



111 SW Columbia St, Suite 480  
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(503) 892-5726 Main  
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www.tannercreekenergy.com

A CHRISTENSON COMPANY

September 9, 2011

Oregon Public Utilities Commission  
550 Capital St NE #215  
PO Box 2148  
Salem, OR 97308-2148

**RE: Additional information: eFiling 14724**  
**EXPIDITED REQUEST for a waiver of the 12-month installation requirement (OAR 860-084-2010 (1) for Pacific Power and Light (PP&L) Oregon Solar Incentive Program (OSIP) applications for Williams Heifer Raising**

Dear Mr. Sobhy:

Per your questions, I have included data on our effort to this point in regards to design, scheduling and permitting. Hopefully, you can see that we have proceeded in good faith and with a great deal of effort. With some cooperation with the harvest schedule it would have been a tight time schedule but very doable. However, lateness of the harvest left too little time to confidently ask the customer for a contract.

*Design drawings – attached*

These are complete drawing sets and are ready for submission zoning, permitting and engineering. In addition, a complete bill of material has been completed with construction schedule take-offs and detailed parts list. Attached are drawings and Suneye reports for both sites. The single bill of materials will be used for both sites as they are nearly identical in configuration.

*Construction Schedule*

Based on our experience in rural ground mount PV system construction, we estimate the following schedule:

Project timeline	Estimated days
Permitting, engineering and procurement	21
Mobilization	1
Excavation and concrete	5
Racking construction	5
Electrical construction	5
AC connection/cutover	2
Inspection and tests	1

*Permitting*

There are three separate Umatilla County application efforts – zoning review, building permit and electrical permit. Applications are ready for submittal. All supplementary information has been produced including site plan, building and electrical drawings (see attachment). However, the owners are understandably hesitant to submit the applications and the estimated \$1,500 in fees without more confidence in the project's ability to proceed without a waiver on the October completion dates.

Hopefully, this meets your needs. Please let me know if any further information would be useful.

Respectfully submitted,

Alan Hickenbottom  
General Manager



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Alan Hickenbottom  
General Manager

**PHOTOVOLTAIC SYSTEM**  
**WILLIAMS DAIRY HEIFER RAISING**  
**TAX LOT 2601, PARCEL 1, BUROKER RD.**  
**MILTON FREEWATER, OREGON**

**OWNER**

WILLIAMS DAIRY HEIFER RAISING  
 49654 UMAPINE RD.  
 MILTON FREEWATER, OREGON 97862  
 541-558-3918

**PROJECT MANAGER**

CHRISTENSON ELECTRIC  
 111 SW COLUMBIA, SUITE 480  
 PORTLAND, OREGON 97201  
 503.419.3330

**GENERAL/ELECTRICAL CONTRACTOR**

CHRISTENSON ELECTRIC  
 111 SW COLUMBIA, SUITE 480  
 PORTLAND, OREGON 97201  
 503.419.3330

**SYSTEM DESIGN**

TANNER CREEK ENERGY  
 111 SW COLUMBIA, SUITE 480  
 PORTLAND, OREGON 97201  
 503.892.5726

**SYSTEM DESCRIPTION**

- (40) SOLARWORLD 250 MONO PV MODULES
- (1) SOLECTRA PVI 10KW INVERTER
- 10,000 WATTS DC STC

**SCOPE OF WORK**

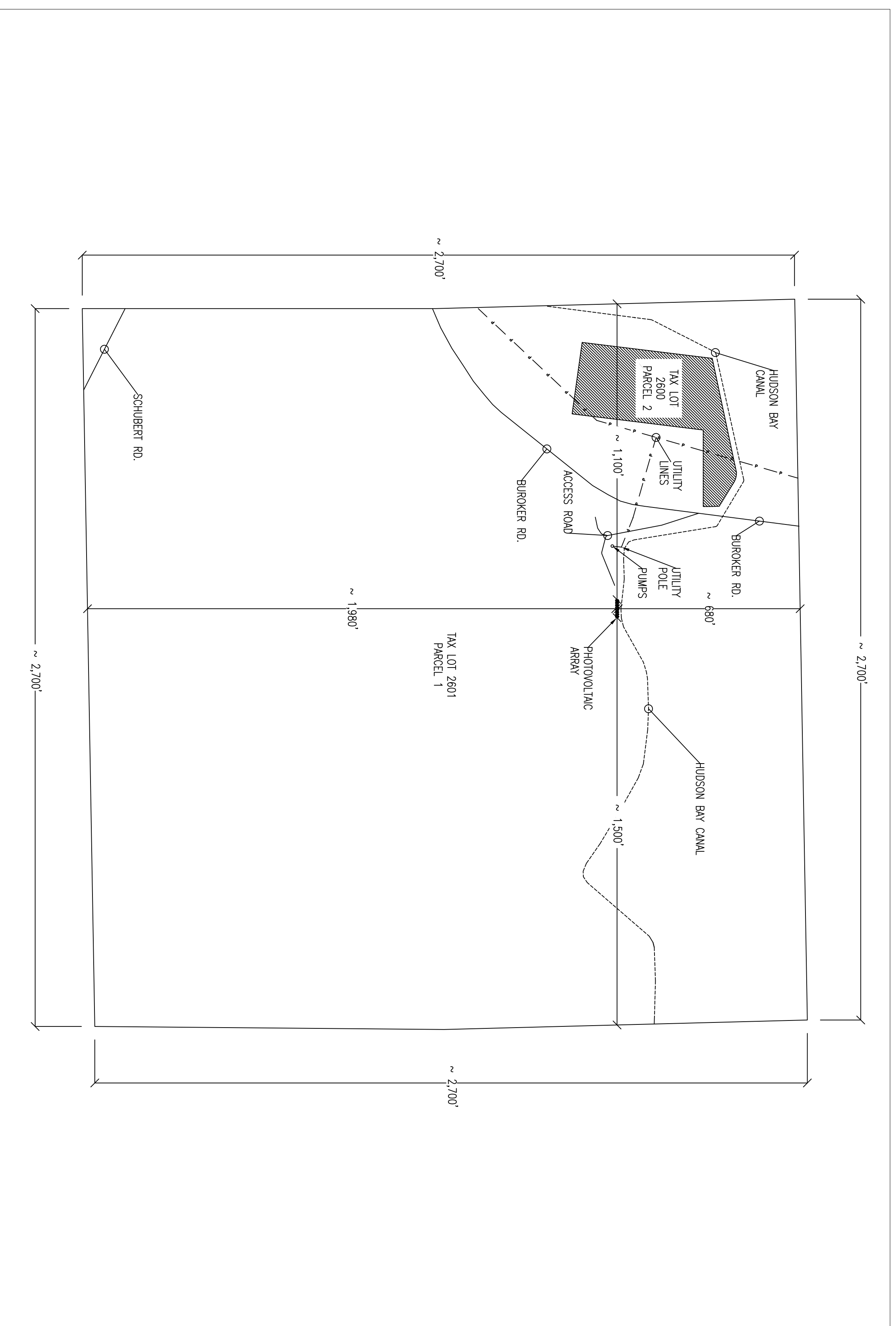
THE PROJECT SCOPE INCLUDES THE DESIGN AND INSTALLATION OF A 10,000 W DC GRID-TIED SOLAR PHOTOVOLTAIC (PV) SYSTEM AT ONE OF WILLIAMS' IRRIGATION PUMPS OUTSIDE OF MILTON FREEWATER, OREGON.

THE PV SYSTEM CONSISTS OF ONE NON-COMBUSTIBLE GROUND MOUNTED SOLAR ARRAY, ONE INVERTER AND RELATED ELECTRICAL EQUIPMENT.

DURING DAYLIGHT HOURS THIS PV SYSTEM WILL PROVIDE ELECTRICITY IN PARALLEL WITH THE LOCAL ELECTRIC UTILITY SERVICE PROVIDER.

ALL EQUIPMENT WILL BE INSTALLED AS REQUIRED BY APPLICABLE CODES (2010 OREGON SOLAR INSTALLATION SPECIALTY CODE) AND PORTLAND GENERAL ELECTRIC SOLAR PERMIT REQUIREMENTS.

SHEET LIST TABLE	
T	TITLE PAGE & SITE PLAN
A	LAYOUT & ELEVATION
E.1	ELECTRICAL NOTES & PLAN
E.2	ELECTRICAL DIAGRAM
E.3	SIGNAGE
S.1	FOOTING & FRAMING PLAN
S.2	RACKING & MODULE PLAN
S.3	ELEVATIONS
S.4	DETAILS



1 SITE PLAN  
T  
SCALE: N/A

Revisions:

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**WILLIAMS DAIRY HEIFER RAISING**  
**PHOTOVOLTAIC PROJECT**  
 Tax Lot 2601, Parcel 1, Buroker Rd.  
 Milton Freewater, Oregon

Sheet Title:  
**TITLE PAGE +**  
**SITE PLAN**

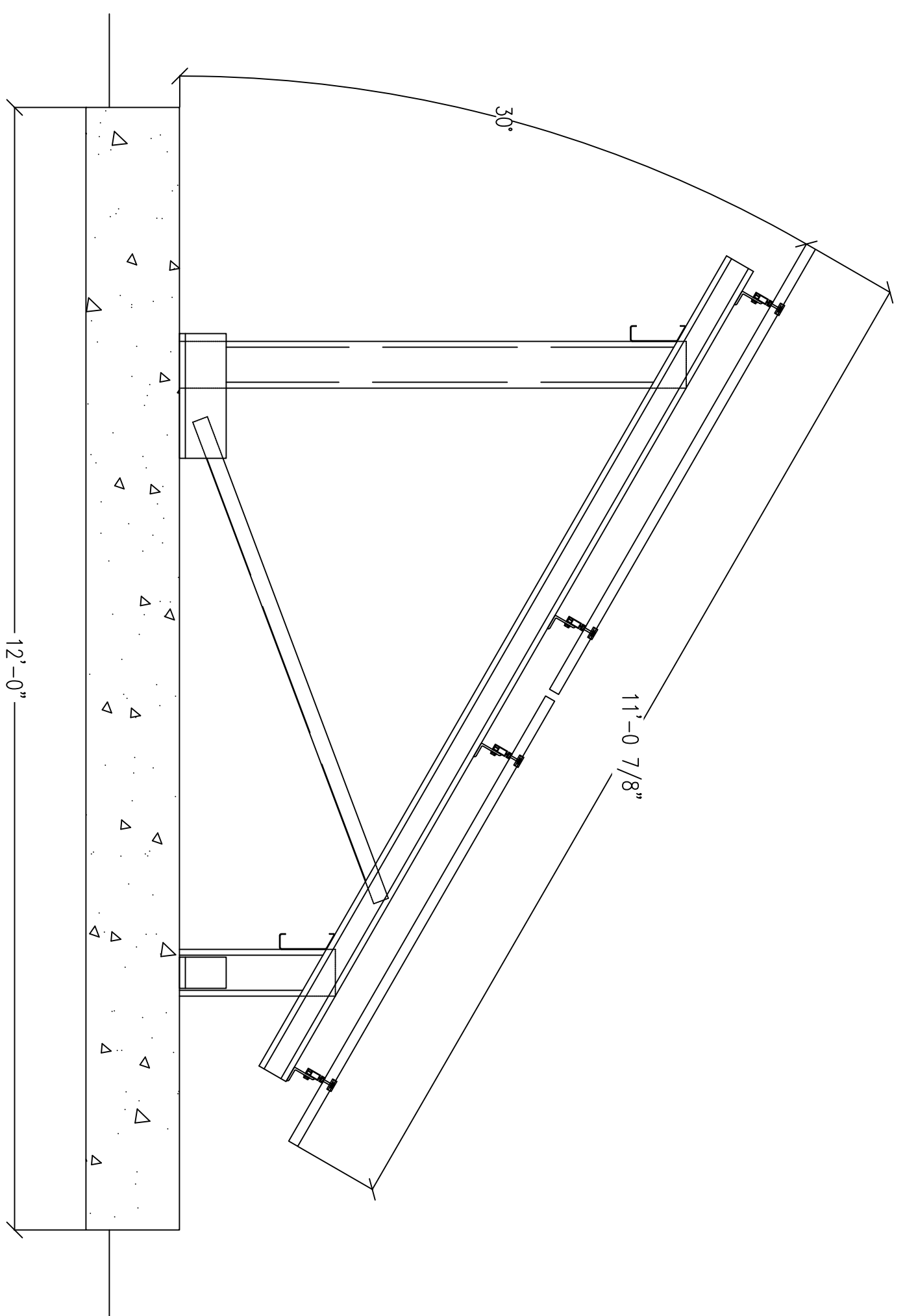
Date: 08/25/2011  
 CEI Project No.  
 CEI Project Manager: JZ  
 Designed By: KK  
 Drawn By: KK  
 Checked By:  
 Project Type: 230

Sheet Number:

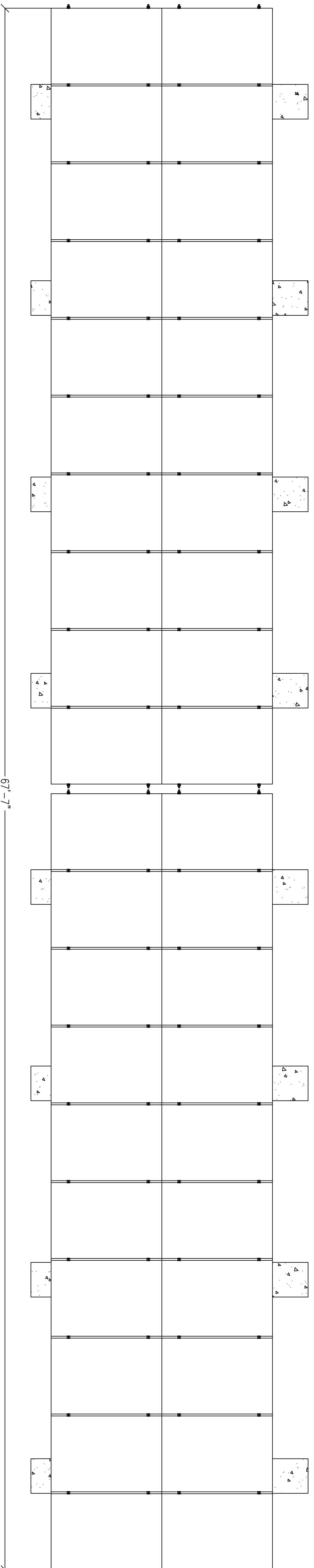
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DESIGN

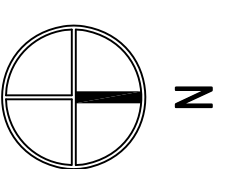
SYSTEM DESCRIPTION	
MODULE TYPE	SOLARWORLD 250 MONO
QUANTITY	40 MODULES
SYSTEM SIZE	10 kW DC STC
TILT ANGLE	30°
AZIMUTH	180°
INVERTER	(1) SOLECTRA PVI 10kW



1 WEST ELEVATION  
SCALE: 3/4" = 1' - 0"



2 PV LAYOUT  
SCALE: 3/8" = 1' - 0"



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PHOTOVOLTAIC PROJECT**  
Tax Lot 2601, Parcel 1, Buroker Rd.  
Milton Freewater, Oregon

Sheet Title:  
**LAYOUT +  
ELEVATION**

Date: 08/25/2011  
CEI Project No.  
CEI Project Manager: JZ  
Designed By: KK  
Drawn By: KK  
Checked By: KK  
Project Type: 230

Sheet Number:

A

DESIGN



**SYSTEM DESCRIPTION**

1 ARRAY, 40 MODULES TOTAL  
 1 INVERTER (SOLECTRA PVI 10KW) – 480VAC/12A  
 SIZE – 10,000 W DC STC  
 EST. ANNUAL PRODUCTION – 13,768 KWH AC

**SOURCE CIRCUIT**

PHOTOVOLTAIC MODULE:

SOLECROWLD 250 MONO, 250 W STC

Voc = 37.8V (42.9V @ -16°C – ASHRAE MEAN EXTREME LOW TEMP)

Vmp = 31.1V (24.9V @ 39°C – ASHRAE 0.4% HIGH TEMP)

Isc = 8.28A

Iimp = 8.05A

**PHOTOVOLTAIC ARRAY**

40 MODULES, 10 MODULES/STRING (4 STRINGS TOTAL)

Voc = 429.1V @ -16°C

Vmp = 31.1V TYPICAL (24.9V @ 39°C)

Isc = 8.28A

Iimp = 8.05A

**OUTPUT CIRCUITS**

- MODULES MOUNTED TO UNIRAC RACKING ON CUSTOM GROUND MOUNT SYSTEM.
- INVERTER WITH DC/AC DISCONNECT MOUNTED TO BACK OF RACKING STRUCTURE.

- INVERTER OUTPUT CONDUIT ROUTED TO UTILITY REQUIRED PV PRODUCTION METER LOCATION UTILITY POLE ~200' WEST OF THE ARRAY.
- POINT OF COMMON CONNECTION (POCC) LOCATED IN NEW UTILITY METER MAN.

**ELECTRICAL NOTES FOR NEW PV SYSTEM**

- THIS PROPOSED SOLAR ELECTRIC SYSTEM IS INTENDED TO OPERATE IN PARALLEL DURING THE DAY WITH POWER RECEIVED FROM THE UTILITY SERVICE PROVIDER.
- ALL EQUIPMENT IS UL APPROVED AND IDENTIFIED FOR USE IN THE PV SYSTEM.
- THIS SYSTEM IS INTENDED TO CONNECT TO THE EXISTING FACILITY POWER SYSTEM AT ONE POINT, POINT OF COMMON COUPLING (POCC). THIS CONNECTION SHALL BE IN COMPLIANCE WITH THE NEC ARTICLE 705.12 "POINT OF CONNECTION".

**WIRING + WIRING METHODS**

ALL WIRING METHODS AND INSTALLATION PRACTICES CONFORM TO THE NATIONAL ELECTRIC CODE, OREGON SOLAR INSTALLATION SPECIALTY CODE, AND OTHER APPLICABLE LOCAL CODES.

**GROUNDING**

SEE E.2 – ELECTRICAL DIAGRAM FOR MORE GROUNDING INFORMATION.

