE MADE AFTER THE PILES HAVE BEEN PAINTED.
8. PILES DRIVEN TOO SHALLOW OR TOO DEEP WILL NEED TO BE ALTERED AT THE CONTRACTORS EXPENSE. UNIRAC HAS PROVIDED TOLERANCES IN THE GFT INSTALLATION GUIDE THAT SHALL BE FOLLOWED.
9. IT IS THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE MEANS AND METHODS FOR DRIVING PILES, IN ORDER TO MATCH THE PILE INSTALLATION METHOD UTILIZED DURING ONSITE PILE TESTING. THE CONTRACTOR MUST INSTALL PILES UTILIZING A PILE DRIVING RIG WITH A PERCUSSION HAMMER.
10. THE RACKING DISTRIBUTOR SHALL NOT BE HELD RESPONSIBLE FOR DAMAGE TO THE PILE AFTER IT ARRIVES TO THE SITE OR THE POINT OF AGREED DROP OFF.
11. IF DAMAGE OCCURS WHERE GALVANIZATION IS REMOVED FROM THE PILE, THE PILE SHALL BE TOUCHED UP WITH GALVANIZATION OF EQUAL THICKNESS PRIOR TO INSTALLATION AT THE CONTRACTOR'S EXPENSE.
12. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO ENSURE THAT VIBRATIONS FROM DRIVING EQUIPMENT AND PILE INSTALLATION DO NOT AFFECT ANY ADJACENT PROPERTY STRUCTURES. THE CONTRACTOR SHALL BE HELD LIABLE FOR DAMAGE TO THE ADJACENT PROPERTY IF DAMAGE OCCURS.
13. ANY EXCAVATIONS NEAR THE PILE SHALL NOT BE MADE CLOSER THAN 3 FEET FROM PILE FACE OR DEEPER THAN 3 FEET FROM GRADE. THESE EXCAVATIONS [illegible] RECORD'S RECOMMENDATIONS. IF EXCAVATIONS EXCEED THESE DIMENSIONAL REQUIREMENTS FOR FROST HEAVE OR OTHER REASONS, THE CONTRACTOR SHALL NOTIFY UNIRAC. THE ENGINEER OF RECORD SHALL BE INFORMED OF ANY
14. EXCAVATION AND COMPACTION EFFORTS ON THE SITE.
15. PILES MAY NOT BE ALTERED IN ANY WAY WITHOUT UNIRAC WRITTEN APPROVAL. PILES HAVE BEEN DESIGNED FOR STATIC LOADING. ABOVE GRADE PILES HAVE BEEN ANALYZED STATICALLY

QUALITY ASSURANCE AND SPECIAL INSPECTION:

1. TESTING LABORATORY: RETAINED BY OWNER AND SATISFACTORY TO ENGINEER OF RECORD (THROUGH UNIRAC) AND GOVERNING CODE AUTHORITY TO PERFORM REQUIRED TESTS AND INSPECTIONS OF THIS CONTRACT AND APPLICABLE CODE. THE TYPE AND FREQUENCY OF SPECIAL INSPECTION, STRUCTURAL TESTING AND SUBSEQUENT REPORTING SHALL CONFORM TO THE REQUIREMENTS OF THE 2000 INTERNATIONAL BUILDING CODE (IBC)

CONCRETE:

