Appendix C

Miscellaneous Support Calculations

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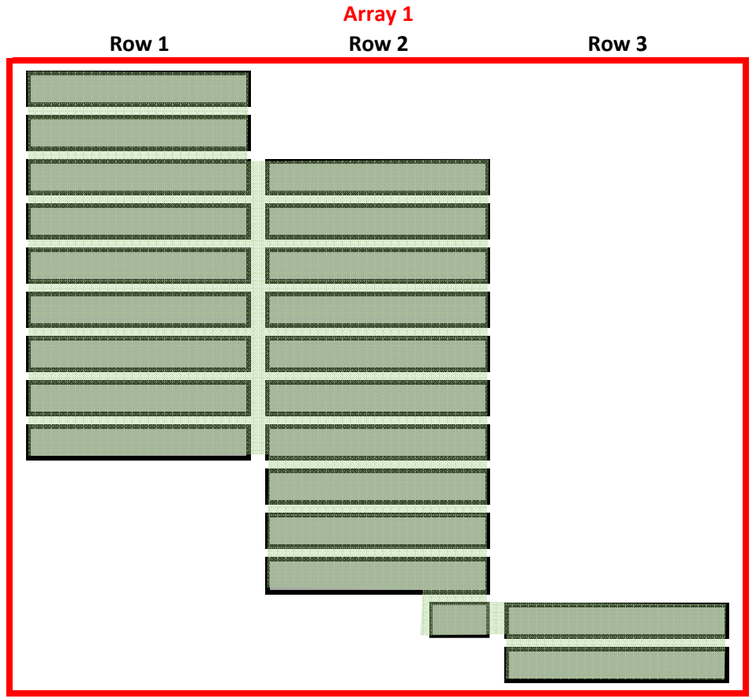
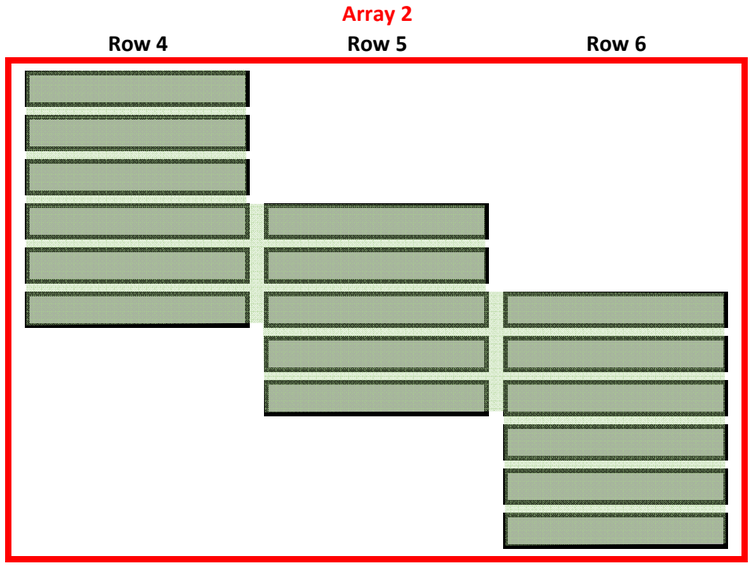
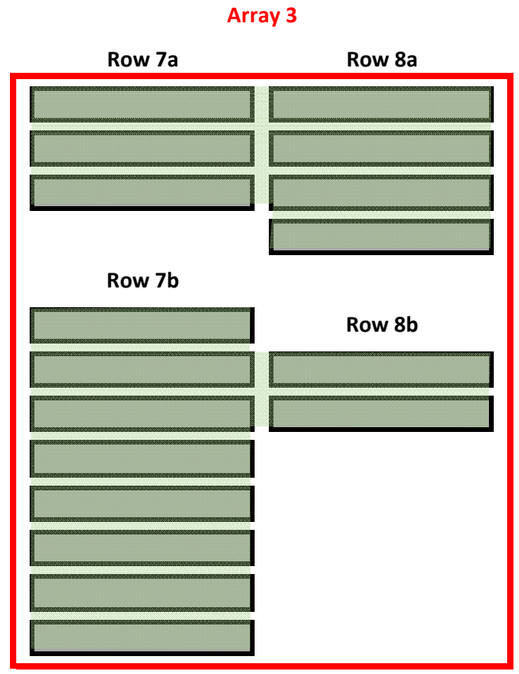
Hellman Solar EV Electric System Project
Solar Panel Layout