**GROUND FAULT PROTECTION**

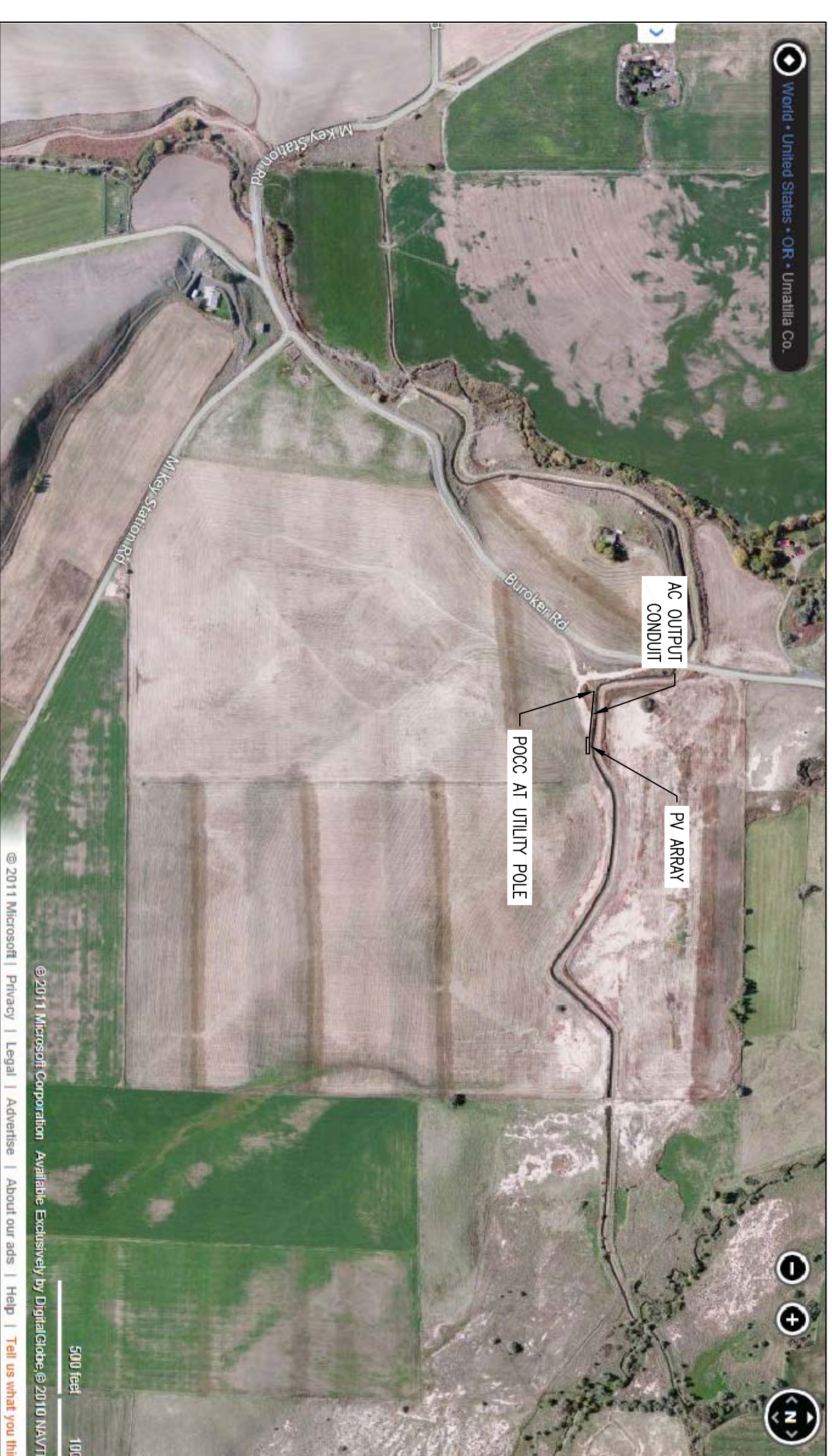
PHOTOVOLTAIC INVERTERS ARE EQUIPPED WITH DC GROUND FAULT PROTECTION TO REDUCE FIRE HAZARDS. INVERTERS ARE ALSO EQUIPPED WITH ANTI-ISLANDING CIRCUITRY.

**DISCONNECTING MEANS**

MEANS ARE PROVIDED TO DISCONNECT ALL CURRENT CARRYING CONDUCTORS OF THE PHOTOVOLTAIC POWER SOURCE FROM ALL OTHER CONDUCTORS AT THE LOCATION.

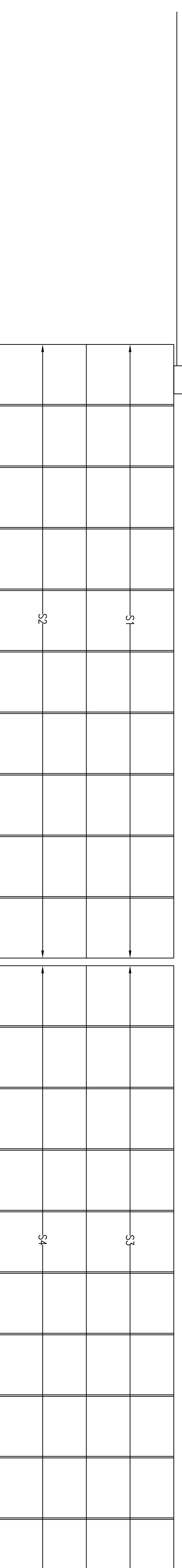
**REQUIRED SAFETY SWITCHES, LABELS + MARKINGS**

REQUIRED SAFETY SIGNS AND LABELS ARE PERMANENTLY ATTACHED BY ADHESIVE, OR OTHER MECHANICAL MEANS. LABELS COMPLY WITH ARTICLE 690 OF THE NEC OR OTHER APPLICABLE STATE AND LOCAL CODES. SEE E.3 – SIGNAGE FOR MORE DETAILS.



POCC LOCATED ~200' ADJACENT TO UTILITY POLE W/ PV PRODUCTION METER NEXT TO NEW UTILITY METER MAN

INVERTER W/ INTEGRATED PV COMBINER & DC/AC DISCONNECTS



MODULE TYPE	SOLECROWLD 250 MONO
QUANTITY	40 MODULES
SOURCE CIRCUITS	(4) TOTAL
JUNCTION BOXES	N/A
INVERTERS	(1) TOTAL

**2 ELECTRICAL PLAN**  
 SCALE: 1/4" = 1' - 0"



**1 ELECTRICAL NOTES**  
 SCALE: N/A

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Revisions:

**WILLIAMS DAIRY HEIFER RAISING  
 PHOTOVOLTAIC PROJECT**  
 Tax Lot 2601, Parcel 1, Buroker Rd.  
 Milton Freewater, Oregon

Sheet Title:  
**ELEC NOTES +  
 PLAN**

Date: 08/25/2011  
 CEI Project No.:  
 CEI Project Manager: JZ  
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 Checked By:  
 Project Type: 230

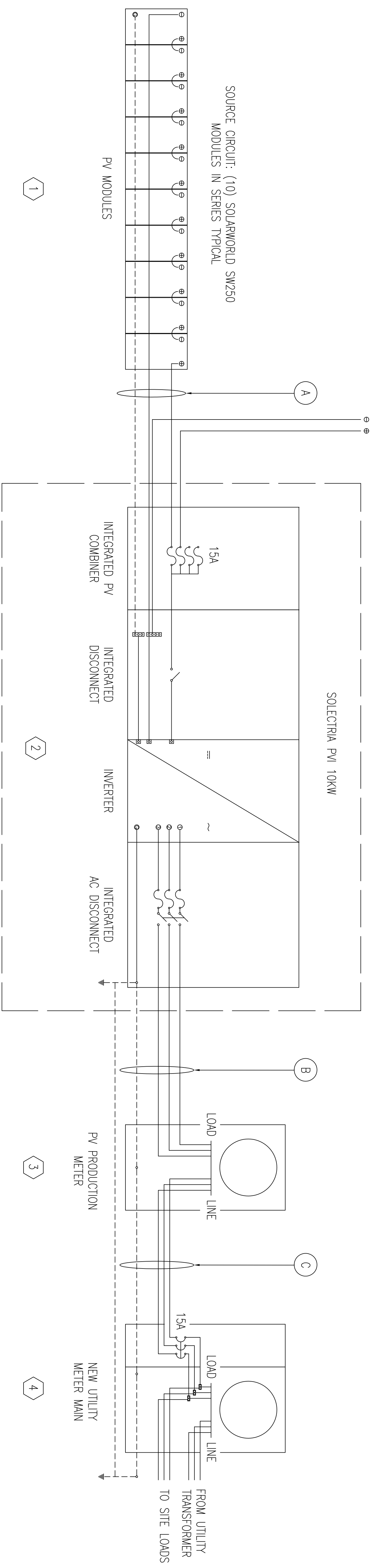
Sheet Number:

**E.1**

DESIGN



FROM OTHER SOURCE CIRCUITS, TYPICAL AS SHOWN AT LEFT. (4) SOURCE CIRCUITS TOTAL.



**SHEET NOTES**

- 1 SOLARWORLD 250 MONO PV MODULES W/ MCA TYPE CONNECTORS. GROUNDING W/ WEBB GROUNDING CLIPS TO RAILS. WEBB GROUNDING LUGS ON RAILS AND CONNECTED TO INVERTER GROUND LUG.
- 2 SOLECTRIA PVI 10KW INVERTER W/ DC/AC DISCONNECTS - (1) TOTAL INVERTERS.
- 3 PV PRODUCTION MAIN (COOPER B-LINE 1177B) - METER TO BE INSTALLED BY UTILITY.
- 4 NEW UTILITY METER MAIN (COOPER B-LINE 217MBMS15) W/ 15A MAIN CIRCUIT BREAKER FOR PV.

TABLE A: PV SOURCE CIRCUIT CONDUCTOR & CONDUIT IDENTIFICATION

CONDUCTOR LOCATION A	# OF MODULES IN SERIES	Isc (A)	Imp (A)	Voc (VDC)	Vmp (VDC)	MAX. ONE WAY LENGTH (FT.)	VOLTAGE DROP %	CURRENT CARRYING CONDUCTOR SIZE	CONDUCTOR TYPE	BONDING CONDUCTOR	CONDUIT
MODULES TO INVERTER	10	8.28	8.05	429.1	311.0	75'-0"	0.50%	#10	USE-2	#6	N/A

TABLE B: INVERTER OUTPUT CIRCUIT CONDUCTOR & CONDUIT IDENTIFICATION

CONDUCTOR LOCATION	NOMINAL VOLTAGE (VAC)	PHASES	GENERATION AMPACITY (A)	DISTANCE	VOLTAGE DROP %	CURRENT CARRYING CONDUCTOR SIZE	CONDUCTOR TYPE	GROUNDING CONDUCTOR	CONDUIT
B	480	3	12.0	200'-0"	0.70%	#8	THWN-2	#6	3" PVC
C	480	3	12.0	10'-0"	0.10%	#10	THWN-2	#6	1" EMT



Revisions:

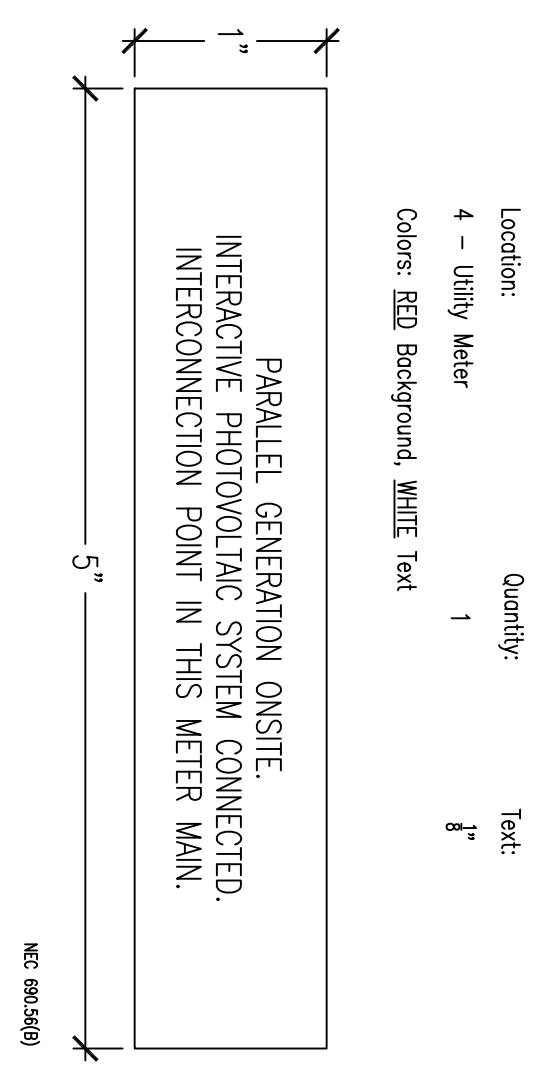
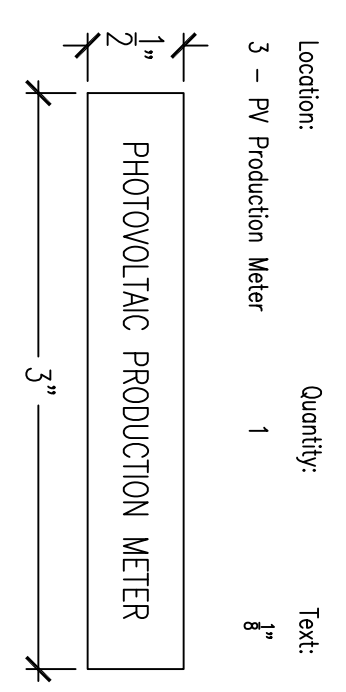
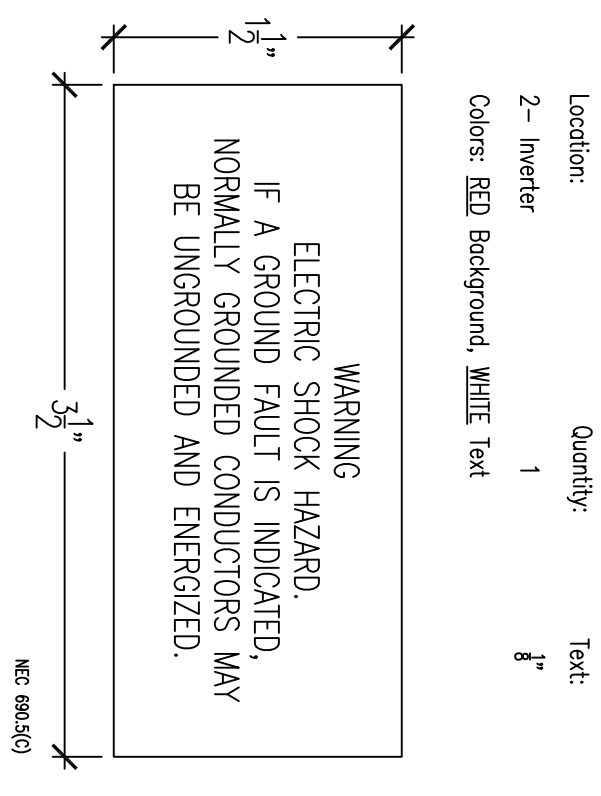
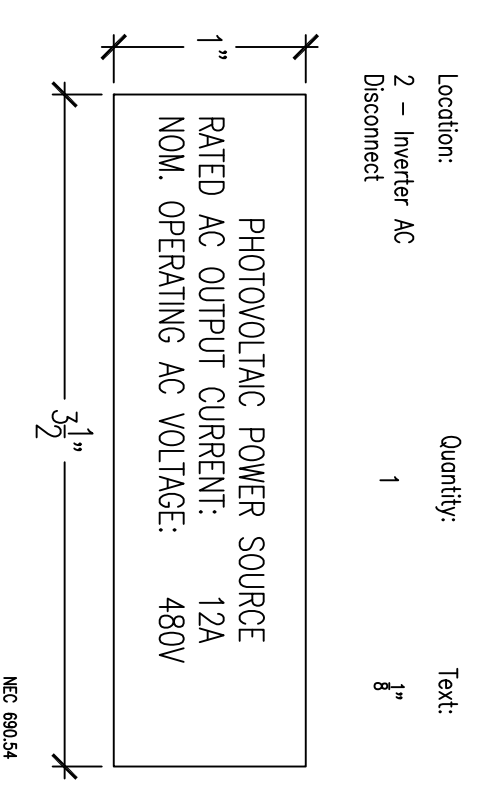
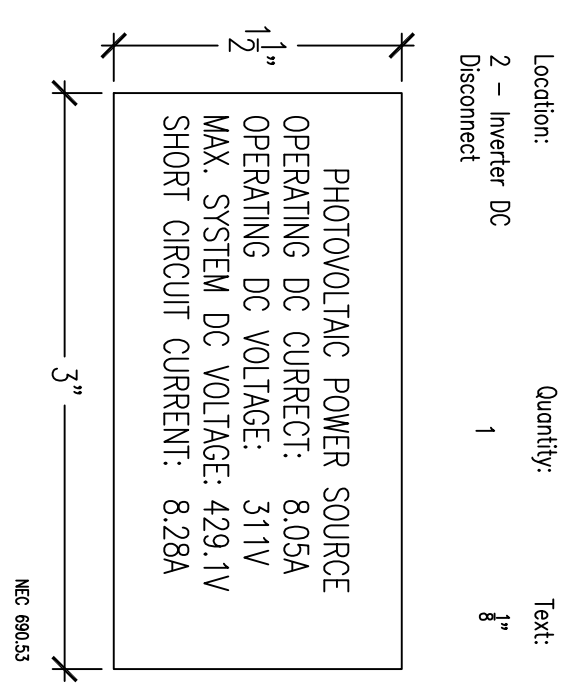
**WILLIAMS DAIRY HEIFER RAISING  
PHOTOVOLTAIC PROJECT**  
Tax Lot 2601, Parcel 1, Buroker Rd.  
Milton Freewater, Oregon

Sheet Title:  
**SIGNAGE**

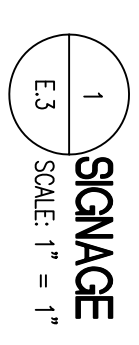
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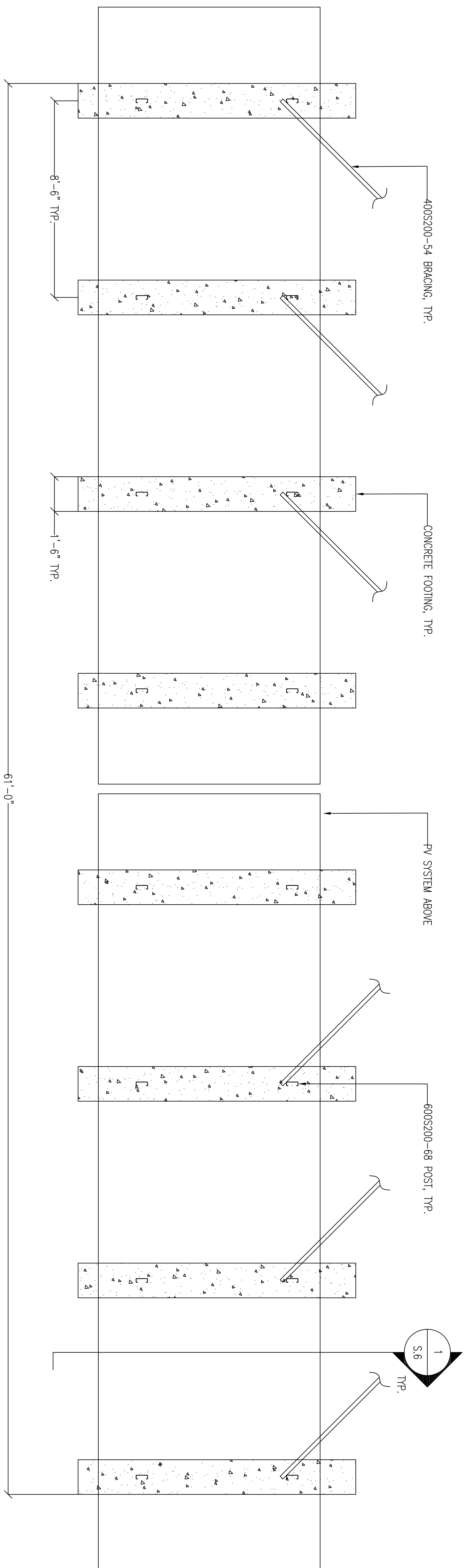
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**E3**