1. ALL ASPECTS OF WORK PERTAINING TO THE CONCRETE CONSTRUCTION SHALL BE IN ACCORDANCE WITH ACI 318-08, "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE" AND THE LATEST EDITION OF "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS" ACI 301, WITH MODIFICATIONS AS NOTED ON THE PROJECT DRAWINGS AND/OR SPECIFICATIONS.
2. HOT WEATHER CONCRETING SHALL CONFORM TO ACI 305, "HOT WEATHER CONCRETING"
3. COLD WEATHER CONCRETING SHALL CONFORM TO ACI 306, "COLD WEATHER CONCRETING"
4. ALL MIX DESIGNS SHALL BE DESIGNED BY A QUALIFIED TESTING LABORATORY AND SHALL BE WET STAMPED BY A CIVIL ENGINEER LICENSED IN THE JURISDICTION OF THE PROJECT. BASE DESIGN MIX BASED ON FIELD EXPERIENCE OR TRIAL MIXTURES AS STIPULATED IN IBC SECTION 1905.3
5. TYPE II PORTLAND CEMENT SHALL BE USED AT ALL CONCRETE ALTERNATE FOUNDATION LOCATIONS FOR THE RACKING SYSTEM - WHERE CONCRETE IS REQUIRED AS AN ALTERNATE SOLUTION. (TYPE V CEMENT SHALL BE USED WHERE THE CONCRETE IS IN CONTACT WITH SOIL CONTAINING SULFATES IN EXCESS OF 3000 PPM. CONCRETE THAT WILL BE EXPOSED TO SULFATE-CONTAINING SOLUTIONS SHALL COMPLY WITH IBC SECTION 1904.3 AND ACI 318-05 TABLE 4.3.1 SEVERE AND VERY SEVERE SULFATE EXPOSURES AS IDENTIFIED IN THE PROJECT GEOTECHNICAL REPORT. THE WATER CEMENT RATIO SHALL NOT EXCEED 0.44.)
6. IN THE PRESENCE OF REACTIVE AGGREGATE, CLASS F FLY ASH OR OTHER ASR MITIGATING ADMIXTURE SHALL BE INCORPORATED IN THE MIX SUCH THAT THE EXPANSION PRODUCED BY THE MORTAR-BAR METHOD (ASTM C1567) USING BLENDED AGGREGATES IS LESS THAN 0.1% AT 14 DAYS IMMERSED IN SOLUTION. WHERE CLASS F FLY ASH IS SELECTED AS A SUPPLEMENTAL ADMIXTURE, THE LOSS OF IGNITION SHALL BE LIMITED TO 2%. THE CONTRACTOR SHALL SUBMIT ALL CERTIFICATES SHOWING THE FLY ASH IS IN ACCORDANCE WITH ASTM C618.
7. DO NOT USE CONCRETE OR GROUT CONTAINING CHLORIDES. WATER SHALL CONTAIN A CHLORIDE CONTENT LESS THAN 1000 PPM AS Cl. DO NOT USE CONCRETE CONTAINING ALKALI-CARBONATE AND BIOCHARBONATES PRESENT IN AGGREGATE IN EXCESS OF 1000 PPM. TESTS FOR THEIR EFFECT ON SETTING TIME AND 28 DAY STRENGTH SHALL BE EVALUATED.
8. HARD ROCK CONCRETE AGGREGATE SHALL CONFORM TO ALL REQUIREMENTS AND TESTS OF THE ASTM C33 CLASS DESIGNATION 3S AND PROJECT SPECIFICATIONS. EXCEPTIONS MAY BE USED ONLY WITH APPROVAL OF THE STRUCTURAL ENGINEER. PROVIDE CONCRETE MIX DESIGN WITH PROVEN SHRINKAGE CHARACTERISTICS OF LESS THAN 0.0005 INCHES/INCH.
9. MAXIMUM SIZED AGGREGATE OF 0.75"
10. SLUMP RANGE OF 3" ± 1" PER ASTM C143
11. CONCRETE PLACEMENT SHALL BE IN ACCORDANCE WITH ACI STANDARD 304 AND PROJECT SPECIFICATIONS
12. THE UNIRAC PILE SHALL BE CENTERED IN THE HOLE TO MAXIMIZE CONCRETE COVER AND THE HOLE SHALL BE CENTERED IN THE SPECIFIED LOCATION TO ALLOW FOR RACKING INSTALLABILITY
13. THE TOP OF THE CONCRETE SHALL BE SMOOTHED AND SLOPED AT 2% TO FACILITATE POSITIVE DRAINAGE AWAY FROM THE UNIRAC PILE.
14. CONCRETE CHLORIDE PERMEABILITY SHALL BE CLASSIFIED AS HAVING "NEGLIGIBLE" TO "VERY LOW" CHLORIDE ION PERMEABILITY PER ASTM C1202
15. CONCRETE SHOULD BE PLACED IN A CONTINUOUS FLOW WITHOUT SEGREGATING THE CONCRETE. DO NOT ALLOW CONCRETE TO FREE FALL MORE THAN 5 FEET UNLESS MEASURES ARE TAKEN TO ENSURE THAT CONCRETE DOES NOT HIT THE SIDES OF THE EXCAVATION DURING FREE FALL
16. MECHANICALLY VIBRATE THE CONCRETE AT EACH PIER.
17. PRECAUTIONS SHOULD BE TAKEN DURING THE INSTALLATION OF PIERS TO MINIMIZE THE POSSIBILITY OF CAVING. PIER EXCAVATIONS SHOULD BE FILLED WITH CONCRETE AS SOON AFTER DRILLING AND INSPECTION AS POSSIBLE. CONCRETE MIXING OPERATION SHALL CONFORM TO ASTM C-94
18. AGGREGATE FOR HARDROCK CONCRETE SHALL CONFORM TO ALL REQUIREMENTS AND TESTS OF THE ASTM C-33 AND PROJECT SPECIFICATIONS. EXCEPTIONS MAY BE USED ONLY WITH THE PERMISSION OF THE ENGINEER OF RECORD.
19. THE MAXIMUM DENSITY OF CONCRETE SHALL BE 150 PCF. THE 28 DAY STRENGTH OF CONCRETE SHALL BE 3000 PSI WITH A MAXIMUM WATER-CEMENT RATIO OF 0.40.