2 x 28 Solar Table (56 solar panels)

2 x 10 Solar Table (20 solar panels)

Permanent Impact Area

Not to Scale

Hellman Solar EV Electric System Project
Area Calculations

Item	Array 1				Array 2				Array 3					Total All Arrays	Comments
	Row 1	Row 2	Row 3	Total	Row 4	Row 5	Row 6	Total	Row 7a	Row 7b	Row 8a	Row 8b	Total		
28x2 Tables	9	10	2	21	6	5	6	17	3	8	4	2	17	55	Table is made up of 2 panels wide by 28 panels long for a total of 3080 solar panels.
10x2 Tables	0	1	0	1	0	0	0	0	0	0	0	0	0	1	Table is made up of 2 panels wide by 10 panels long for a total of 20 solar panels.
9' Gaps Between Tables	8	9	1	18	5	3	5	13	2	6	2	1	11	--	This is the total number of gaps between tables in each row.
Area of Row (ft^2)	19,426	22,177	3,641	45,244	12,661	9,537	12,661	34,859	5,896	16,302	7,282	3,641	33,121	113,224	This is the area that would be covered by solar panels and the gaps between rows.
Area of Tables (ft^2)	12,476	14,358	2,772	29,606	8,317	6,931	8,317	23,565	4,159	11,089	5,545	2,772	23,565	76,736	This it the total area of the of just the solar panels.
# of Pile Footings	63	73	14	150	42	35	42	119	21	56	28	14	119	388	This is the number of pile footing used for each row.
Area of Pile Footings (ft^2)	111	129	25	265	74	62	74	210	37	99	49	25	210	685	This is the total area of the pile footing for each row.
Permanent Impact Area (ft^2)	20,230	22,292	3,641	46,163	13,006	9,882	12,661	35,548	6,241	16,532	7,282	3,641	33,696	115,407	The permanent impact area for each row includes the area of the row plus the space between rows.
Permanent Impact Area (acres)	0.46	0.51	0.08	1.06	0.30	0.23	0.29	0.82	0.14	0.38	0.17	0.08	0.77	2.65	The permanent impact area for each row includes the area of the row plus the space between rows.
Temporary Impacted Area (ft^2)	8,206	8,955	4,216	21,376	8,026	5,090	7,086	20,202	5,403	10,002	5,370	1,998	22,773	64,351	This is the area that would be temporarily disturbed around each row during construction, and represents a 20 foot area on all sides of the row.
Temporary Impacted Area (acres)	0.19	0.21	0.10	0.49	0.18	0.12	0.16	0.46	0.12	0.23	0.12	0.05	0.52	1.48	This is the area that would be temporarily disturbed around each row during construction, and represents a 20 foot area on all sides of the row.
Total Impacted Area (acres)	0.65	0.72	0.18	1.55	0.48	0.34	0.45	1.28	0.27	0.61	0.29	0.13	1.30	4.13	This is sum of the permanent and temporary impacted areas.

Solar Array Input Data

Item	Value	Source
Width of Table (ft)	14.36	Typical Detail SC 4.0, Item 8, Framing Section
28 Table Length (ft)	96.53	Typical Detail SC 3.0, Item 2, Table Purlin Spacing
10 Table Length (ft)	34.58	Typical Detail SC 3.1, Item 2, Table Purlin Spacing
2x28 Table Area (ft^2)	1,386.17	Calculated
2x10 Table Area (ft^2)	496.57	Calculated
Gap Between Rows in an Array (ft)	8.00	Typical Detail SC 2.1, Table to Table Pile Spacing
Gap Between Tables (ft)	9.00	Typical Detail SC 2.0, Site Array Layout
Temporary Disturbance on Outside of Rows (ft)	20.00	
# Support Structures for 28 Table	7.00	Typical Detail SC 3.0, Item 1, Table Purlin Spacing
# Support Structures for 10 Table	3.00	Typical Detail SC 3.1, Item 1, Table Purlin Spacing