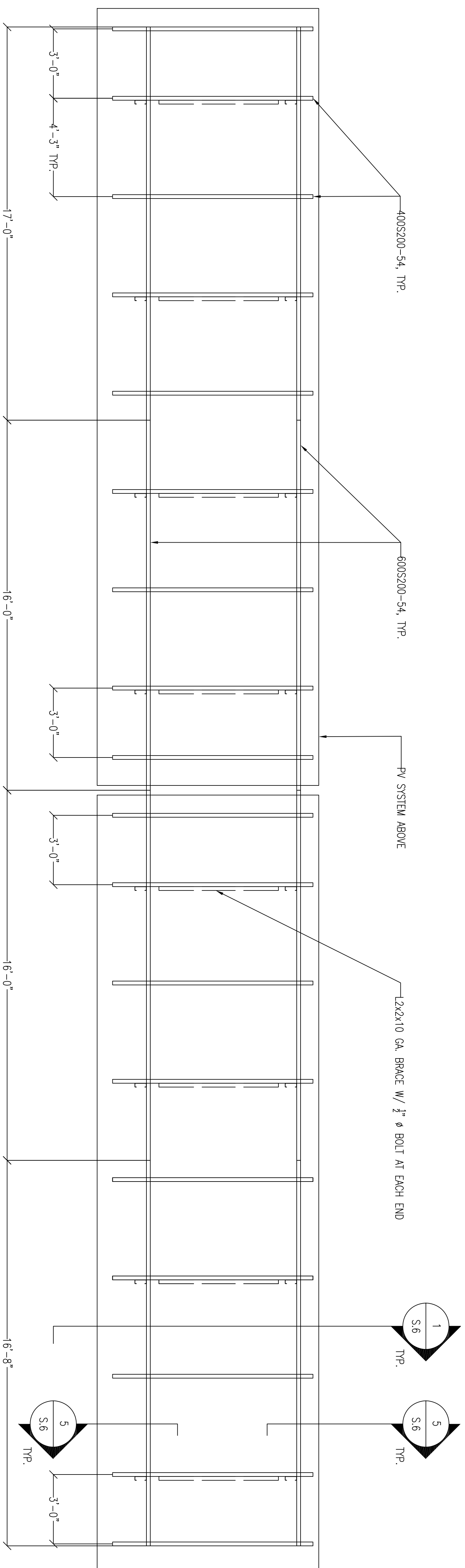


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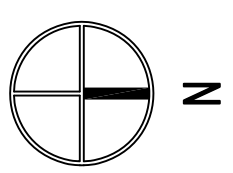




1 FOOTINGS PLAN  
S.1 SCALE: 3/8" = 1' - 0"



2 FRAMING PLAN  
S.1 SCALE: 3/8" = 1' - 0"



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PHOTOVOLTAIC PROJECT  
Tax Lot 2601, Parcel 1, Buroker Rd.  
Milton Freewater, Oregon

Sheet Title:  
**FOOTING +  
FRAMING PLAN**

Date: 08/25/2011

CEI Project No.

CEI Project Manager: JZ

Designed By: KK

Drawn By: KK

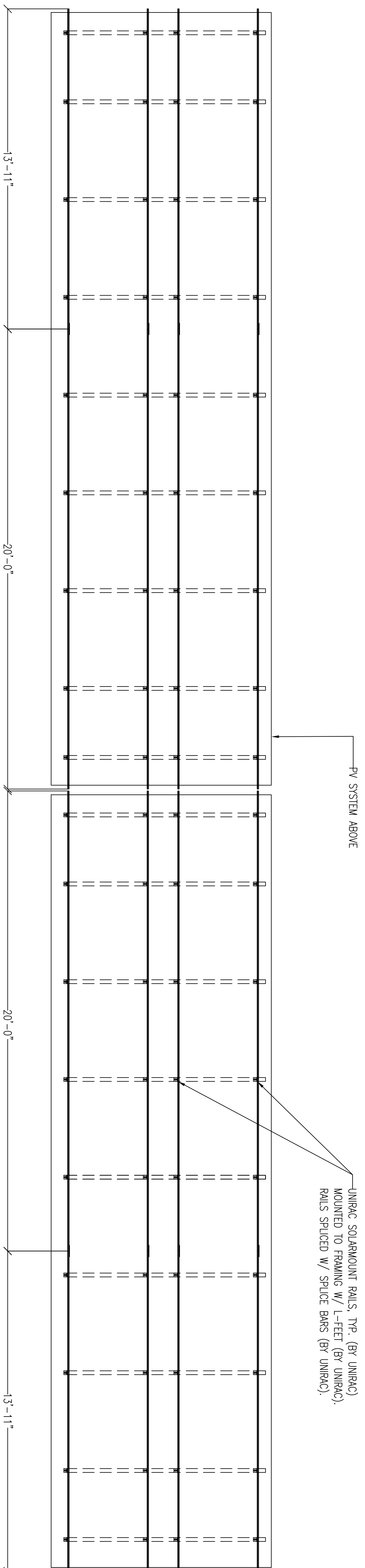
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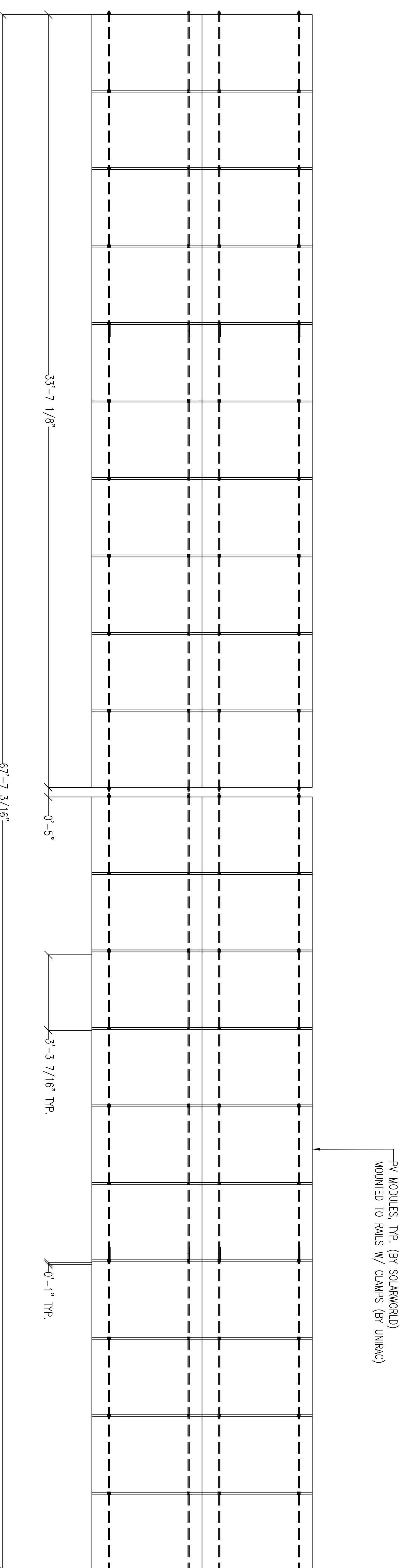
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S.1

DESIGN

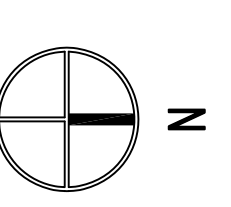


1 RACKING PLAN  
S2 SCALE: 3/8" = 1' - 0"



2 MODULE PLAN  
S2 SCALE: 3/8" = 1' - 0"

SYSTEM DESCRIPTION	
MODULE TYPE	SQUAREWORLD 250 MONO
QUANTITY	40 MODULES
SYSTEM SIZE	10 KW DC STC
TILT ANGLE	30°
AZIMUTH	180°



Revisions:

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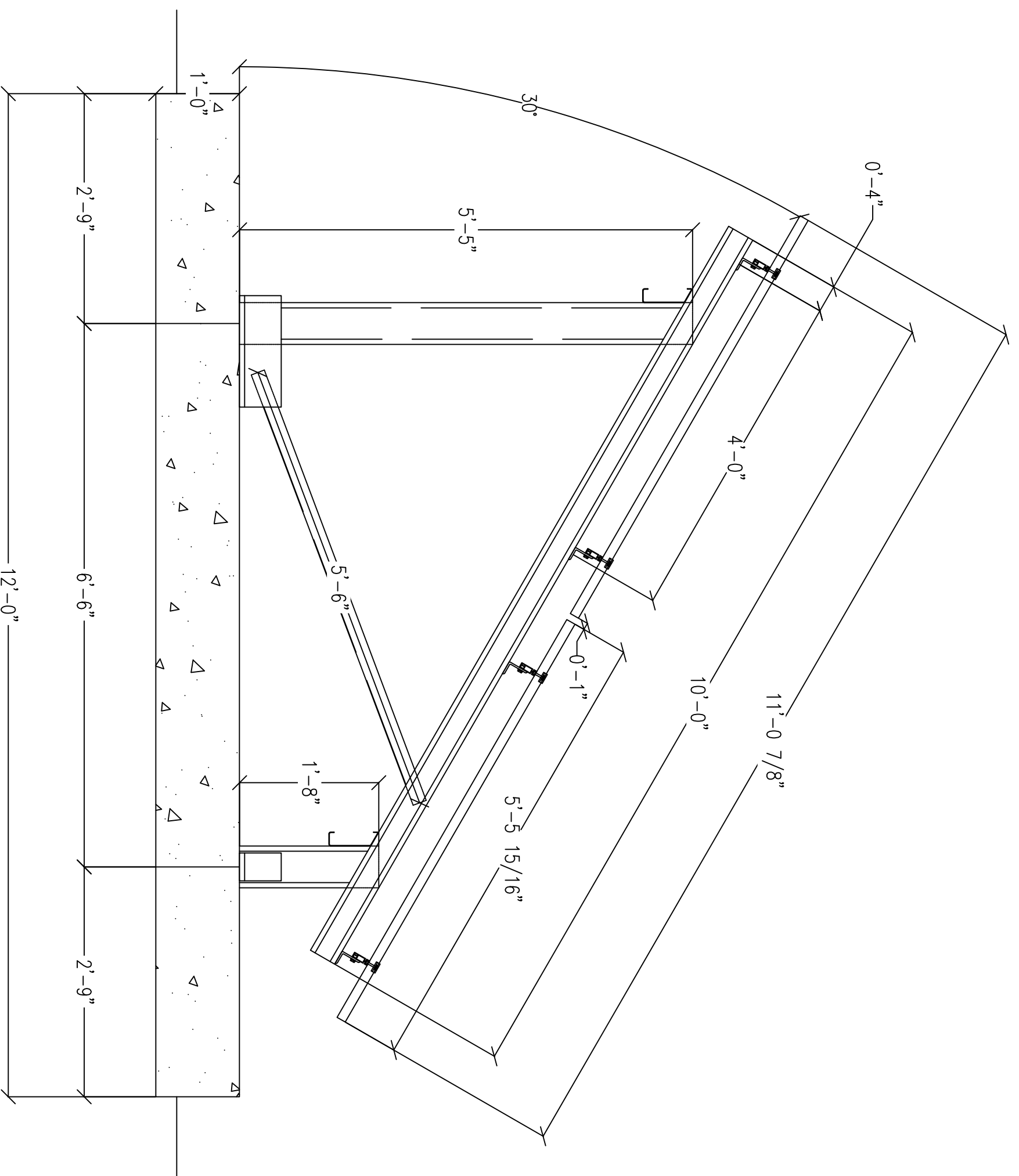
WILLIAMS DAIRY HEIFER RAISING  
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Tax Lot 2601, Parcel 1, Buroker Rd.  
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Sheet Title:  
**RACKING +  
MODULE PLAN**

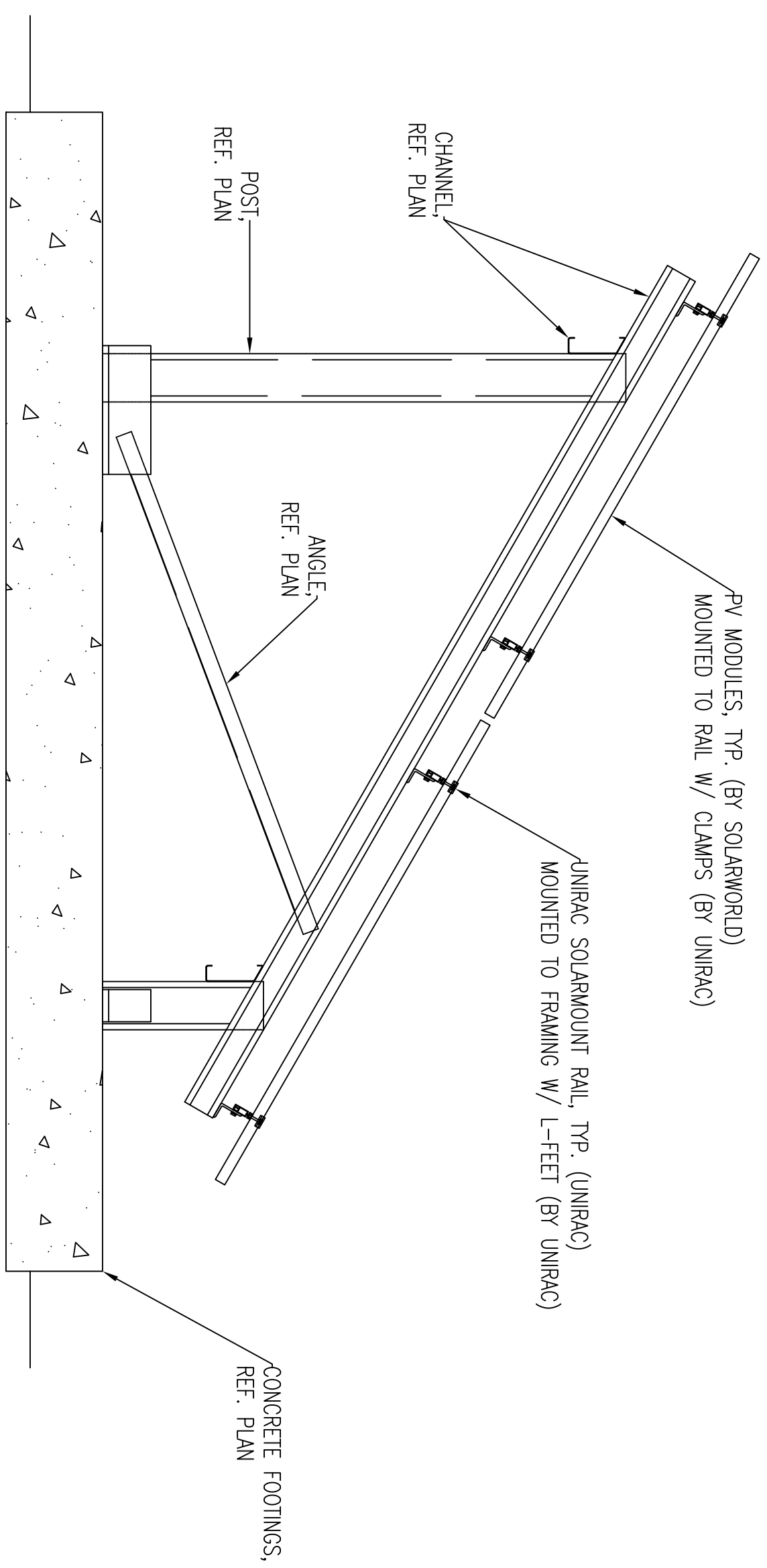
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CEI Project Manager: JZ  
Designed By: KK  
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Checked By: KK  
Project Type: 230

Sheet Number:  
**S2**

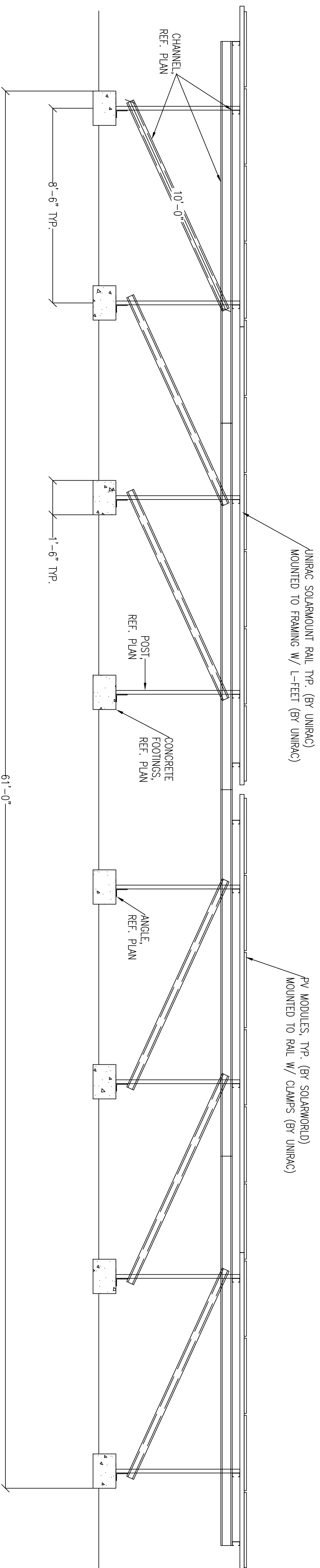
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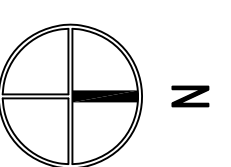
1 WEST ELEVATION (DIMS)  
S3 SCALE: 1/2" = 1'-0"



1 PACKING + MODULE PLAN  
S3 SCALE: 3/8" = 1'-0"



1 PACKING + MODULE PLAN  
S3 SCALE: 3/8" = 1'-0"



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Sheet Title:  
ELEVATIONS

Date: 08/25/2011  
CEI Project No.  
CEI Project Manager: JZ  
Designed By: KK  
Drawn By: KK  
Checked By: KK  
Project Type: 230

Sheet Number:

S3

DESIGN

# GENERAL STRUCTURAL NOTES

CODE REQUIREMENTS:  
CONFORM TO THE 2010 OREGON STRUCTURAL SPECALTY CODE (OSSC), BASED ON THE 2009 INTERNATIONAL BUILDING CODE (IBC).