SHEET INDEX

SHEET NUMBER	SHEET TITLE
SD-100	GENERAL STRUCTURAL RACKING NOTES
SD-200	RACKING DIMENSIONS & PARTS LIST [illegible]
SD-300	RACKING DIMENSIONS & PARTS LIST [illegible]
SD-400	[illegible]
SD-500	RACKING DETAILS

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SHEET TITLE
GENERAL STRUCTURAL RACKING NOTES

SHEET NUMBER
SD-100

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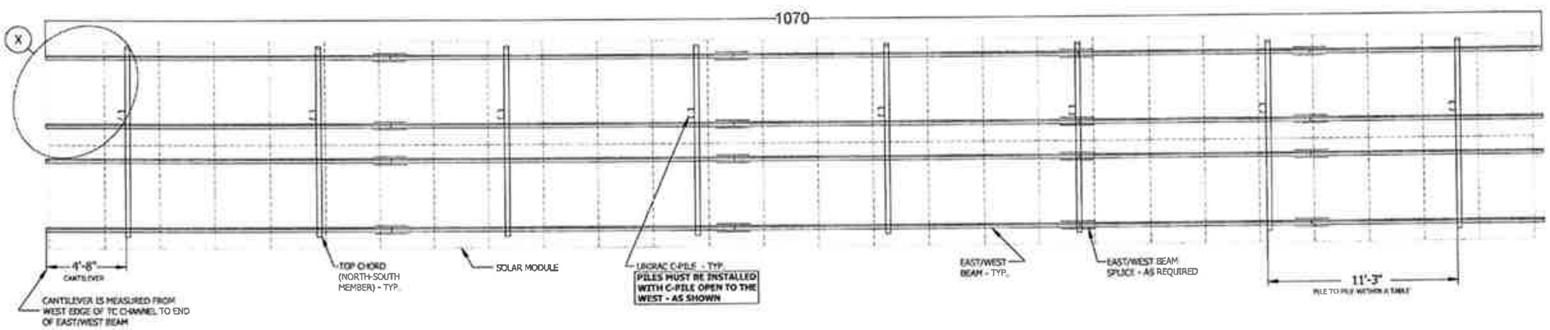
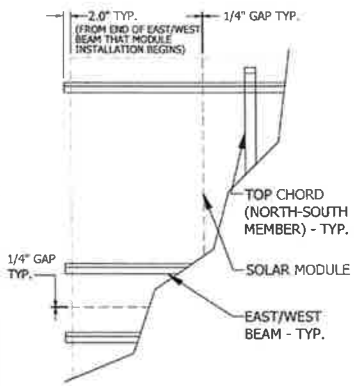
ARRAY LAYOUT