Source: Hellman Plan Set 12-06-2022, Newport Power

Solar System Summary Table

Array#	# Solar Tables	# Solar Panels	# Support Structures
Array 1	22	1,196	150
Array 2	17	952	119
Array 3	17	952	119
Total	***56***	***3,100***	***388***

Pile Footings Input Data

Item	Value	Source
# per 28 Table	7	Typical Detail SC 3.0, Item 1, 2x28 Table Pile Spacing
# per 10 Table	3	Typical Detail SC 3.1, Item 1, 2x10 Table Pile Spacing
Diameter (ft)	1.5	Typical Detail SC 4.0, Item 1, Pile Foundation
Depth (ft)	6.25	Typical Detail SC 4.0, Item 1, Pile Foundation
Volume of Pile Footing Hole (Ft^3)	11.04	Calculated
Volume of Pile Footing Hole (cubic y	0.41	Calculated
Total Volume of Pile Footings (cubic	158	Calculated

Source: Hellman Plan Set 12-06-2022, Newport Power

Hellman Solar EV Electric System Project
Area Calculations

Equipment Pads

Pad Type	Quantity	Length (ft)	Width (ft)	Depth (ft)	Pad Area (ft^2)		
					Within Table Footprint	Outside Table Footprint	Total
Inverter/PV Subpanel Pad #1	1	38	5.5	0.33	133	76	209
Inverter/PV Subpanel Pad #2	1	33	5.5	0.33	116	66	182
Inverter/PV Subpanel Pad #3	1	17	5.5	0.33	60	34	94
Inverter/PV Subpanel Pad #4	1	17.25	5.5	0.33	60	35	95
Transformer/PV System Subpanel/AC Disconnect Switches Pad	1	33	12	0.33	0	396	396

Two feet of inverter pads would be outside of the solar array footprint.
Source: E-Mails from NewportPower (Corey Van De Hey 8-3-23 and 8-11-23)

Other Temporary Impacted Areas

Item	Length (ft)	Width (ft)	Total Area		Temporary Impacted Area	
			ft^2	acres	ft^2	acres
Trench for AC Power Lines	1,300	22	28,600	0.66	12,800	0.29
Trench for DC Power Lines	500	22	11,000	0.25	0	0.00
Staging Area	120	50	6,000	0.14	6,000	0.14

Temporary impacted area is based upon the area of the trench work that is outside of the permanent or temporary impact areas of the solar arrays.
Assumes 2 foot wide trench and 10 feet of work area on either side of trench.
Source: E-mails from NewportPower (Corey Van De Hey 8-11-23 and 8-14-23)

Total Impacted Areas

Item	Permanent		Temporary		Total	
	ft^2	Acres	ft^2	Acres	ft^2	Acres
Solar Array Tables	115,407	2.65	64,351	1.48	179,758	4.13
Equipment Pads	607	0.01	NA[1]	0.00	607	0.01
Power Line Trenches	0	0.00	12,800	0.29	12,800	0.29
Staging Area	0	0.00	6,000	0.14	6,000	0.14
Total	116,014	2.66	83,151	1.91	199,165	4.57

1. Accounted for in power line trenches.

Hellman Solar EV Electrc System Project
Construction Input Data

Construction Activity, Shedulule, and Worker and Truck Trips

Activity	Duration (days)	# Construction Workers per Day	# Vendor Visits per Day	Delivery Trucks per Day	Peak Hourly One-Way Trips			Start Date	End Date
					Worker Vechicles	Vendor Vechicles	Delivery Trucks		
Site Preparation	3	6	0	2	6	0	2	9/16/2026	9/18/2026
Support Pile Installation	21	8	1	4	8	1	2	9/21/2026	10/19/2026
Solar PV System, Equipment, and Conduit Installation	20	10	1	4	10	1	2	10/19/2026	11/13/2026
Testing and Commissioning	20	4	2	0	4	2	0	11/16/2026	12/11/2026