TEMPORARY CONDITIONS:  
THE STRUCTURE IS DESIGNED TO FUNCTION AS A UNIT UPON COMPLETION. THE CONTRACTOR IS RESPONSIBLE FOR FINISHING ALL TEMPORARY BRACING AND/OR SUPPORT THAT MAY BE REQUIRED AS THE RESULT OF THE CONTRACTOR'S CONSTRUCTION METHODS AND/OR SEQUENCES.

DESIGN CRITERIA:  
IN ADDITION TO THE DEAD LOADS, THE FOLLOWING LOADS AND ALLOWABLES WERE USED FOR DESIGN:

SNOW LOADING: 20 PSF  
WIND LOADING: 95 MPH — EXPOSURE C  
IMPERFORMANCE FACTORS: I = 0.8 (SNOW)  
I = 0.87 (WIND)

SUBMITTALS:  
SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER PRIOR TO FABRICATION AND CONSTRUCTION OF ALL STRUCTURAL ITEMS, INCLUDING THE FOLLOWING: CONCRETE MIX DESIGNS AND LIGHT GAUGE STEEL PRODUCT INFORMATION.

CONCRETE WORK SHALL CONFORM TO CHAPTER 19 OF THE OSSC. CONCRETE STRENGTHS SHALL BE VERIFIED BY CONCRETE 28-DAY CYLINDER TESTS PER ASTM C39, AND SHALL BE AS FOLLOWS:

f<sub>c</sub> (PSI) ABSOLUTE WATER-CEMENT RATIO BY WEIGHT 48

MINIMUM CEMENT CONTENT PER CUBIC YARD SHALL BE AS FOLLOWS:

f<sub>c</sub> (PSI) MINIMUM CEMENT PER CUBIC YARD 470 LBS

FLYASH CONFORMING TO ASTM C618 (INCLUDING TABLE 2A) TYPE F OR TYPE C, MAY BE USED TO REPLACE UP TO 20% OF THE CEMENT CONTENT, PROVIDED THAT THE MAX STRENGTH IS SUBSTANTIATED BY TEST DATA.

THE CONTRACTOR SHALL SUBMIT CONCRETE MIX DESIGNS, ALONG WITH TEST DATA COMPLIANT WITH OSSC SECTION 1905, PRIOR TO PLACING CONCRETE. NO WATER MAY BE ADDED TO CONCRETE IN THE FIELD UNLESS SPECIFICALLY APPROVED IN WRITING BY THE CONCRETE SUPERVISOR IN CONJUNCTION WITH THE CONCRETE MIX DESIGN.

REINFORCING STEEL:  
REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 60, FOR DEFORMED BARS.  
UP ALL REINFORCING BARS 30 INCHES.

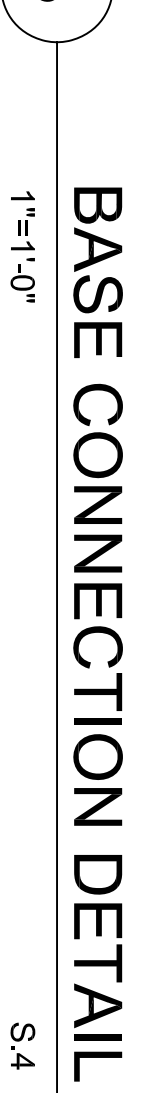
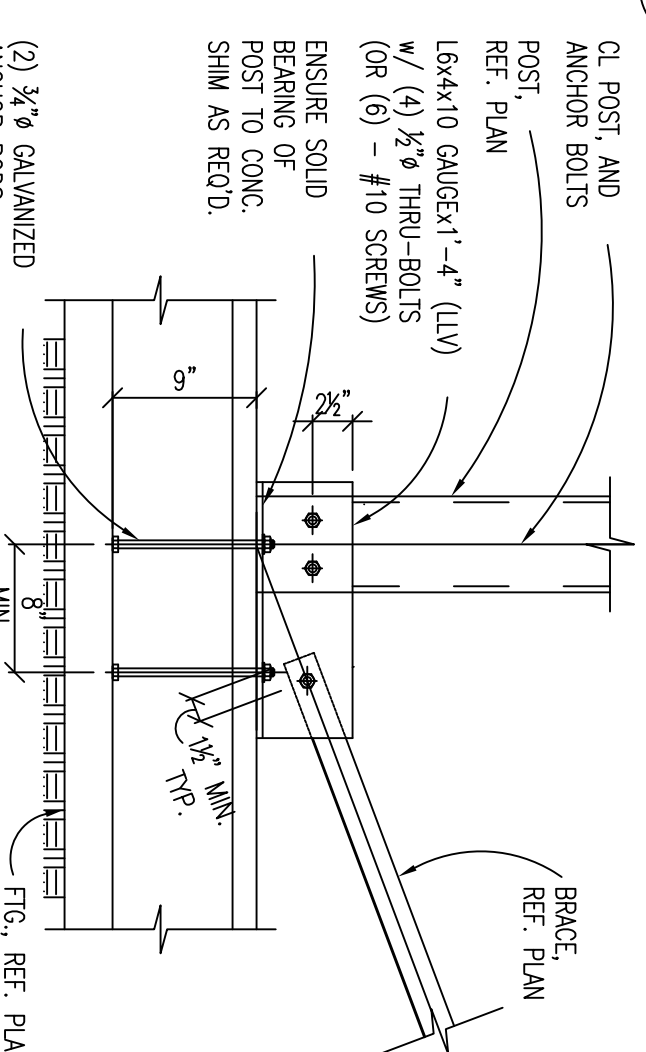
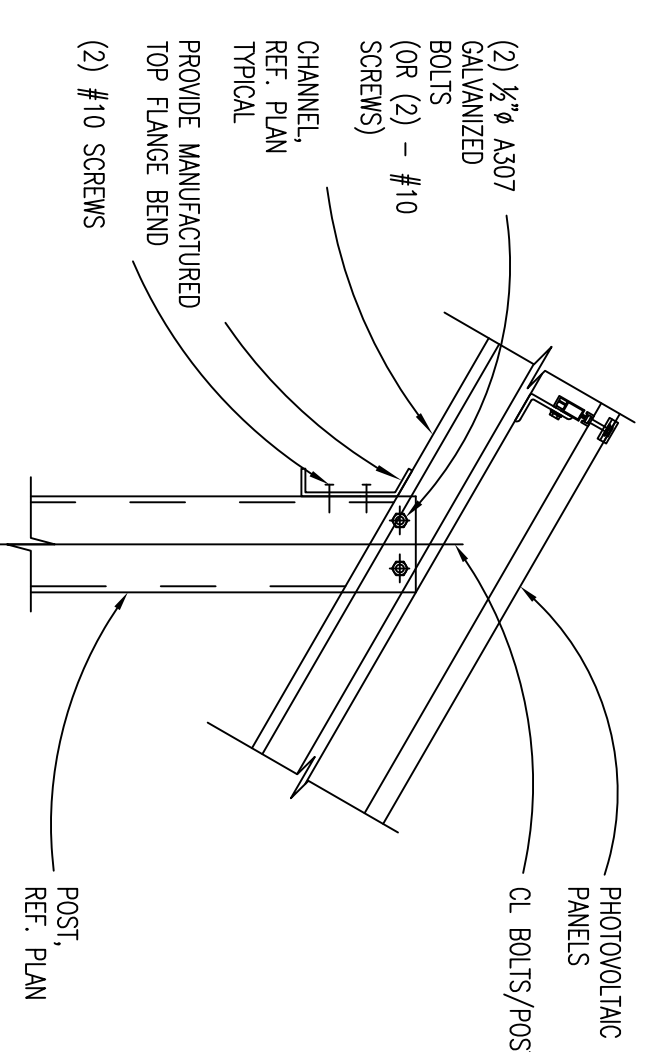
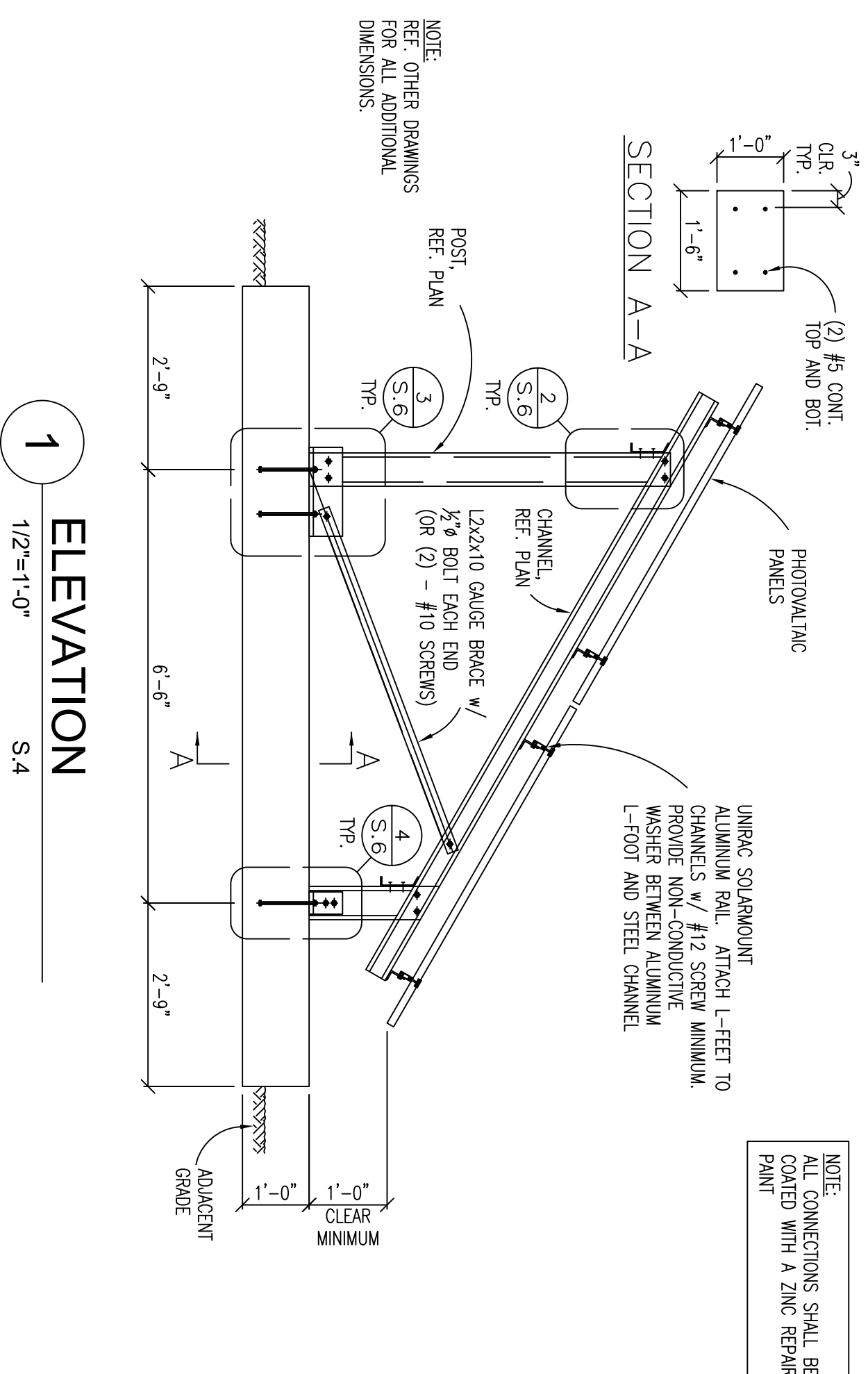
REINFORCING STEEL SHALL HAVE PROTECTION AS FOLLOWS:

FOOTING BARS: 3"

LIGHT GAUGE METAL FRAMING:  
LIGHT GAUGE METAL STUDS SHALL BE C-STUDS WITH A MINIMUM YIELD OF 33,000 PSI FOR 18 AND 20 GAUGE, AND 50,000 PSI FOR 12, 14 AND 16 GAUGE. ALL GALVANIZING SHALL BE G90. STUDS SHALL BE OF THE SIZE, GAUGE, AND SPACING SHOWN ON THE DRAWINGS. SCREWS SHALL BE G90. THE FIELD SHALL BE INSTALLED PER IBC FOR ALL STUDS. END STUDS SHALL BE INSTALLED PER IBC. THE FIELD SHALL BE INSTALLED IN CONFORMANCE WITH ICC-ES E-1013 AND SHALL CONFORM TO AISI SPECIFICATIONS AND STANDARDS.

SQUARE PANEL RAILS:  
PREMANUFACTURED RAILS AND CONNECTIONS SHALL BE PROVIDED BY UNISTRUT. RAILS SHALL BE INSTALLED IN STRICT CONFORMANCE WITH MANUFACTURER'S DETAILS AND RECOMMENDATIONS.

STRUCTURAL STEEL:  
ANCHOR BOLTS: ASTM F1554 GR. 36 HEADED ANCHOR RODS (GALVANIZED)  
BOLTS: ASTM A307 (GALVANIZED)





**PHOTOVOLTAIC SYSTEM**  
**WILLIAMS DAIRY HEIFER RAISING**  
**TAX LOT 2702, PARCEL 3, M KEY STATION RD.**  
**MILTON FREEWATER, OREGON**

**OWNER**

WILLIAMS DAIRY HEIFER RAISING  
 49654 UMAPINE RD.  
 MILTON FREEWATER, OREGON 97862  
 541.558.3918

**PROJECT MANAGER**

CHRISTENSON ELECTRIC  
 111 SW COLUMBIA, SUITE 480  
 PORTLAND, OREGON 97201  
 503.419.3330

**GENERAL/ELECTRICAL CONTRACTOR**

CHRISTENSON ELECTRIC  
 111 SW COLUMBIA, SUITE 480  
 PORTLAND, OREGON 97201  
 503.419.3330

**SYSTEM DESIGN**

TANNER CREEK ENERGY  
 111 SW COLUMBIA, SUITE 480  
 PORTLAND, OREGON 97201  
 503.892.5726

**SYSTEM DESCRIPTION**

- (40) SOLARWORLD 250 MONO PV MODULES
- (1) SOLECTRA PVI 10KW INVERTER
- 10,000 WATTS DC STC

**SCOPE OF WORK**

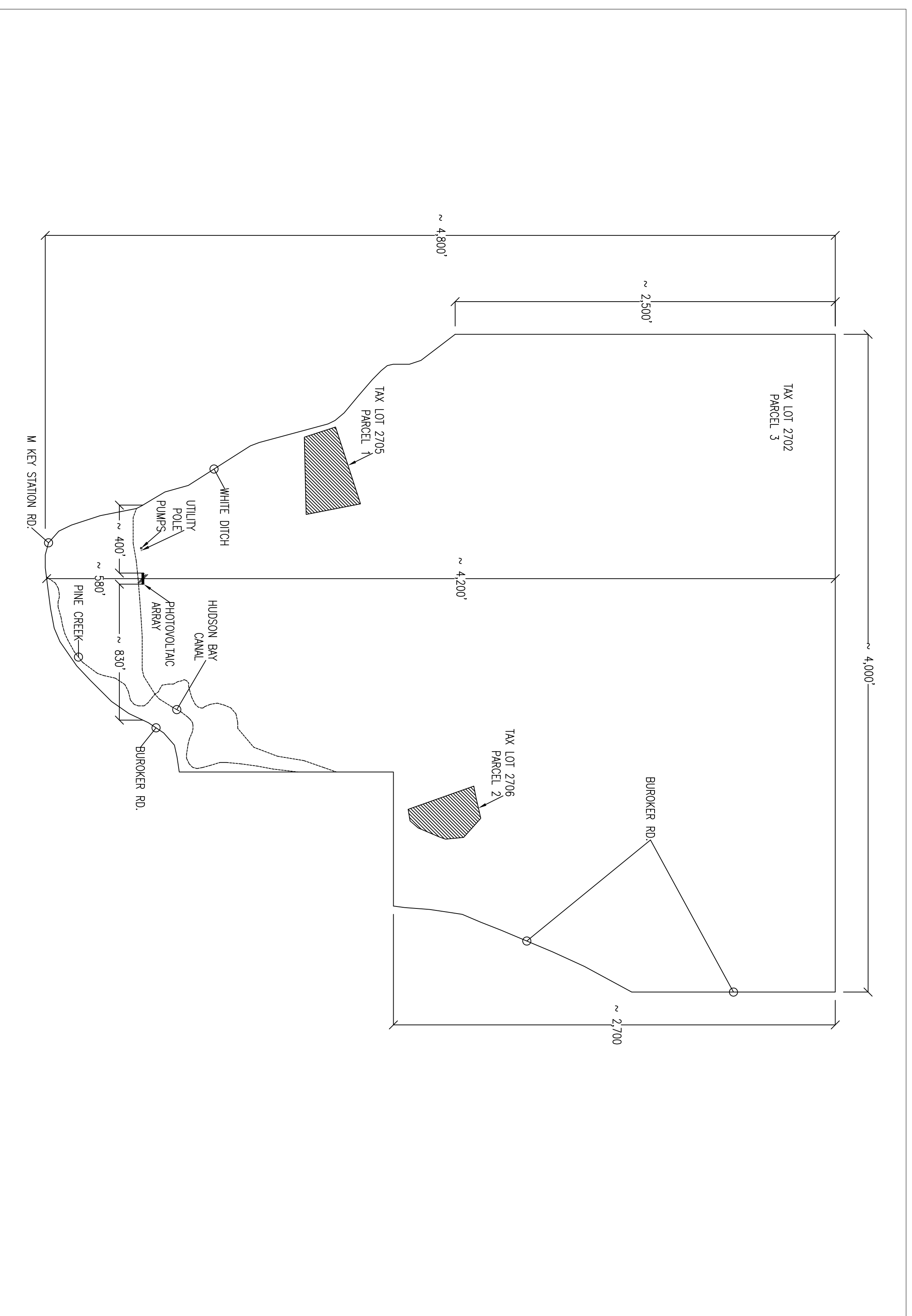
THE PROJECT SCOPE INCLUDES THE DESIGN AND INSTALLATION OF A 10,000 W DC GRID-TIED SOLAR PHOTOVOLTAIC (PV) SYSTEM AT ONE OF WILLIAMS' IRRIGATION PUMPS OUTSIDE OF MILTON FREEWATER, OREGON.

DURING DAYLIGHT HOURS THIS PV SYSTEM WILL PROVIDE ELECTRICITY IN PARALLEL WITH THE LOCAL ELECTRIC UTILITY SERVICE PROVIDER.

ALL EQUIPMENT WILL BE INSTALLED AS REQUIRED BY APPLICABLE CODES (2010 OREGON SOLAR INSTALLATION SPECIALTY CODE) AND PORTLAND GENERAL ELECTRIC SOLAR PERMIT REQUIREMENTS.

THE PV SYSTEM CONSISTS OF ONE NON-COMBUSTIBLE GROUND MOUNTED SOLAR ARRAY, ONE INVERTER AND RELATED ELECTRICAL EQUIPMENT.