SD-200

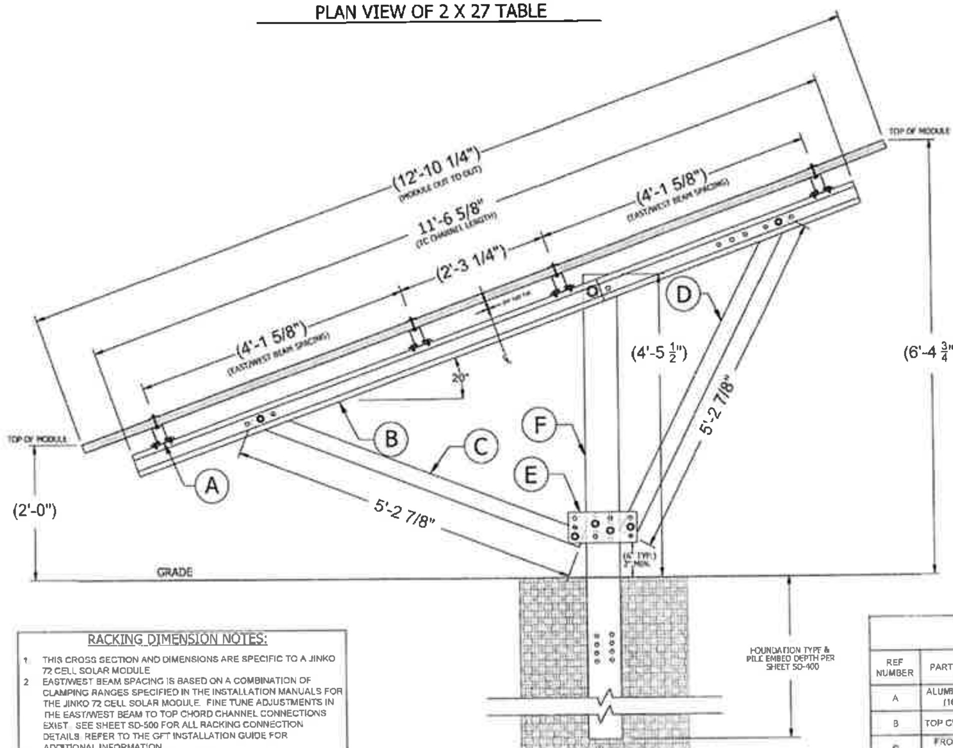


PLAN VIEW OF 2 X 27 TABLE



(X) DETAILED VIEW

NOTE:
FOR INFORMATION REGARDING T-BOLT (MID-CLAMP) SETBACKS AT EAST/WEST BEAM SPLICE LOCATIONS, REFER TO DETAIL 502 ON SHEET SD-500.



RACKING DIMENSION NOTES:

1. THIS CROSS SECTION AND DIMENSIONS ARE SPECIFIC TO A JINKO 72 CELL SOLAR MODULE
2. EAST/WEST BEAM SPACING IS BASED ON A COMBINATION OF CLAMPING RANGES SPECIFIED IN THE INSTALLATION MANUALS FOR THE JINKO 72 CELL SOLAR MODULE. FINE TUNE ADJUSTMENTS IN THE EAST/WEST BEAM TO TOP CHORD CHANNEL CONNECTIONS EXIST. SEE SHEET SD-500 FOR ALL RACKING CONNECTION DETAILS. REFER TO THE GFT INSTALLATION GUIDE FOR ADDITIONAL INFORMATION
3. ALL DIMENSION SHOWN WITH PARENTHESIS ( ), ARE DIMENSIONS THAT MAY VARY SLIGHTLY, DUE TO THE FOLLOWING; INSTALLING THE SYSTEM USING DIFFERENT HOLE OPTIONS, VARIANCE IN PILE STICK-UP HEIGHT, MODULE SELECTION, OR VARIANCE IN FINISHED/EXISTING GARADE. ALL OTHER DIMENSIONS ARE FIXED

SECTION VIEW OF DGFT TABLE - 20° TILT
(72 CELL SOLAR PANELS)

GFT PARTS LIST

REF NUMBER	PART DESCRIPTION	CATALOG #	GUAGE/ THICKNESS	FINISH
A	ALUMINUM E-W BEAM (166" OR 246")	411166M OR 411246M	SEE SHEET SD-100	
B	TOP CHORD CHANNEL	404010	SEE SHEET SD-100	
C	FRONT DIAGONAL BRACE (20°)		SEE SHEET SD-100	
D	REAR DIAGONAL BRACE (20°)	404011	SEE SHEET SD-100	
E	DIAGONAL BRACE PLATE		SEE SHEET SD-100	
F	C-PILE 9.0 FT	404001 OR 404002	SEE SHEET SD-100	

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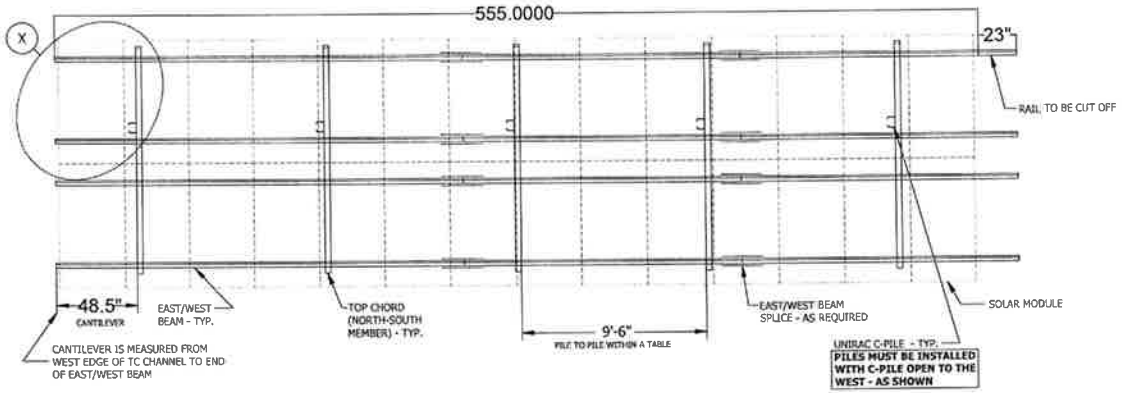
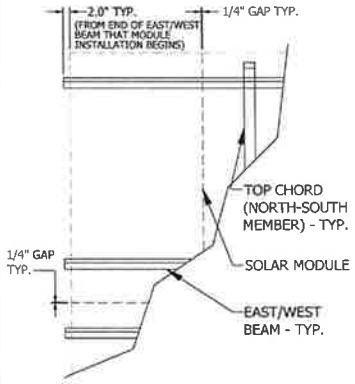
SHEET TITLE
DGFT TABLE CROSS-SECTION AND PARTS LIST (20 DEGREE TILT)