Offroad Construction Equipment

Site Preparation	**Quanity**	**Hours/Day**	**Hp**	**Load Factor**
Rubber Tire Dozer	1	8	84	0.37
Grader	1	8	148	0.41
Backhoe/Loader	1	8	84	0.37
Water Truck	1	4	376	0.38
Support Pile Installation				
Backhoe/Loader	1	7	84	0.37
Forklift	1	8	82	0.2
Generator	1	8	14	0.74
Water Truck	1	2	376	0.38
Solar PV System, Equipment, and Conduit Installation				
Forklift	1	8	82	0.2
Backhoe/Loader	1	7	84	0.37
Generator	1	8	14	0.74
Welding Machine	1	8	46	0.45
Water Truck	1	2	376	0.38

Hp and Load factors are defaults from CalEEMod Version 2022.1.1.29.

Estimated Noise Levels for Construction
Hellman Solar PV Project

Estimated Construction Equipment Noise

Phase/Equipment	Quantity	Noise Level (dBA)	Distance (feet)
Site Preparation			
Rubber Tire Dozer	1	82	50
Grader	1	85	50
Backhoe/Loader	1	79	50
Water Truck	1	74	50
Combined Noise Level		***88***	***50***
Noise Level at Nearest Property Line		***96***	***20***
Noise Level at Nearest Receptor		***69***	***450***
Noise Level at Nearest Residential Receptor		***68***	***480***
Support Pile Installation			
Backhoe/Loader	1	79	50
Forklift	1	75	50
Generator	1	81	50
Water Truck	1	74	50
Combined Noise Level		***84***	***50***
Noise Level at Nearest Property Line		***92***	***20***
Noise Level at Nearest Receptor		***65***	***450***
Noise Level at Nearest Residential Receptor		***65***	***480***
Solar PV System, Equipment, and Conduit Installation			
Forklift	1	75	50
Backhoe/Loader	1	79	50
Generator	1	81	50
Welding Machine	1	74	50
Water Truck	1	74	50
Combined Noise Level		***85***	***50***
Noise Level at Nearest Property Line		***93***	***20***
Noise Level at Nearest Receptor		***65***	***450***
Noise Level at Nearest Residential Receptor		***65***	***480***

Source: FHWA Construction Noise Handbook, 2006. Table 9.1

Construction Equipment Reference Noise Levels

Equipment	Reference Noise Level (dBA@50 feet)
Rubber Tire Dozer	82
Grader	85
Backhoe/Loader	79
Water Truck	74
Forklift	75
Generator	81
Welding Machine	74

Source: FHWA Construction Noise Handbook, 2006. Table 9.1

Distance to Receptors

Distance to Nearest Property Line (feet)	20
Distance to Nearest Receptor (feet)	450
Distance to Nearest Residential Receptor (feet)	480

Vibration Levels

Equipment	Vibration Level (in/sec)		
	at 25-feet	at 60-feet	at 450-feet
Backhoe/Caisson Drilling	0.089	0.124	0.001
Small Bulldozer	0.003	0.004	0.000
Large Truck	0.076	0.106	0.001

Source: Adapted from FTA 2006 and Caltrans 2013.

Estimated Noise Levels for Operations
Hellman Solar PV Project

Operational Noise Levels

Equipment	Quantity	Nearest Property Line		Nearest Residential Receptor	
		Distance (feet)	Noise Level (dBA)	Distance (feet)	Noise Level (dBA)
Inverters (1-6)	6	30	54	1,030	23
Inverters (7-11)	5	85	44	940	23
Inverters (12,14)	2	25	50	550	24
Inverters (13,15,16)	3	130	38	500	26
Transformer	1	110	22	1,150	1

Noise would only occur during daylight hours when electrical power is being generated.