SHEET LIST TABLE	
T	TITLE PAGE & SITE PLAN
A	LAYOUT & ELEVATION
E.1	ELECTRICAL NOTES & PLAN
E.2	ELECTRICAL DIAGRAM
E.3	SIGNAGE
S.1	FOOTING & FRAMING PLAN
S.2	RACKING & MODULE PLAN
S.3	ELEVATIONS
S.4	DETAILS



1 SITE PLAN  
T  
SCALE: V/A

Revisions:

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**WILLIAMS DAIRY HEIFER RAISING**  
**PHOTOVOLTAIC PROJECT**  
 Tax Lot 2702, Parcel 3, M Key Station Rd.  
 Milton Freewater, Oregon

Sheet Title:  
**TITLE PAGE +**  
**SITE PLAN**

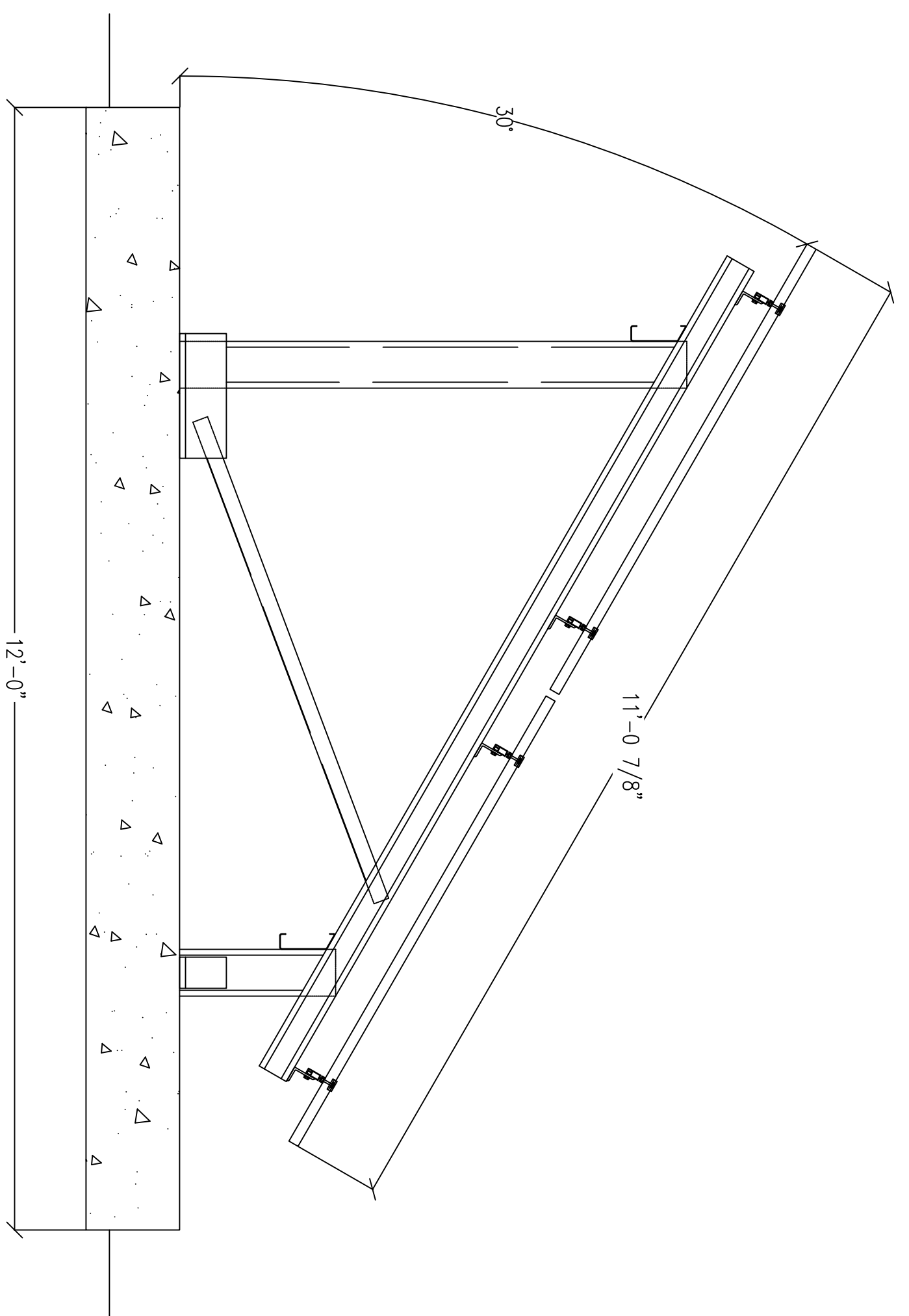
Date: 08/25/2011  
 CEI Project No.  
 CEI Project Manager: JZ  
 Designed By: KK  
 Drawn By: KK  
 Checked By: KK  
 Project Type: 230

Sheet Number:

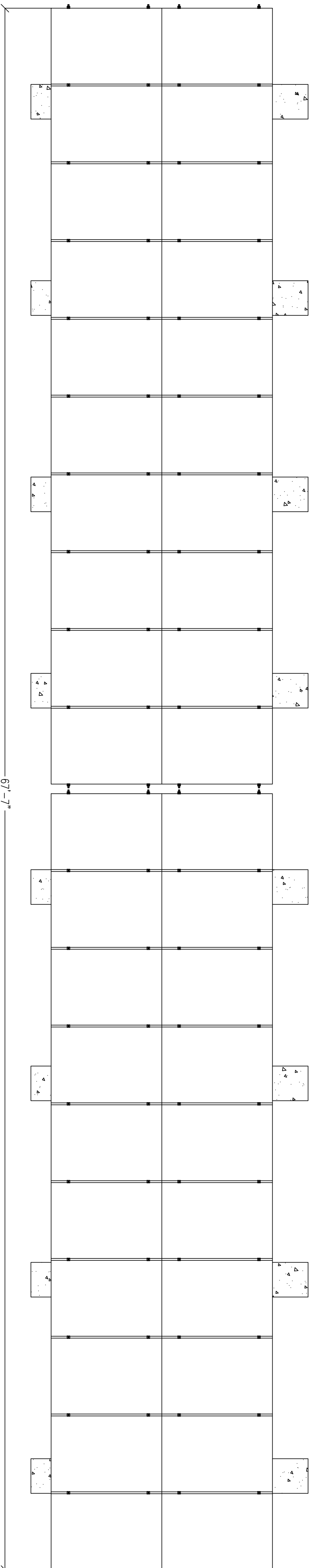
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DESIGN

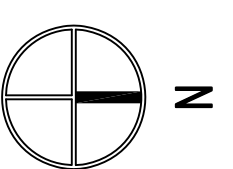
SYSTEM DESCRIPTION	
MODULE TYPE	SOLARWORLD 250 MONO
QUANTITY	40 MODULES
SYSTEM SIZE	10 kW DC STC
TILT ANGLE	30°
AZIMUTH	180°
INVERTER	(1) SOLECTRA PVI 10kW



1 WEST ELEVATION  
SCALE: 3/4" = 1' - 0"



2 PV LAYOUT  
SCALE: 3/8" = 1' - 0"



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Revisions:

WILLIAMS DAIRY HEIFER RAISING  
PHOTOVOLTAIC PROJECT  
Tax Lot 2702, Parcel 3, M Key Station Rd.  
Milton Freewater, Oregon

Sheet Title:  
LAYOUT +  
ELEVATION

Date: 08/25/2011  
CEI Project No.  
CEI Project Manager: JZ  
Designed By: KK  
Drawn By: KK  
Checked By: KK  
Project Type: 230

Sheet Number:  
A

DESIGN



**SYSTEM DESCRIPTION**

1 ARRAY, 40 MODULES TOTAL  
 1 INVERTER (SOLETRIA PVI 10KW) – 480VAC/12A  
 SIZE – 10,000 W DC STC  
 EST. ANNUAL PRODUCTION – 13,768 KWH AC

**SOURCE CIRCUIT**

PHOTOVOLTAIC MODULE:

SOLETRAWORLD 250 MONO, 250 W STC

Voc = 37.8V (42.9V @ -16°C – ASHRAE MEAN EXTREME LOW TEMP)

Vmp = 31.1V (24.9V @ 39°C – ASHRAE 0.4% HIGH TEMP)

Isc = 8.28A

Iimp = 8.05A

**PHOTOVOLTAIC ARRAY**

40 MODULES, 10 MODULES/STRING (4 STRINGS TOTAL)

Voc = 429.1V @ -16°C

Vmp = 311V TYPICAL (249.4V @ 39°C)

Isc = 8.28A

Iimp = 8.05A

**OUTPUT CIRCUITS**

- MODULES MOUNTED TO UNIRAC RACKING ON CUSTOM GROUND MOUNT SYSTEM.
- INVERTER WITH DC/AC DISCONNECT MOUNTED TO BACK OF RACKING STRUCTURE.

- INVERTER OUTPUT CONDUIT ROUTED TO UTILITY REQUIRED PV PRODUCTION METER LOCATION UTILITY POLE ~150' WEST OF THE ARRAY.
- POINT OF COMMON CONNECTION (POCC) LOCATED IN NEW UTILITY METER MAN.

**ELECTRICAL NOTES FOR NEW PV SYSTEM**

- THIS PROPOSED SOLAR ELECTRIC SYSTEM IS INTENDED TO OPERATE IN PARALLEL DURING THE DAY WITH POWER RECEIVED FROM THE UTILITY SERVICE PROVIDER.
- ALL EQUIPMENT IS UL APPROVED AND IDENTIFIED FOR USE IN THE PV SYSTEM.
- THIS SYSTEM IS INTENDED TO CONNECT TO THE EXISTING FACILITY POWER SYSTEM AT ONE POINT, POINT OF COMMON COUPLING (POCC). THIS CONNECTION SHALL BE IN COMPLIANCE WITH THE NEC ARTICLE 705.12 "POINT OF CONNECTION".

**WIRING + WIRING METHODS**

ALL WIRING METHODS AND INSTALLATION PRACTICES CONFORM TO THE NATIONAL ELECTRIC CODE, OREGON SOLAR INSTALLATION SPECIALTY CODE, AND OTHER APPLICABLE LOCAL CODES.

**GROUNDING**

SEE E.2 – ELECTRICAL DIAGRAM FOR MORE GROUNDING INFORMATION.

**GROUND FAULT PROTECTION**

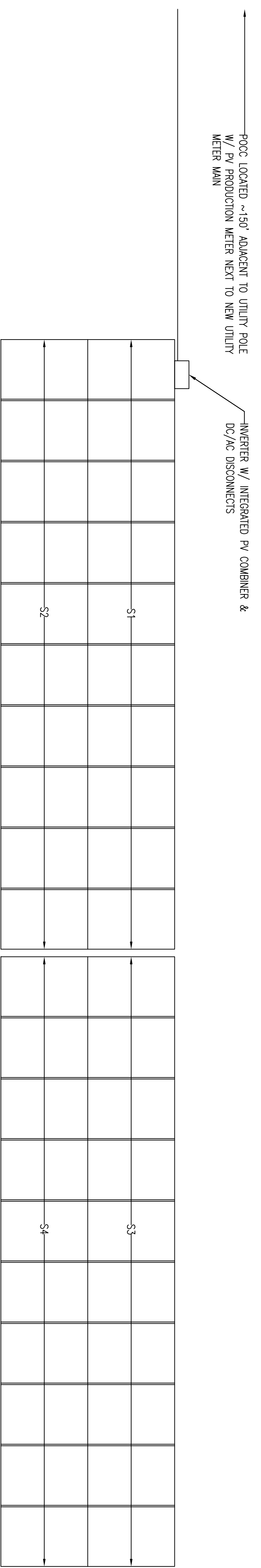
PHOTOVOLTAIC INVERTERS ARE EQUIPPED WITH DC GROUND FAULT PROTECTION TO REDUCE FIRE HAZARDS. INVERTERS ARE ALSO EQUIPPED WITH ANTI-ISLANDING CIRCUITRY.

**DISCONNECTING MEANS**

MEANS ARE PROVIDED TO DISCONNECT ALL CURRENT CARRYING CONDUCTORS OF THE PHOTOVOLTAIC POWER SOURCE FROM ALL OTHER CONDUCTORS AT THE LOCATION.

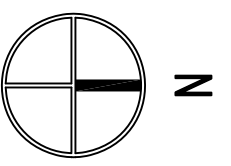
**REQUIRED SAFETY SWITCHES, LABELS + MARKINGS**

REQUIRED SAFETY SIGNS AND LABELS ARE PERMANENTLY ATTACHED BY ADHESIVE, OR OTHER MECHANICAL MEANS. LABELS COMPLY WITH ARTICLE 690 OF THE NEC OR OTHER APPLICABLE STATE AND LOCAL CODES. SEE E.3 – SIGNAGE FOR MORE DETAILS.



MODULE TYPE	QUANTITY	SOURCE CIRCUITS	JUNCTION BOXES	INVERTERS
SOLETRAWORLD 250 MONO	40 MODULES	(4) TOTAL	N/A	(1) TOTAL

**2 ELECTRICAL PLAN**  
 SCALE: 1/4" = 1' - 0"



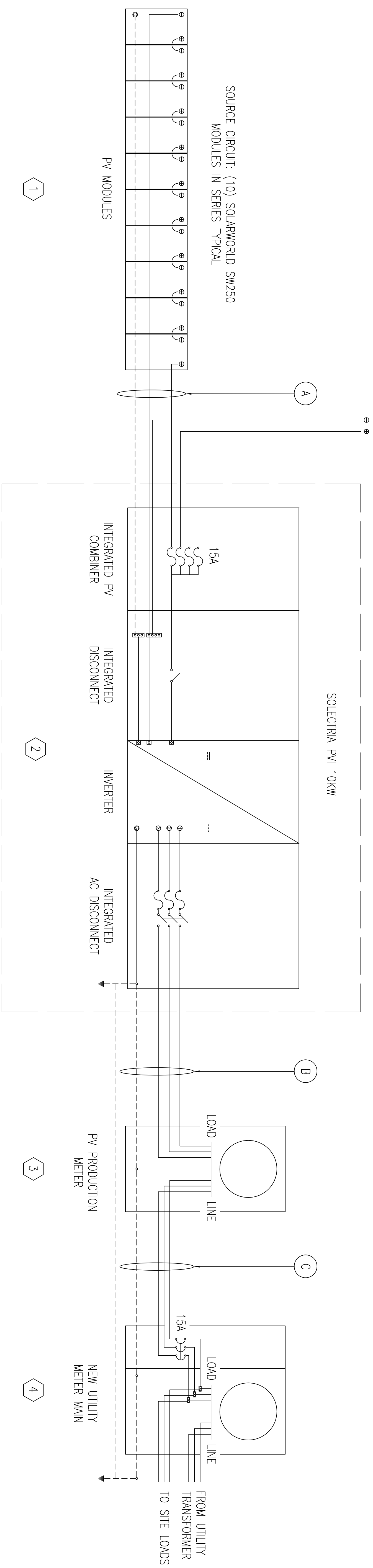
**1 ELECTRICAL NOTES**  
 SCALE: N/A

DESIGN

<p>Sheet Title: <b>ELEC NOTES + PLAN</b></p>	<p><b>WILLIAMS DAIRY HEIFER RAISING PHOTOVOLTAIC PROJECT</b>                  Tax Lot 2702, Parcel 3, M Key Station Rd.                  Milton Freewater, Oregon</p>	<p>Revisions:</p>	<p><b>Christenson</b>                  ELECTRIC, INC.                  ELECTRICAL, POWER &amp; TECHNOLOGY SERVICES                  111 SW Columbia Street, Ste 480                  Portland, OR 97201                  main 503.419.3300                  fax 503.419.3333                  www.christenson.com</p>
<p>Date: 08/25/2011</p> <p>CEI Project No.:</p> <p>CEI Project Manager: JZ</p> <p>Designed By: KK</p> <p>Drawn By: KK</p> <p>Checked By:</p> <p>Project Type: 230</p>	<p>Sheet Number: <b>E.1</b></p>		



FROM OTHER SOURCE CIRCUITS, TYPICAL AS SHOWN AT LEFT. (4) SOURCE CIRCUITS TOTAL.



**SHEET NOTES**

- 1 SOLARWORLD 250 MONO PV MODULES W/ NCA TYPE CONNECTORS. GROUNDING W/ WEBB GROUNDING CLIPS TO RAILS. WEBB GROUNDING LUGS ON RAILS AND CONNECTED TO INVERTER GROUND LUG.
- 2 SOLECTRIA PVI 10KW INVERTER W/ DC/AC DISCONNECTS - (1) TOTAL INVERTERS.
- 3 PV PRODUCTION MAIN (COOPER B-LINE 1177B) - METER TO BE INSTALLED BY UTILITY.
- 4 NEW UTILITY METER MAIN (COOPER B-LINE 217MBMS15) W/ 15A MAIN CIRCUIT BREAKER FOR PV.