SHEET NUMBER
SD-300

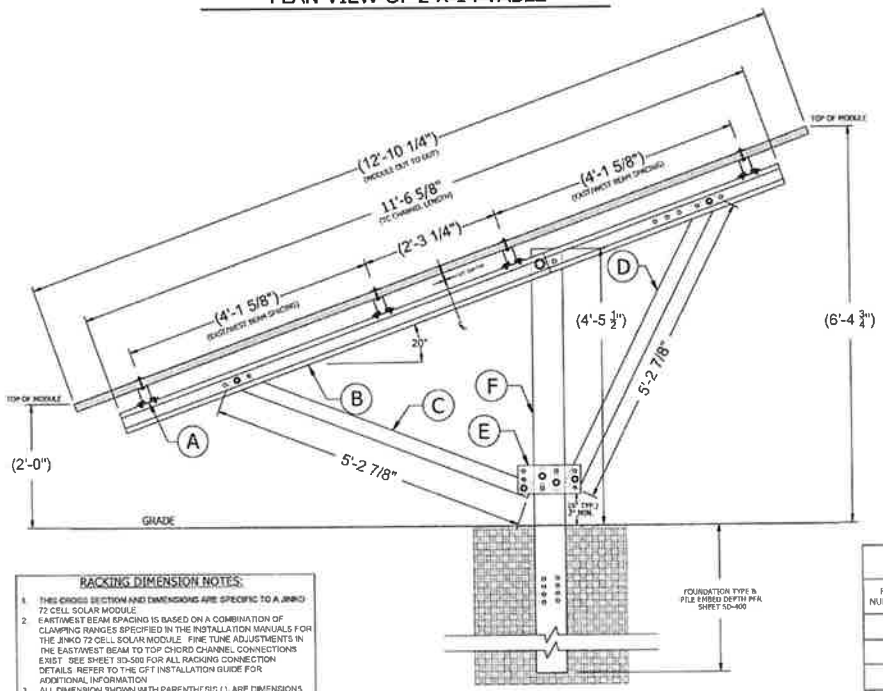


PLAN VIEW OF 2 X 14 TABLE



DETAILED VIEW

NOTE:
FOR INFORMATION REGARDING T-BOLT (MID-CLAMP) SETBACKS AT EAST/WEST BEAM SPLICE LOCATIONS, REFER TO DETAIL S02 ON SHEET SD-500.



SECTION VIEW OF DGFT TABLE - 20° TILT
(72 CELL SOLAR PANELS)

RACKING DIMENSION NOTES:

1. THIS CROSS SECTION AND DIMENSIONS ARE SPECIFIC TO A JINKO 72 CELL SOLAR MODULE
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3. ALL DIMENSION SHOWN WITH PARENTHESIS ( ), ARE DIMENSIONS THAT MAY VARY SLIGHTLY, DUE TO THE FOLLOWING; INSTALLING THE SYSTEM USING DIFFERENT HOLE OPTIONS, VARIANCE IN PILE STICK-UP HEIGHT, MODULE SELECTION, OR VARIANCE IN FINISHED/EXISTING GARADE. ALL OTHER DIMENSIONS ARE FIXED

GFT PARTS LIST

REF NUMBER	PART DESCRIPTION	CATALOG #	GUAGE/ THICKNESS	FINISH
A	ALUMINUM E-W BEAM (165" OR 246")	411165M OR 411246M	SEE SHEET SD-100	
B	TOP CHORD CHANNEL	404010	SEE SHEET SD-100	
C	FRONT DIAGONAL BRACE (20°)	404011	SEE SHEET SD-100	
D	REAR DIAGONAL BRACE (20°)		SEE SHEET SD-100	
E	DIAGONAL BRACE PLATE		SEE SHEET SD-100	
F	C-PILE 9.0 FT	404001 OR 404002	SEE SHEET SD-100	