Operational Noise Equipment Levels

Equipment	Noise Level (dBA)	Distance (feet)
Inverters	65	3.3
Transformer	52	3.3

Sources: CPS datasheet for 100/125kW, 1500Vdc String Inverters
https://eepower.com/technical-articles/transformer-nameplate-details-and-sound-levels/

Fuel Use Calculations
Hellman Solar PV Project

Offroad Construction Equipment

Site Preparation	Quantity	Hours/Day	Days	Hp	Load Factor	Fuel Use (gals/hr)	Fuel Use (gals)
Rubber Tire Dozer	1	8	3	84	0.37	9.6	230
Grader	1	8	3	148	0.41	3.7	88
Backhoe/Loader	1	8	3	84	0.37	3.7	88
Water Truck	1	4	3	376	0.38	8.2	98
Support Pile Installation							
Backhoe/Loader	1	7	20	84	0.37	3.7	511
Forklift	1	8	20	82	0.20	1.0	152
Generator	1	8	20	14	0.74	1.6	256
Water Truck	1	2	20	376	0.38	8.2	327
Solar PV System, Equipment, and Conduit Installation							
Forklift	1	8	21	82	0.20	1.0	160
Backhoe/Loader	1	7	21	84	0.37	3.7	537
Generator	1	8	21	14	0.74	1.6	269
Welding Machine	1	8	21	46	0.45	1.3	218
Water Truck	1	2	21	376	0.38	8.2	344
Total Offroad Construction Equipment Fuel Use							***3,277***

Construction Equipment Fuel Use by Load Factor Range

Representative Equipment Model	Fuel Use (Gals/hr)			Equipment Reference
	Low	Medium	High	
Grader	2.5	3.1	3.7	Cat 120-14 AWD JOY
Rubber Tire Dozer	6.2	7.9	9.6	Cat 824K
Backhoe/Loader	2.5	3.1	3.7	Cat 415-07
Forklift	0.7	0.8	1.0	Hyster 2.0 XT
Generator	0.6	1.3	1.6	20 kW Generator
Welding Machine	0.5	1.0	1.3	Trailblazer® 325 Diesel
Water Truck	5.2	6.7	8.2	Cat 770G

Sources: Caterpillar Performance Handbook Edition 44
https://www.generatorsource.com/Diesel_Fuel_Consumption.aspx
https://www.adaptalift.com.au/blog/how-much-diesel-does-a-forklift-use-per-hour
https://www.millerwelds.com/-/media/miller-electric/imported-mam-assets/spec-sheets/2/2/5/ed4-8.pdf

Onroad Construction Vehicles

Phase	Workers/day	Vendors/day	Trucks/day	Days	Car VMT	Truck VMT	Fuel Use (gals)
Site Preparation	6	0	2	3	475	240	58
Support Pile Installation	8	1	4	21	5,275	3,360	747
Solar PV System, Equipment, and Conduit Installation	10	1	4	20	6,080	3,200	758
Testing and Commissioning	4	2	0	20	3,712	0	162
Total Onroad Construction Equipment Fuel Use							***1,725***
Total Construction Fuel Use							**5,002**

Fuel Use Case	Fuel Use (mpg)	Miles per Trip
Trucks	6.5	20
Workers	22.9	13.2
Vendors	22.9	20

Miles per Trip from CalEEMod
Source: For Trucks-A Survey of Fuel Economy and Fuel Use by Heavy-Duty Truck Fleets. University of Michigan. October 2016.
Source for Workers/Vendors-US Department of Transportation

22,342

Equipment Group	Fuel Use (gals)		
	Diesel	Gasoline	Total
Onsite Construction Equipment	3,277	0	3,277
Onroad Construction Vehicles	1,046	679	1,725
Total	4,323	679	5,002

Operational Equipment

Item	Trips/year	VMT/year	hrs/yr	Fuel Use (gals/hr)	Fuel Use (gals)
Workers	8	480	--	--	21
Lawn Mower	--	--	6	1	6
Total Operational Fuel Use					**27**

Fuel Use for Lawn Mower is an estimate.
VMT/Year from CalEEMod.