TABLE A: PV SOURCE CIRCUIT CONDUCTOR & CONDUIT IDENTIFICATION

CONDUCTOR LOCATION A	# OF MODULES IN SERIES	Isc (A)	Imp (A)	Voc (VDC)	Vmp (VDC)	MAX. ONE WAY LENGTH (FT.)	VOLTAGE DROP %	CURRENT CARRYING CONDUCTOR SIZE	CONDUCTOR TYPE	BONDING CONDUCTOR	CONDUIT
MODULES TO INVERTER	10	8.28	8.05	429.1	311.0	75'-0"	0.50%	#10	USE-2	#6	N/A

TABLE B: INVERTER OUTPUT CIRCUIT CONDUCTOR & CONDUIT IDENTIFICATION

CONDUCTOR LOCATION	NOMINAL VOLTAGE (VAC)	PHASES	GENERATION AMPACITY (A)	DISTANCE	VOLTAGE DROP %	CURRENT CARRYING CONDUCTOR SIZE	CONDUCTOR TYPE	GROUNDING CONDUCTOR	CONDUIT
B	480	3	12.0	150'-0"	0.80%	#10	THWN-2	#6	¾" PVC
C	480	3	12.0	10'-0"	0.10%	#10	THWN-2	#6	½" EMT

Revisions:

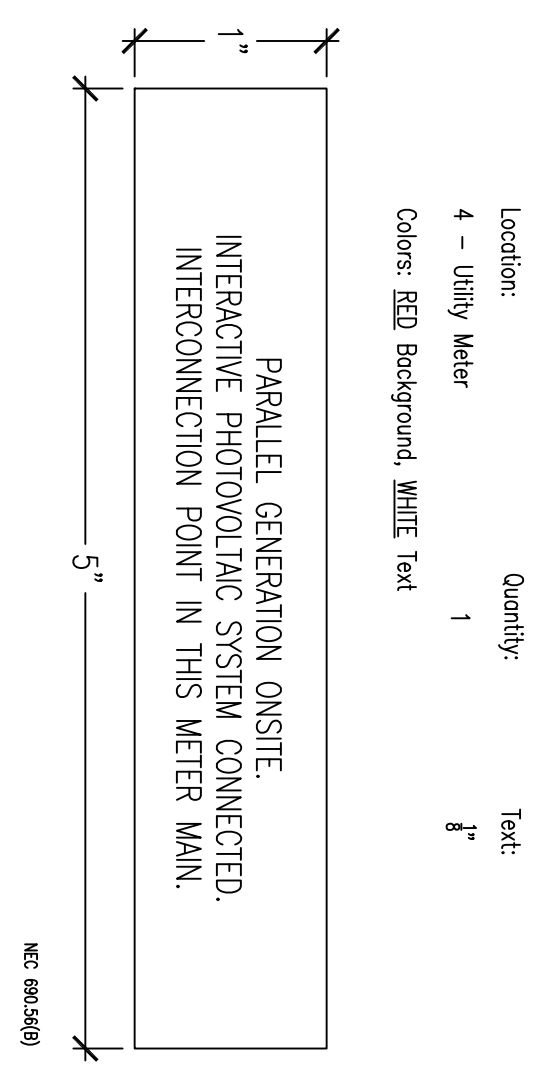
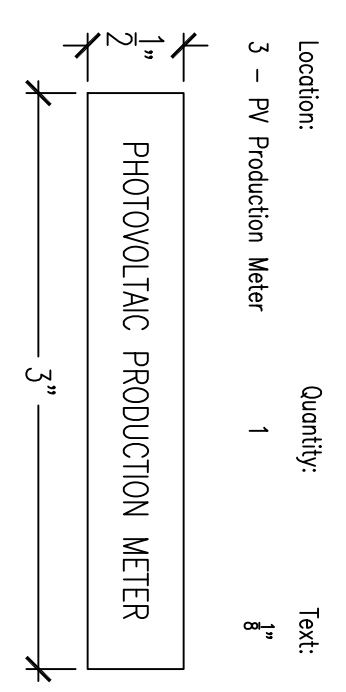
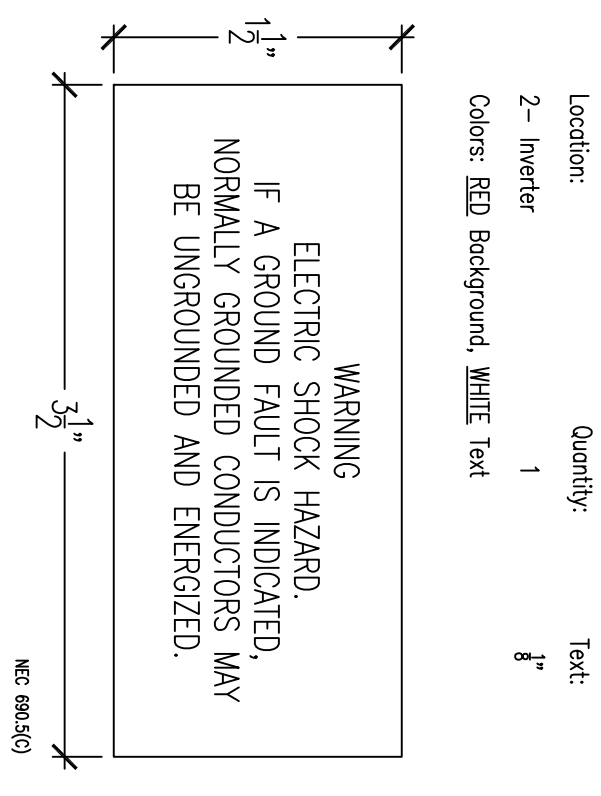
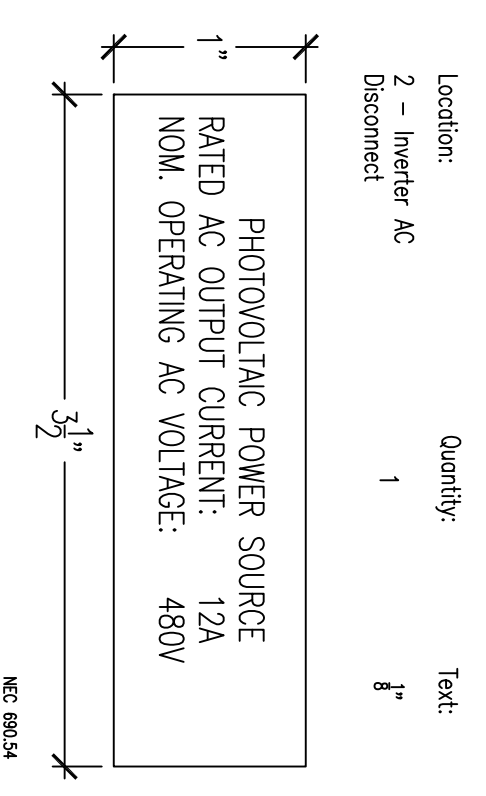
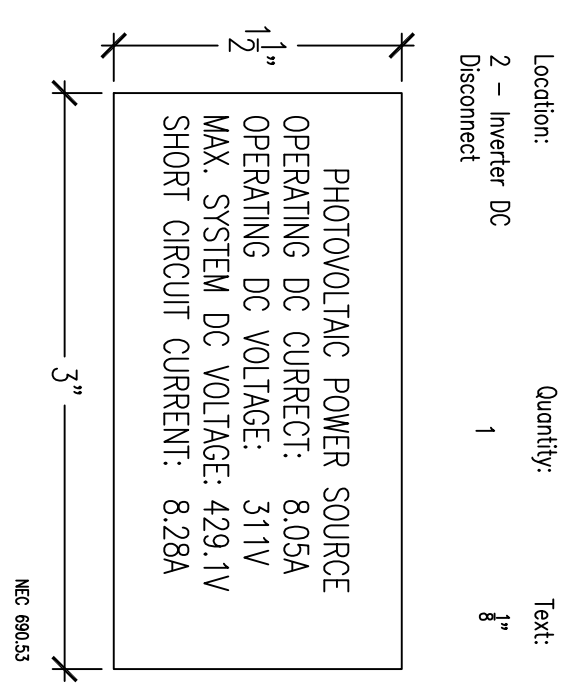
**WILLIAMS DAIRY HEIFER RAISING  
PHOTOVOLTAIC PROJECT**  
Tax Lot 2702, Parcel 3, M Key Station Rd.  
Milton Freewater, Oregon

Sheet Title:  
**SIGNAGE**

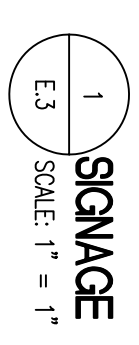
Date: 08/25/2011  
CEI Project No.  
CEI Project Manager: JZ  
Designed By: KK  
Drawn By: KK  
Checked By: KK  
Project Type: 230

Sheet Number:

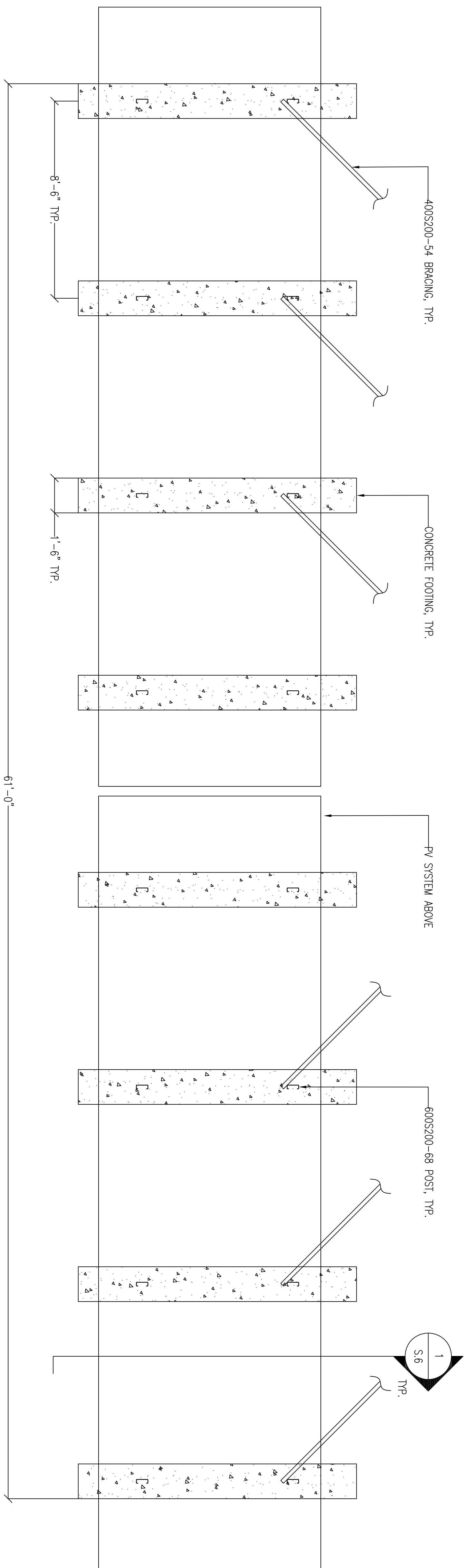
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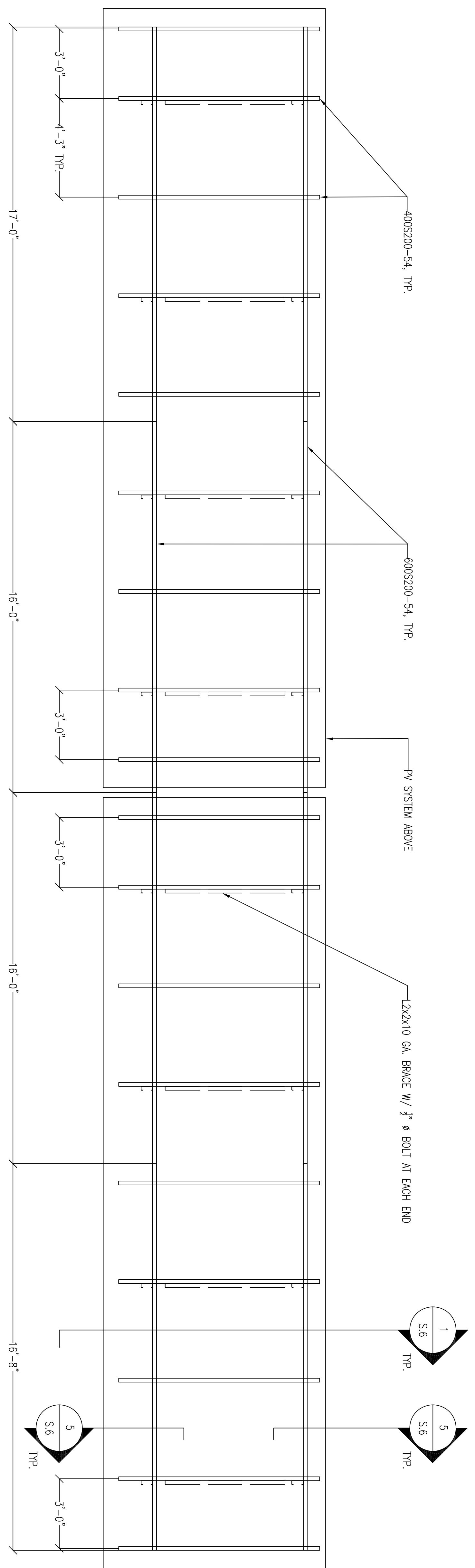
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1 FOOTINGS PLAN  
S.1 SCALE: 3/8" = 1' - 0"



2 FRAMING PLAN  
S.1 SCALE: 3/8" = 1' - 0"

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WILLIAMS DAIRY HEIFER RAISING  
PHOTOVOLTAIC PROJECT  
Tax Lot 2702, Parcel 3, M Key Station Rd.  
Milton Freewater, Oregon

Sheet Title:  
**FOOTING +  
FRAMING PLAN**

Date: 08/25/2011  
CEI Project No.  
CEI Project Manager: JZ  
Designed By: KK  
Drawn By: KK  
Checked By: KK  
Project Type: 230

Revisions:

Sheet Number:  
**S.1**

DESIGN

Revisions:

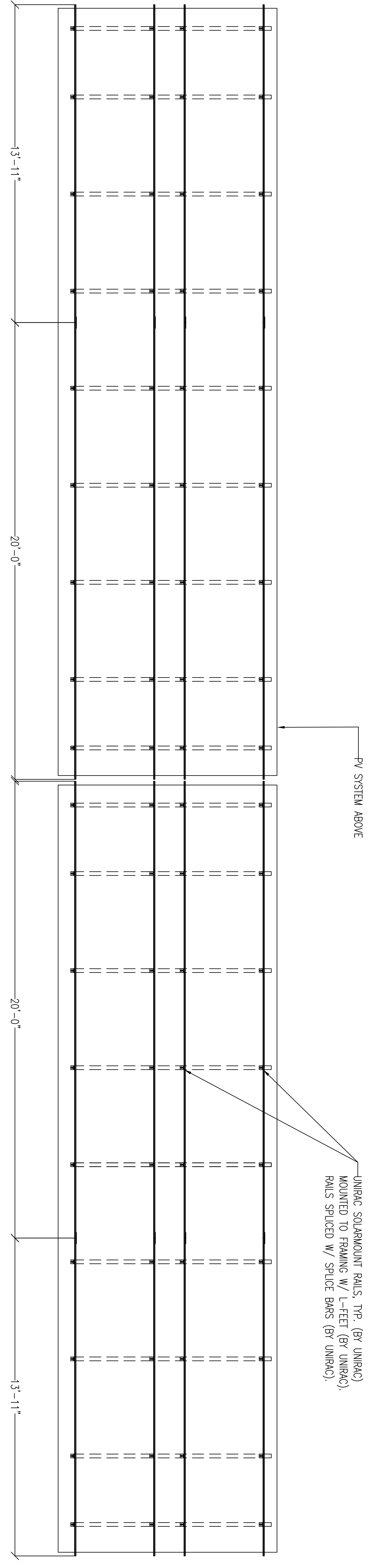
WILLIAMS DAIRY HEIFER RAISING  
PHOTOVOLTAIC PROJECT  
Tax Lot 2702, Parcel 3, M Key Station Rd.  
Milton Freewater, Oregon

Sheet Title:  
**RACKING +  
MODULE PLAN**

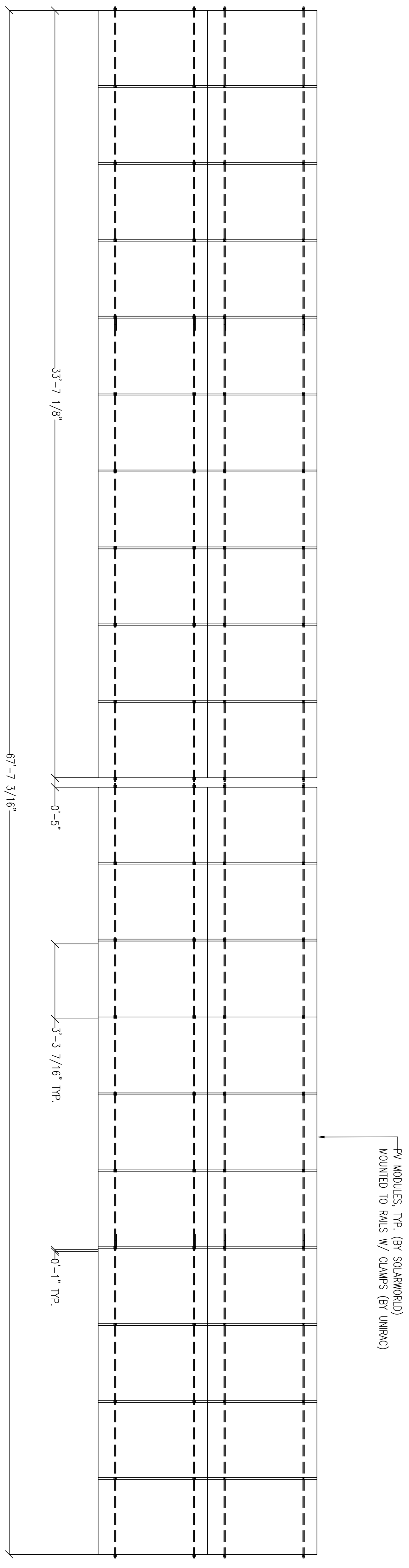
Date: 08/25/2011  
CEI Project No.  
CEI Project Manager: JZ  
Designed By: KK  
Drawn By: KK  
Checked By: KK  
Project Type: 230

Sheet Number:  
**S2**

DESIGN

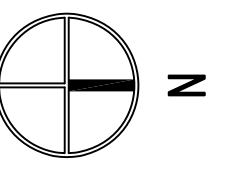


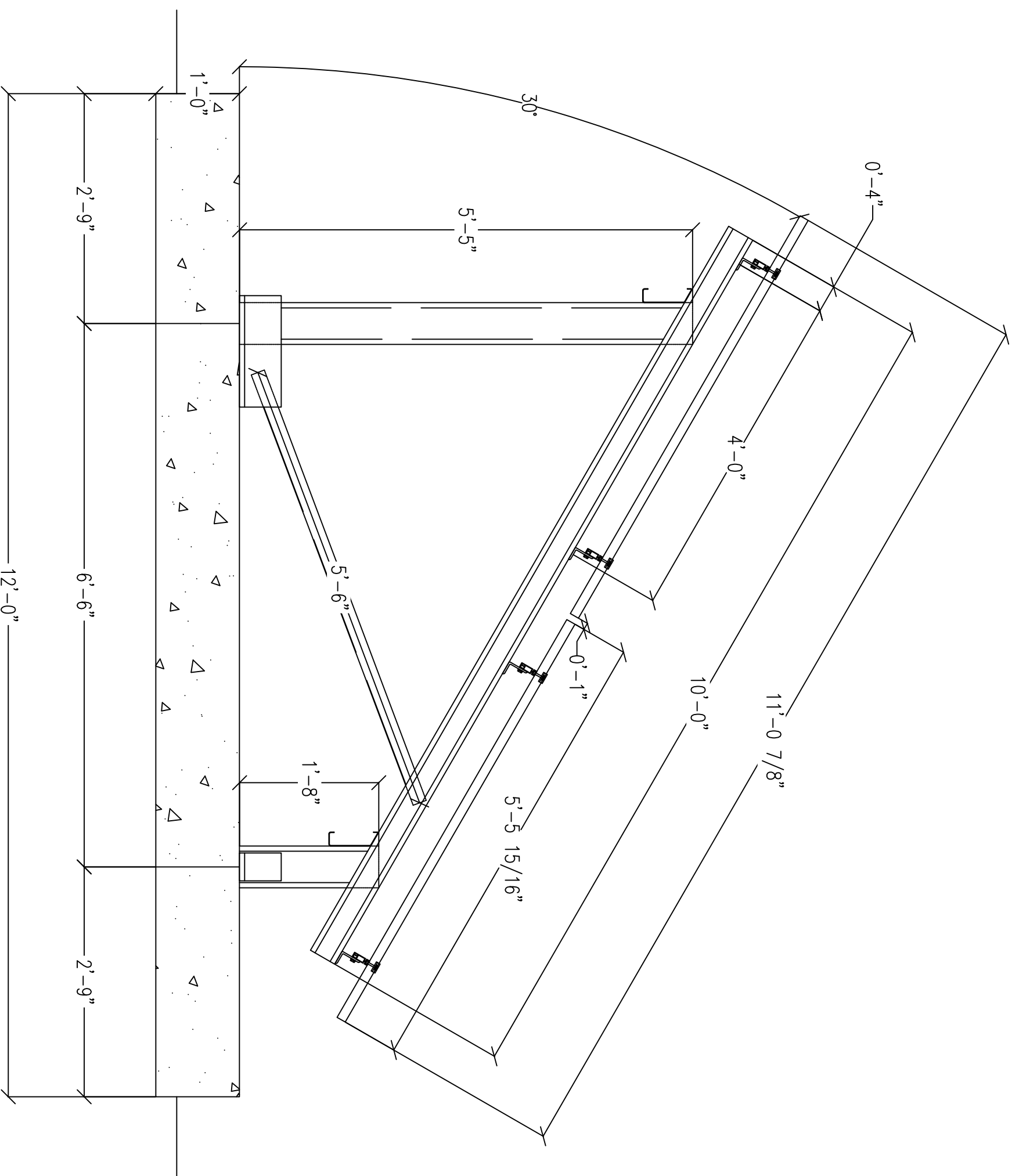
1 RACKING PLAN  
S2 SCALE: 3/8" = 1' - 0"