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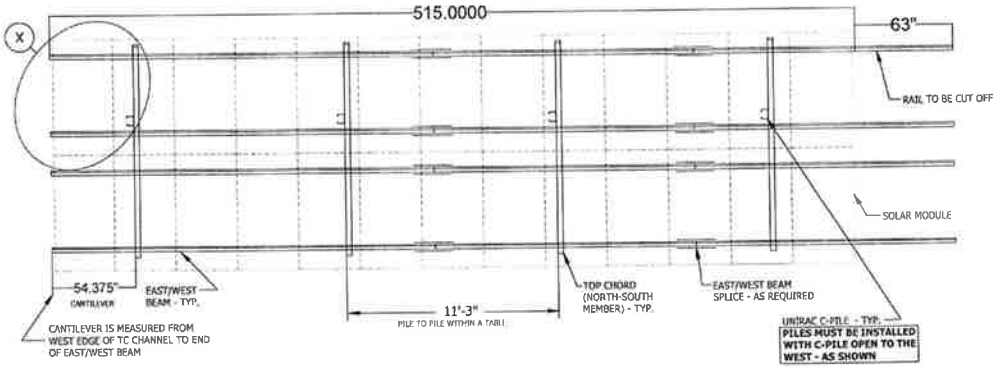
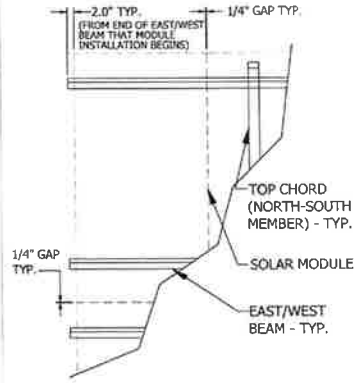
SHEET TITLE
DGFT TABLE CROSS-SECTION AND PARTS LIST (20 DEGREE TILT)

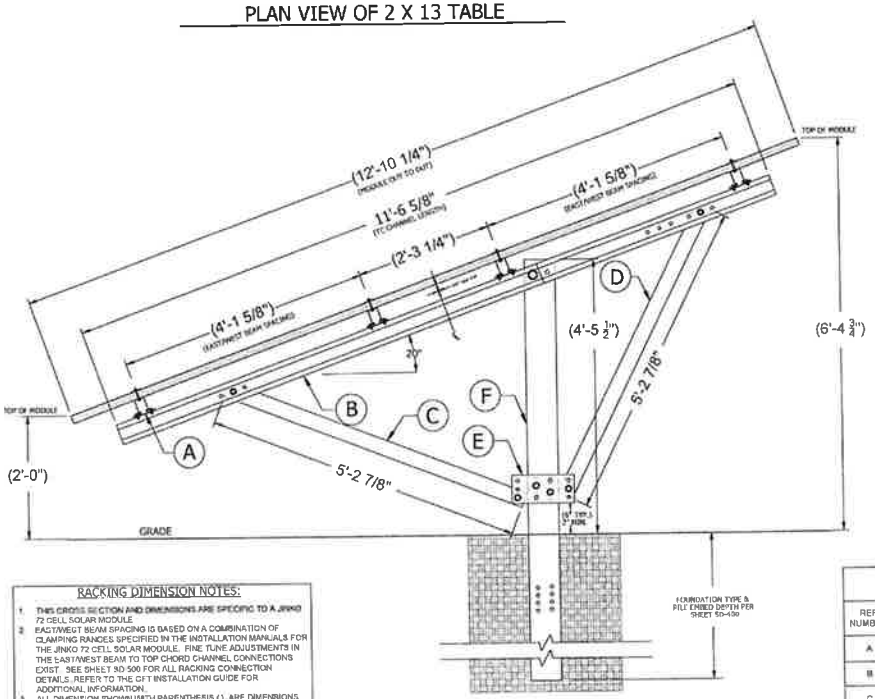
SHEET NUMBER
SD-301



PLAN VIEW OF 2 X 13 TABLE



NOTE:
FOR INFORMATION REGARDING T-BOLT (MID-CLAMP) SETBACKS AT EAST/WEST BEAM SPLICE LOCATIONS, REFER TO DETAIL S02 ON SHEET SD-500.



SECTION VIEW OF DGFT TABLE - 20° TILT
(72 CELL SOLAR PANELS)

RACKING DIMENSION NOTES:

1. THIS CROSS SECTION AND DIMENSIONS ARE SPECIFIC TO A JINKO 72 CELL SOLAR MODULE
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3. ALL DIMENSION SHOWN WITH PARENTHESIS ( ) ARE DIMENSIONS THAT MAY VARY SLIGHTLY DUE TO THE FOLLOWING: INSTALLING THE SYSTEM USING DIFFERENT HOLE OPTIONS, VARIANCE IN PILE STICK-UP HEIGHT, MODULE SELECTION, OR VARIANCE IN FINISHED/EXISTING GRADE. ALL OTHER DIMENSIONS ARE FIXED.