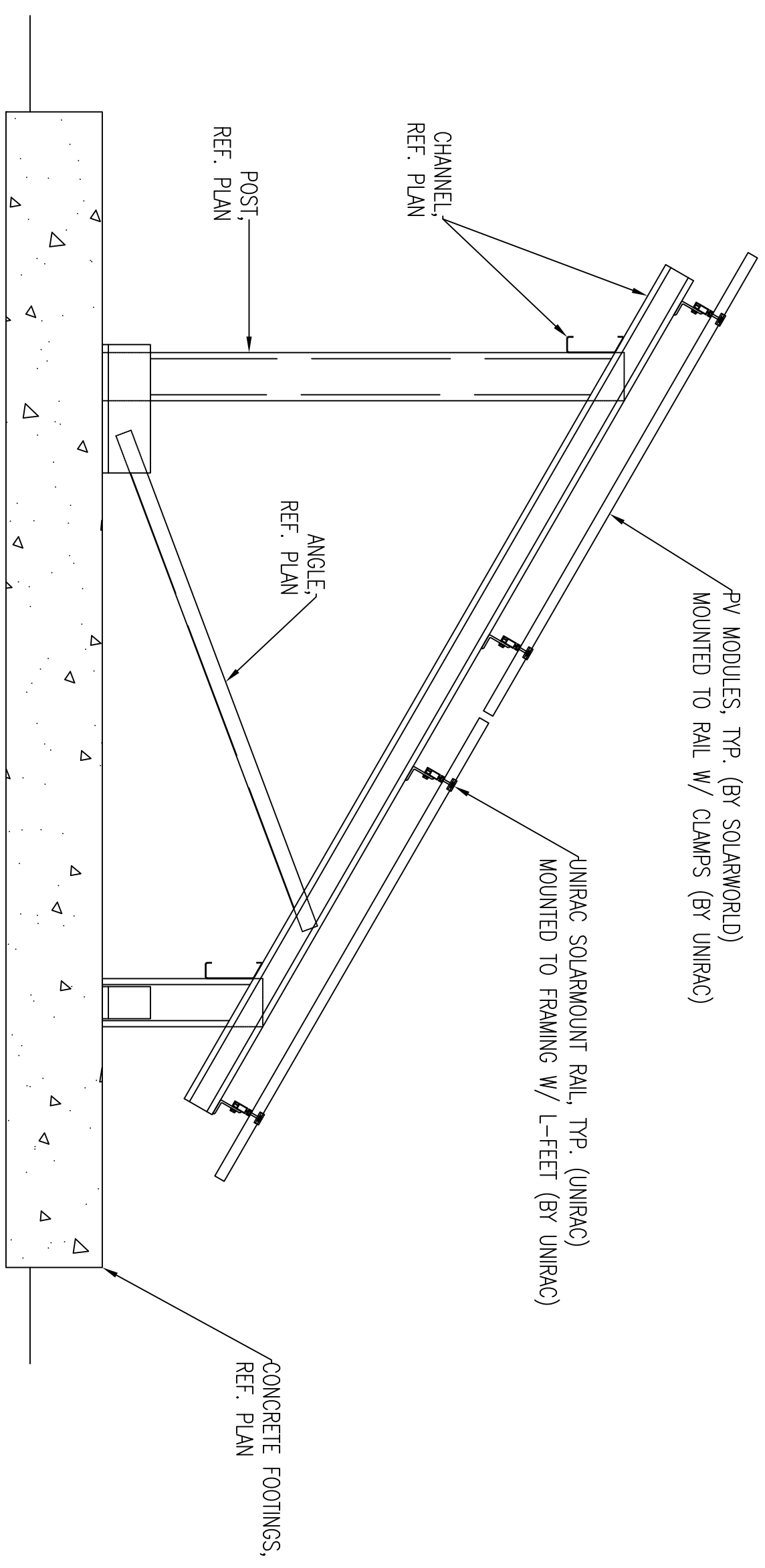
SYSTEM DESCRIPTION	
MODULE TYPE	SQUAREWORLD 250 MONO
QUANTITY	40 MODULES
SYSTEM SIZE	10 KW DC STC
TILT ANGLE	30°
AZIMUTH	180°

2 MODULE PLAN  
S2 SCALE: 3/8" = 1' - 0"

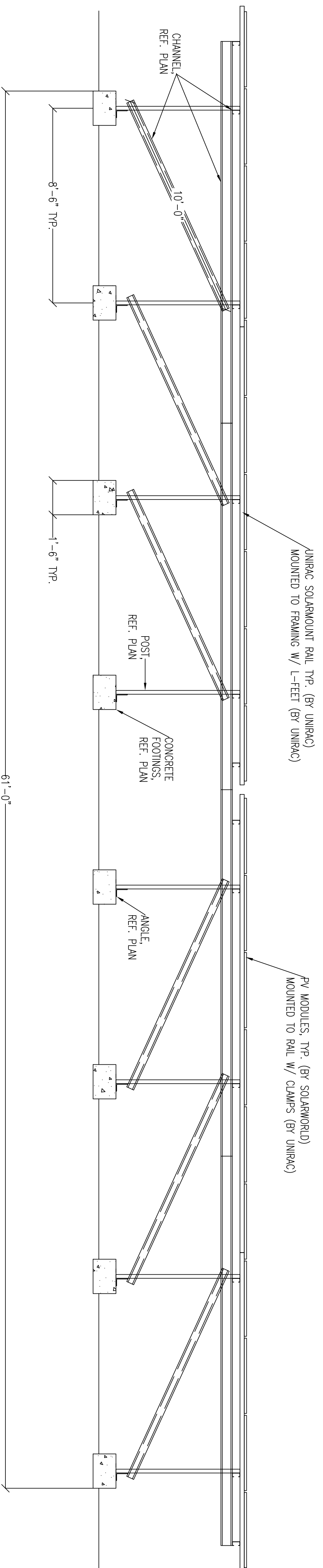




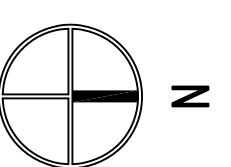
1 WEST ELEVATION (DIMS)  
S3 SCALE: 1/2" = 1'-0"



1 RACKING + MODULE PLAN  
S3 SCALE: 3/8" = 1'-0"



1 RACKING + MODULE PLAN  
S3 SCALE: 3/8" = 1'-0"



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WILLIAMS DAIRY HEIFER RAISING  
PHOTOVOLTAIC PROJECT  
Tax Lot 2702, Parcel 3, M Key Station Rd.  
Milton Freewater, Oregon

Sheet Title:  
**ELEVATIONS**

Date: 08/25/2011  
CEI Project No.  
CEI Project Manager: JZ  
Designed By: KK  
Drawn By: KK  
Checked By: KK  
Project Type: 230

Sheet Number:

**S3**

DESIGN

# GENERAL STRUCTURAL NOTES

CODE REQUIREMENTS:  
CONFORM TO THE 2010 OREGON STRUCTURAL SPECALTY CODE (OSSC), BASED ON THE 2009 INTERNATIONAL BUILDING CODE (IBC).

TEMPORARY CONDITIONS:  
THE STRUCTURE IS DESIGNED TO FUNCTION AS A UNIT UPON COMPLETION. THE CONTRACTOR IS RESPONSIBLE FOR FINISHING ALL TEMPORARY BRACING AND/OR SUPPORT THAT MAY BE REQUIRED AS THE RESULT OF THE CONTRACTOR'S CONSTRUCTION METHODS AND/OR SEQUENCES.

DESIGN CRITERIA:  
IN ADDITION TO THE DEAD LOADS, THE FOLLOWING LOADS AND ALLOWABLES WERE USED FOR DESIGN:

SNOW LOADING: 20 PSF  
WIND LOADING: 95 MPH — EXPOSURE C  
IMPROVANCE FACTORS: I = 0.8 (SNOW)  
I = 0.97 (WIND)

SUBMITTALS:  
SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER PRIOR TO FABRICATION AND CONSTRUCTION OF ALL STRUCTURAL ITEMS, INCLUDING THE FOLLOWING: CONCRETE MIX DESIGNS AND LIGHT GAUGE STEEL PRODUCT INFORMATION.

CONCRETE:  
CONCRETE MIXES SHALL CONFORM TO CHAPTER 19 OF THE OSSC. CONCRETE STRENGTHS SHALL BE VERIFIED BY STANDARD 28-DAY CYLINDER TESTS PER ASTM C39, AND SHALL BE AS FOLLOWS:

f<sub>c</sub> (PSI) ABSOLUTE WATER-CEMENT RATIO BY WEIGHT

46

MINIMUM CEMENT CONTENT PER CUBIC YARD SHALL BE AS FOLLOWS:

f<sub>c</sub> (PSI) MINIMUM CEMENT PER CUBIC YARD

470 LBS

FLYASH CONFORMING TO ASTM C618 (INCLUDING TABLE 2A) TYPE F OR TYPE C, MAY BE USED TO REPLACE UP TO 20% OF THE CEMENT CONTENT, PROVIDED THAT THE MAX STRENGTH IS SUBSTANTIATED BY TEST DATA.

THE CONTRACTOR SHALL SUBMIT CONCRETE MIX DESIGNS, ALONG WITH TEST DATA COMPLIANT WITH OSSC SECTION 1905, PRIOR TO PLACING CONCRETE. NO WATER MAY BE ADDED TO CONCRETE IN THE FIELD UNLESS SPECIFICALLY APPROVED IN WRITING BY THE CONCRETE SUPERVISOR IN CONJUNCTION WITH THE CONCRETE MIX DESIGN.

REINFORCING STEEL:  
REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 60, FOR DEFORMED BARS.  
UP ALL REINFORCING BARS 30 INCHES.

REINFORCING STEEL SHALL HAVE PROTECTION AS FOLLOWS:

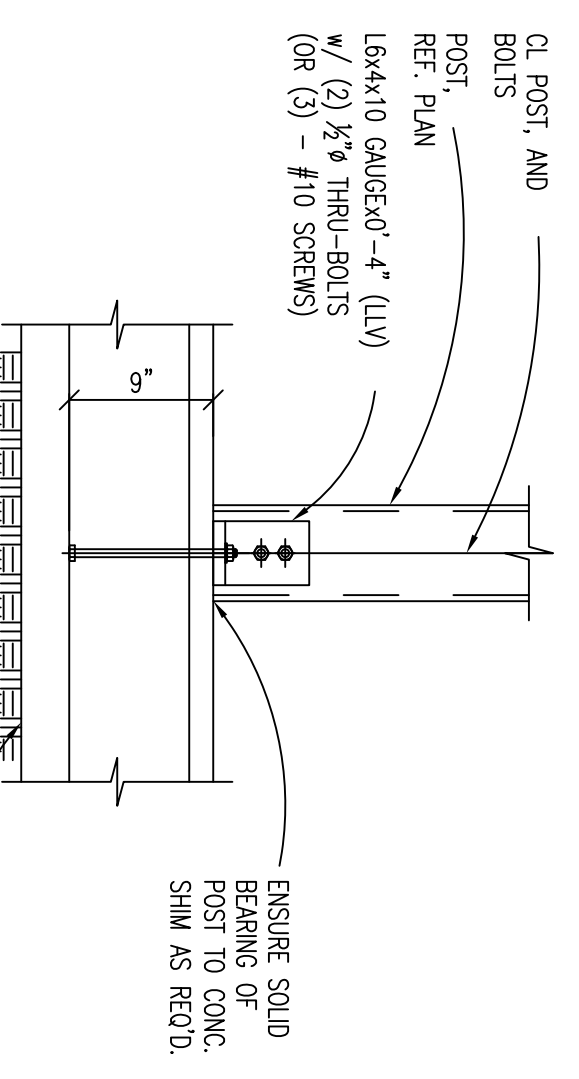
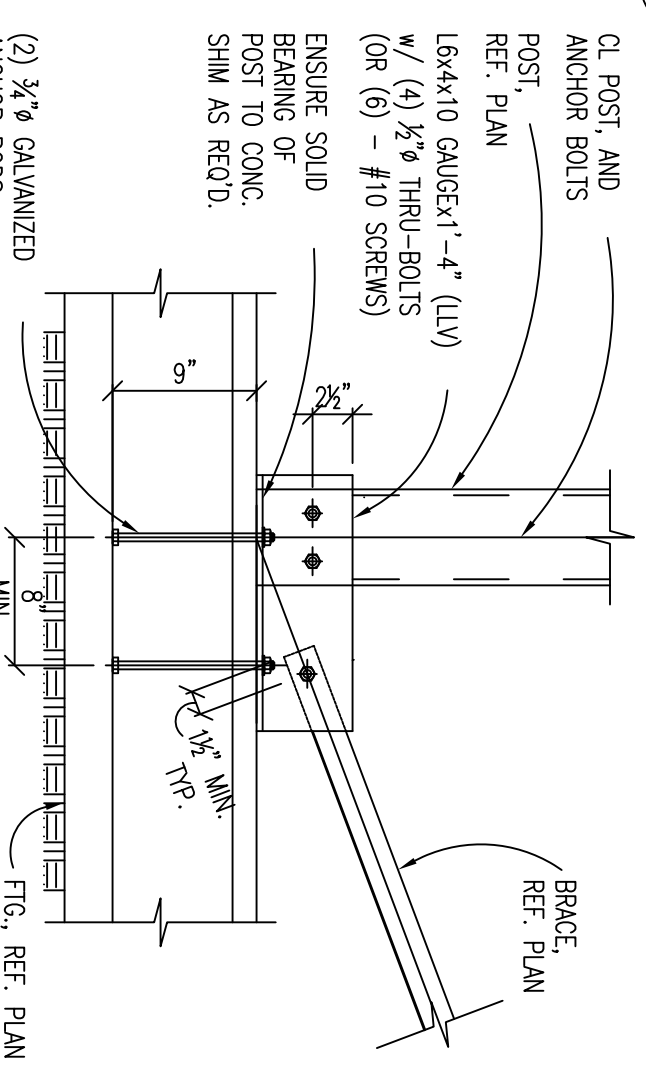
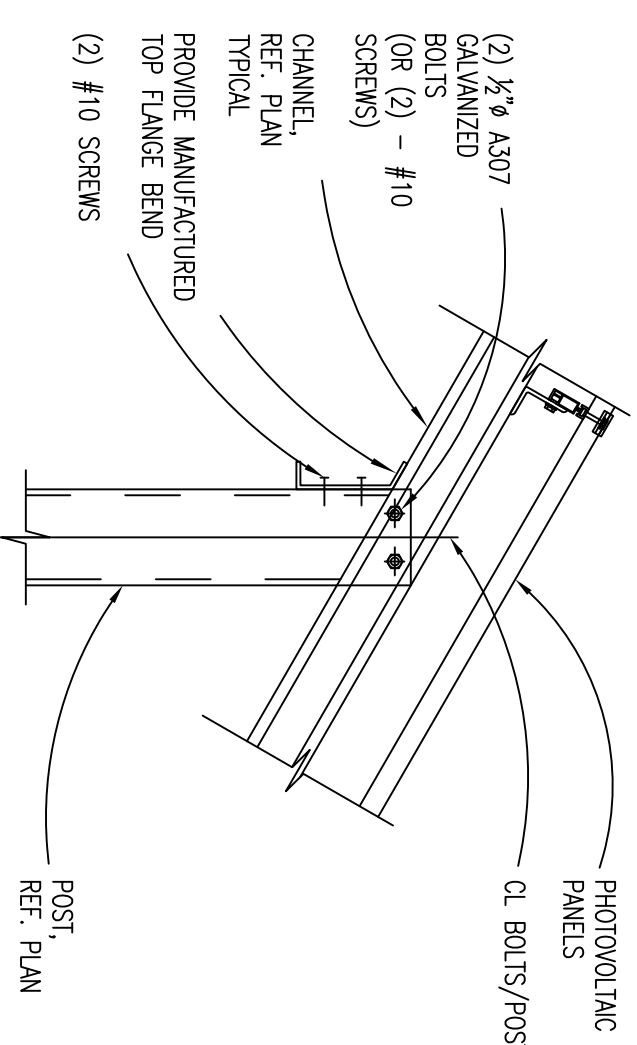
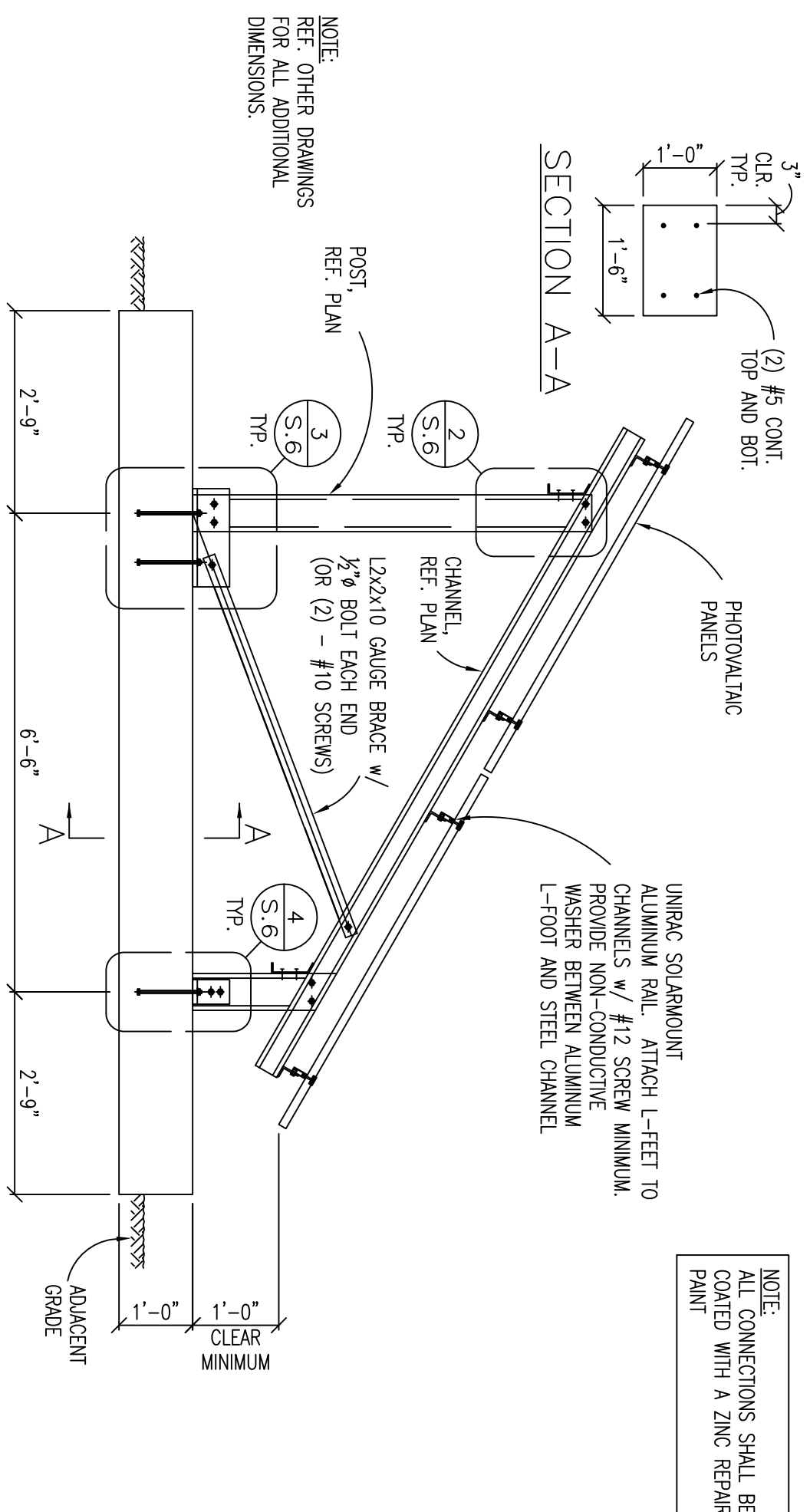
FOOTING BARS: 3"

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STRUCTURAL STEEL:  
ANCHOR BOLTS: ASTM F1554 GR. 36 HEADED ANCHOR RODS (GALVANIZED)

BOLTS: ASTM A307 (GALVANIZED)



# Solar Access and Shade Report

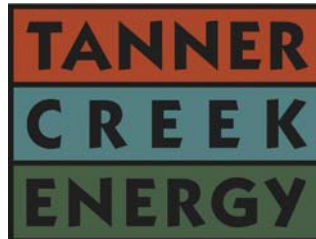
10/27/2010

## For:

**Williams Dairy Heifer Raising (Buroker)**  
49654 Umapine Rd.  
Milton Freewater, OR 97862  
541.558.3918

## By:

**Tanner Creek Energy**  
4210 SW Altadena Ave.  
Portland, Oregon 97239  
503.892.5726



Measurements made by **Solmetric SunEye™** -- [www.solmetric.com](http://www.solmetric.com)





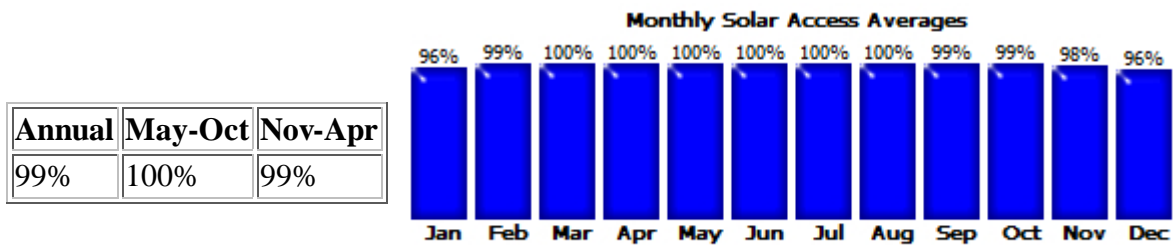
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## Session Properties

<b>Name</b>	Williams Dairy Heifer Raising
<b>Creation Date</b>	10/26/2010 11:52
<b>Note</b>	(none)
<b>Location</b>	46.0°N, 118.5°W Mag Dec: 15.5°E Time Zone: GMT-08:00

## Solar access averages of 1 skyline in this session

Skylines Averaged: Sky01



TSRF for the skyline in this session: 99%

## Skylines

- [Sky01 - Buroker](#)

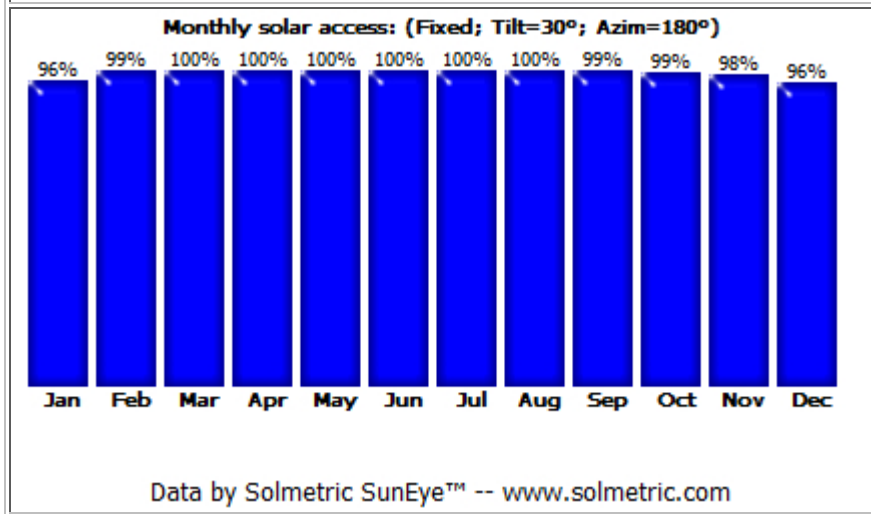
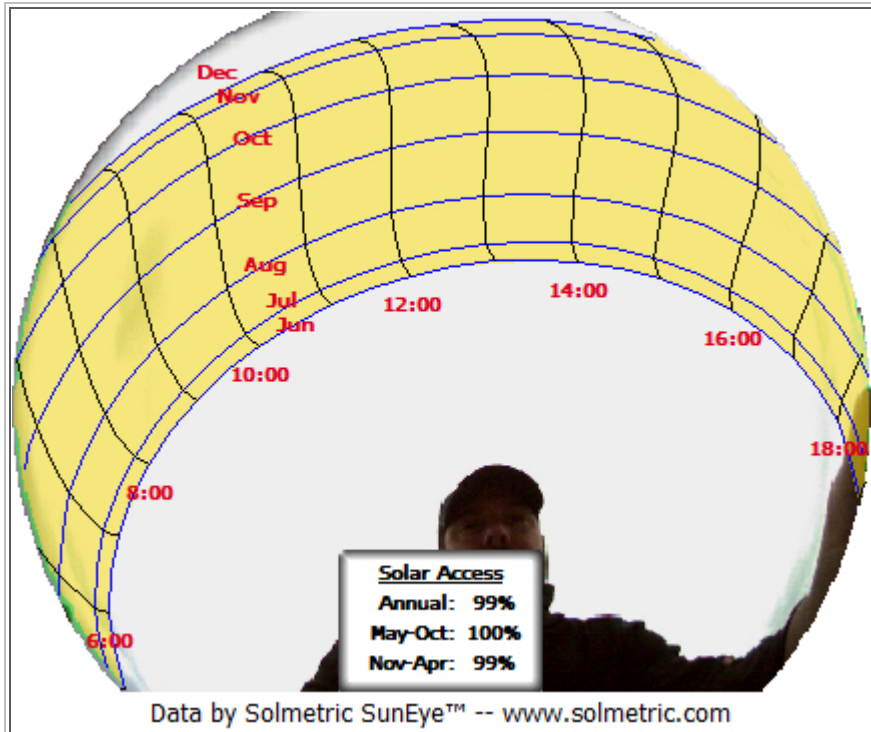
# Sky01 -- 10/26/2010 12:08 -- Buroker

**Panel Orientation:** Tilt=30° -- Azimuth=180° -- **Skyline Heading=196°**

**GPS Location:** Latitude=45.96392°N -- Longitude=118.52848°W

**Solar Access:** Annual: 99% -- Summer (May-Oct): 100% -- Winter (Nov-Apr): 99%

**TSRF:** 99% -- **TOF:** 99%



# Solar Access and Shade Report

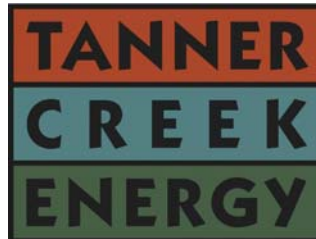
10/27/2010

## For:

**Williams Dairy Heifer Raising (Schubert)**  
49654 Umapine Rd.  
Milton Freewater, OR 97862  
541.558.3918

## By:

**Tanner Creek Energy**  
4210 SW Altadena Ave.  
Portland, Oregon 97239  
503.892.5726



Measurements made by **Solmetric SunEye™** -- [www.solmetric.com](http://www.solmetric.com)



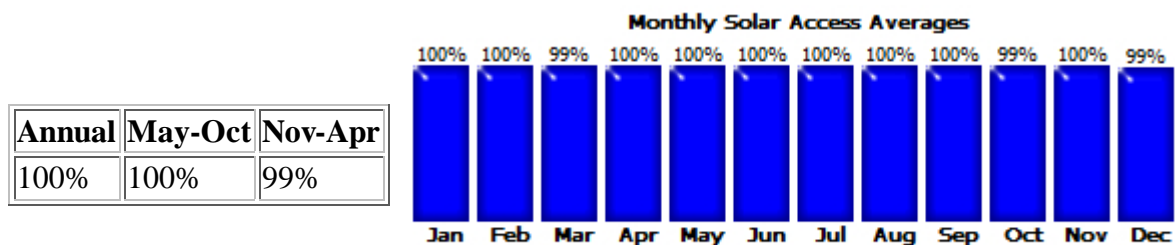
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## Session Properties

<b>Name</b>	Williams Dairy Heifer Raising
<b>Creation Date</b>	10/26/2010 11:52
<b>Note</b>	(none)
<b>Location</b>	46.0°N, 118.5°W Mag Dec: 15.5°E Time Zone: GMT-08:00

## Solar access averages of 1 skyline in this session

Skylines Averaged: Sky02



TSRF for the skyline in this session: 99%

## Skylines

- [Sky02 - Schubert](#)

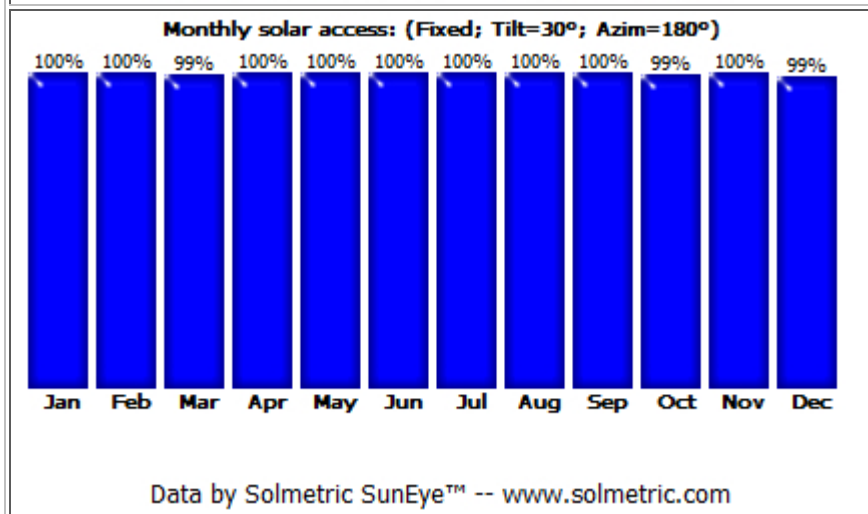
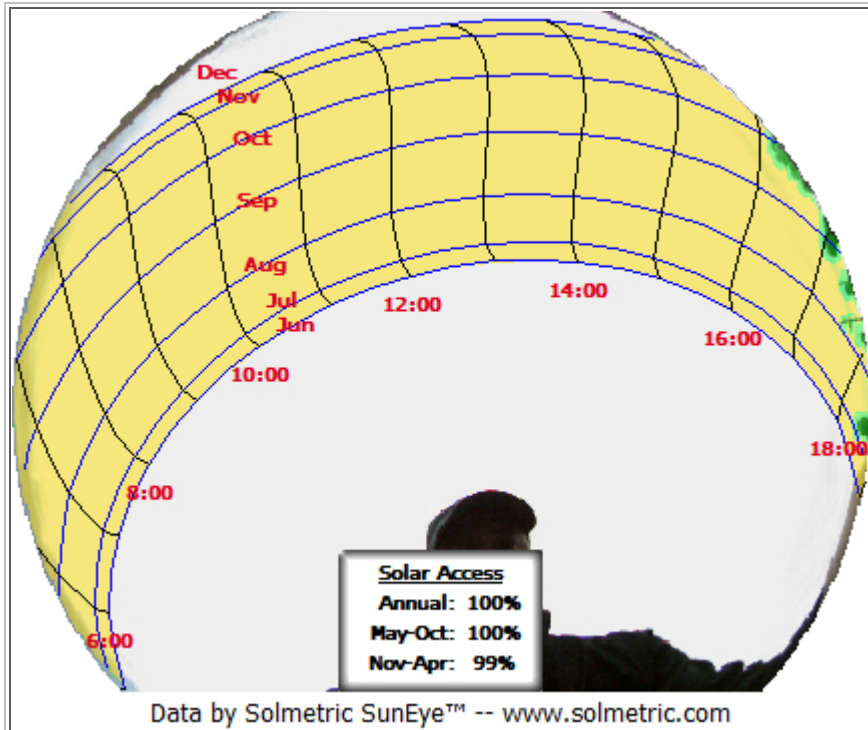
## Sky02 -- 10/26/2010 12:23 -- Schubert

**Panel Orientation:** Tilt=30° -- Azimuth=180° -- **Skyline Heading=196°**

**GPS Location:** Latitude=45.96150°N -- Longitude=118.53734°W

**Solar Access:** Annual: 100% -- Summer (May-Oct): 100% -- Winter (Nov-Apr): 99%

**TSRF:** 99% -- **TOF:** 99%





**Job Name:**

*Williams Dairy Heifer Raising*

**System Size (kWh):** 10

**Address:**

49654 Umapine Rd.  
Milton Freewater, Oregon 97862

**Contact:**

Jeff Zimmerman  
503.419.3643

Item	Qty	Description	Manufacturer	Model/Part #	Supplier
		concrete, steel, fasteners, etc			
		non-conductive washers			
	72	L-feet	Unirac	304000C	Platt
	8	standard rails (240")	Unirac	310240C-B	Platt
R	8	standard rails (168")	Unirac	310168C-B	Platt
	8	splice bars	Unirac	303001C	Platt
	40	grounding clips	Unirac	308001S	Platt
	4	grounding lugs	Unirac	008002S	Platt
	12	bonding jumpers	Wiley	Bonding Jumper-6.7	Platt
	16	top mounting end clamps	Unirac	302002C	Platt
	72	top mounting mid clamps	Unirac	302101C	Platt
1	40	PV modules	SolarWorld	250 mono	Platt
	8	MC connectors	SolarWorld		Platt
2	1	grid-tie inverter	Solectria	PVI 10kW	Platt
3	1	production meter	Cooper B-Line	117TB	Platt
4	1	meter main	Cooper B-Line	217MTBMS15	Platt
Misc		misc conduit, wire, electrodes, etc			CEI

Comments	Additional Notes
for isolation of dissimilar metals (L-feet & steel)	
for 31mm SolarWorld frame	
for 31mm SolarWorld frame	
power rating - 250W	
4 male-female pairs for SW 250	
power rating - 10,00W, 480V	
switch 100A breaker for 15A and double lugs for load bus bars	
see electrical diagram for details	

Supplier	Description	Qty	Manufacturer
Lear	misc conduit & wire	(blank)	(blank)
	grounding wire	(blank)	(blank)
	homerun wire	(blank)	(blank)
Platt	fuses	24	Littlefuse
	PV modules	192	SolarWorld
	grid-tie inverter	6	PV Powered
	RoofTrac rails	2	ProSolar
	splices	5	ProSolar
	intermodule clamps	8	ProSolar
	end clamps	1	ProSolar
	channel nuts	2	ProSolar
	grounding lay-in lugs	318	IlSCO
	pass-thru boxes	6	Hoffman
	lightning arrestors	1	Delta
		6	Delta
	combiner boxes	6	Blue Oak
(blank)	screws	600	Elco
Steeler	z-girt	1	(blank)
		3	(blank)
		24	(blank)
SolarWorld	MC connectors	60	(blank)
Rexel	circuit breakers	6	Square D
	fuses	3	(blank)
		6	(blank)
	DC disconnect	2	Square D
	AC disconnect	1	Square D
AC load center	1	Square D	
Austin Intn.	PV meter	1	(blank)
Grand Total			

Model/Part #	Comments
(blank)	see electrical diagram for details
(blank)	#6 AWG
(blank)	#10 AWG USE-2
KLKD015	15A
SW 175 Mono	power rating - 175W
PVP4600	power rating - 4,600W, 208V
R-136	60/crate - only need 98
A-SPLICE-20	20/box - only need 84
C1332IMC-50	50/box - only need 370
C1332EC-50	50/box - only need 28
P-CN-200	200/box
GBL4DBT	(blank)
A864CHQRFG	fiberglass junction box, quick-release continuous hinge
LA602DC	(blank)
LA602DC	(blank)
HCB4	(blank)
AF 430	Dril-Flex 10-16
400Z150-54-G90	16 GA. 21.5' - 1 1/2"x4"x2 1/2"
400Z150-54-G90	16 GA. 16' - 1 1/2"x4"x2 1/2"
400Z150-54-G90	16 GA. 27' - 1 1/2"x4"x2 1/2"
MC Type 4	30 male-female pairs for SW 175
QO230	30A, 2P
(blank)	100A
(blank)	35A
H362	600V, 60A fusible
H363RB	600V, 100A fusible
QO327M100	100A main breaker, 208Y/120VAC
(blank)	form 16S, 480V, 3 phase