GFT PARTS LIST

REF NUMBER	PART DESCRIPTION	CATALOG #	GUAGE/ THICKNESS	FINISH
A	ALUMINUM E-W BEAM (166" OR 246")	411166M OR 411246M		SEE SHEET SD-100
B	TOP CHORD CHANNEL	404010		SEE SHEET SD-100
C	FRONT DIAGONAL BRACE (20°)	404011		SEE SHEET SD-100
D	REAR DIAGONAL BRACE (20°)			SEE SHEET SD-100
E	DIAGONAL BRACE PLATE			SEE SHEET SD-100
F	C-PILE 9.0 FT	404001 OR 404002		SEE SHEET SD-100

MARK	DATE	DESCRIPTION
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SHEET TITLE
DGFT TABLE CROSS-SECTION AND PARTS LIST (20 DEGREE TILT)

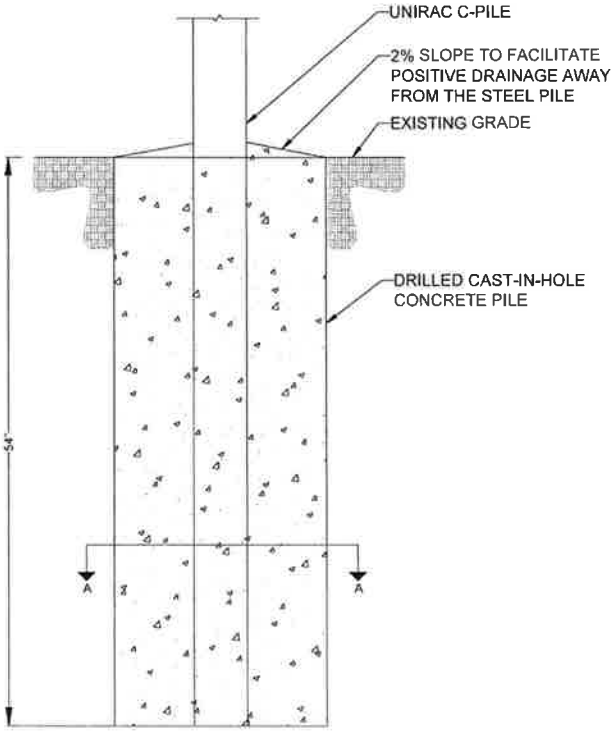
SHEET NUMBER
SD-302

400 DRILLED CAST-IN-HOLE CONCRETE PILE FOUNDATION

NOT TO SCALE

FOUNDATION 400: DRILLED CAST-IN-HOLE CONCRETE PILE FOUNDATION

1. THE FOUNDATION MUST BE EXCAVATED WITH LITTLE TO NO LOOSE MATERIAL IN THE BOTTOM.
2. IF THE FOUNDATION IS BELOW THE GROUND WATER LEVEL, THERE MUST BE A TEMPORARY CASING IN PLACE TO STABILIZE THE EXCAVATION.
3. THE PILE MUST BE CENTERED IN THE HOLE WITH EQUAL AMOUNTS OF CONCRETE AROUND THE CASING.
4. CONCRETE SHALL CONFORM TO THE CONCRETE SPECIFICATIONS LISTED ON DR-100.
5. CONCRETE DEPTH SHALL CONFIRM TO THE DEPTHS LISTED SPECIFIED ON THIS DRAWING.
6. THE TOP OF THE CONCRETE MUST BE ABOVE GRADE.
7. THE CORE OF THE CONCRETE CAST-IN-DRILLED HOLE PILE WILL CONSIST OF THE UNIRAC C- PILES AS DEPICTED IN THE FIGURE.
8. THE C-PILE CAN REST ON THE BOTTOM OF THE BORING AND IS NOT REQUIRED TO BE SUSPENDED ABOVE THE BOTTOM.



SECTION A-A
TOP VIEW

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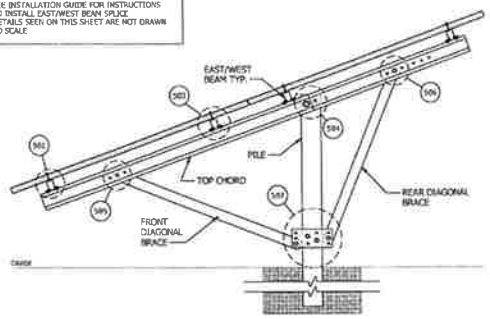
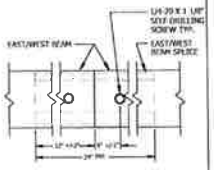
FOUNDATION EMBEDMENT AND FOUNDATION DETAILS

SD-400

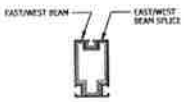
RACKING DETAIL NOTES:

1. SEE INSTALLATION GUIDE FOR PILE TOLERANCES
2. SEE INSTALLATION GUIDE FOR CONNECTION ADJUSTMENT INSTRUCTIONS
3. SEE INSTALLATION GUIDE FOR INSTRUCTIONS TO INSTALL EAST/WEST BEAM SPLICE
4. DETAILS SEEN ON THIS SHEET ARE NOT DRAWN TO SCALE

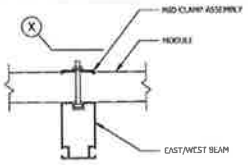


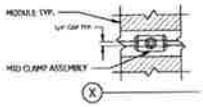


EAST/WEST BEAM WITH SPLICE
(TYPICAL ELEVATION)

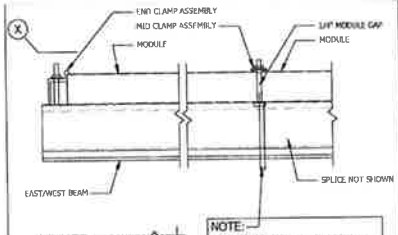


EAST/WEST BEAM WITH SPLICE
(TYPICAL SECTION)

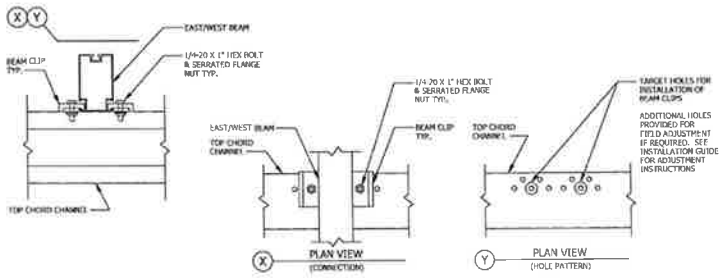




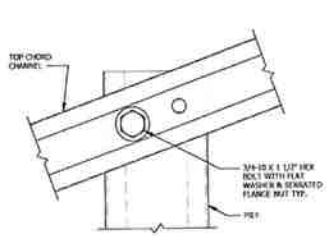
501 MODULE TO EAST/WEST BEAM CONNECTION
(SONDRIC MID CLAMP)

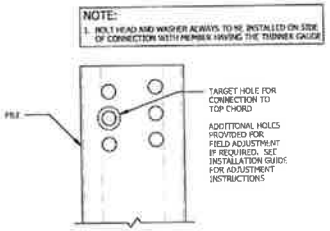


502 MODULE TO EAST/WEST BEAM CONNECTION
(END CLAMP)



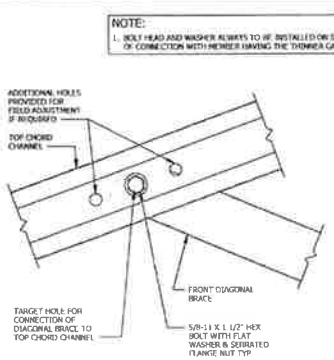
503 EAST/WEST BEAM TO TOP CHORD CONNECTION



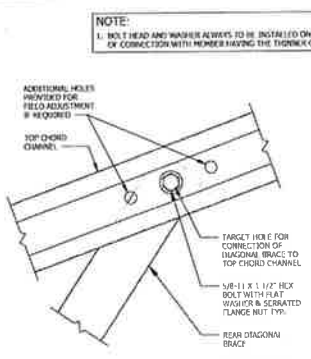


ELEVATION VIEW
(HOLE PATTERN)

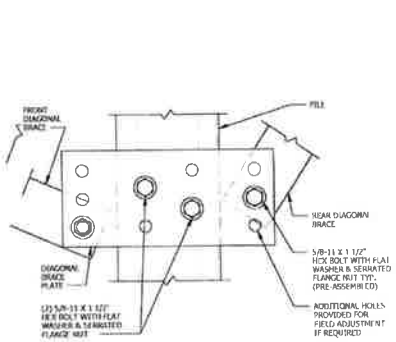
504 TOP CHORD TO PILE CONNECTION

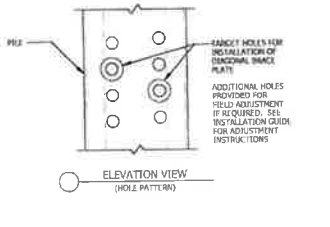


505 TOP CHORD TO DIAGONAL BRACE CONNECTION
(FRONT BRACE)



506 TOP CHORD TO DIAGONAL BRACE CONNECTION
(REAR BRACE)





ELEVATION VIEW
(HOLE PATTERN)

507 DIAGONAL BRACE TO PILE CONNECTION

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LAYOUT SHEET SIZE:	

SHEET TITLE
RACKING DETAILS

SHEET NUMBER
SD-500