Panoche Valley Solar Farm

San Benito County, California

Stream Crossing Alternative Study & Hydraulic Report

Prepared for:

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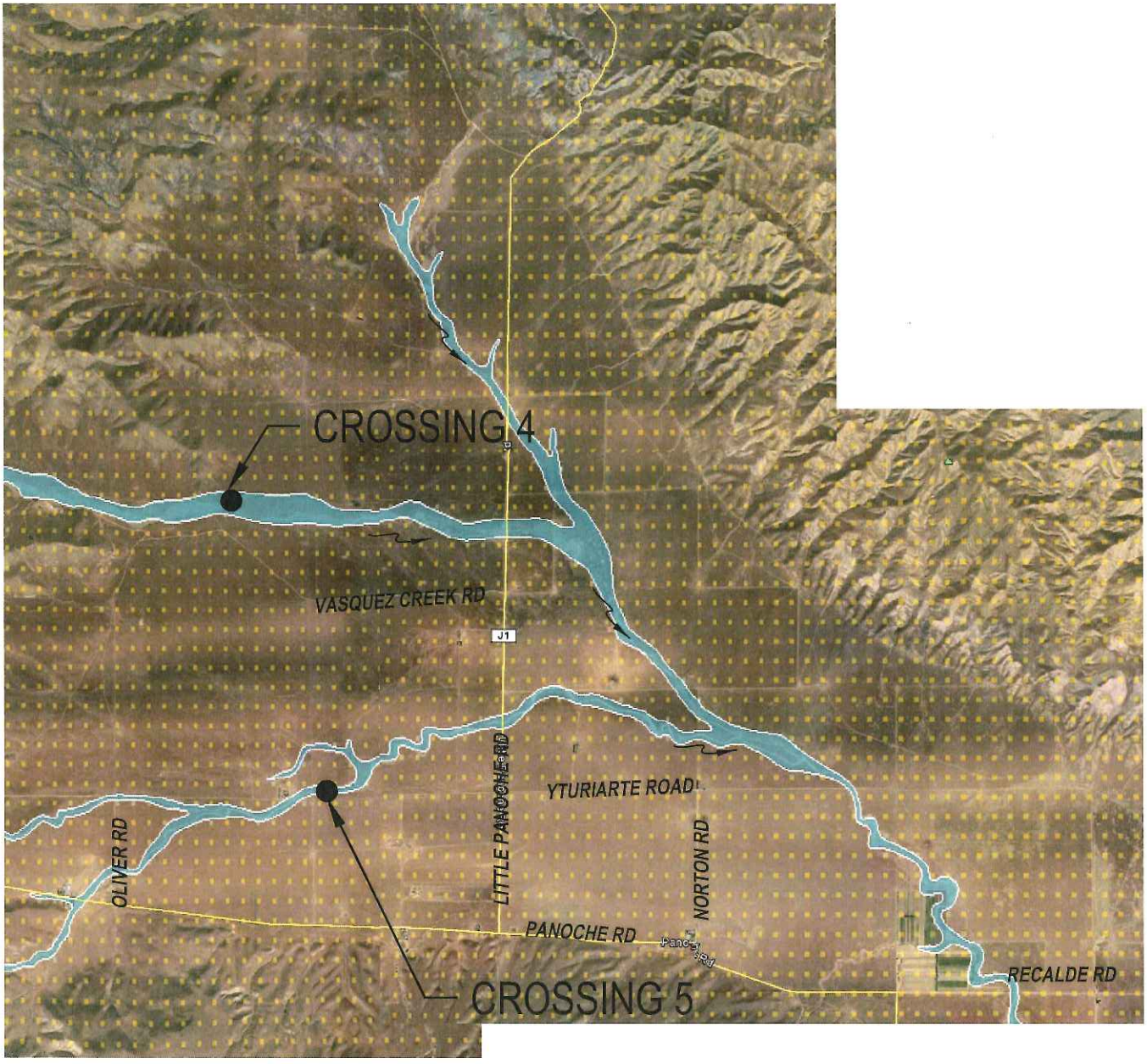
INTRODUCTION

This report is a continuation of a previous study and addresses the hydrologic and hydraulic research and analysis that was conducted as part of the Panoche Valley Solar Facility (PVSF) project in San Benito County, California. The original objective of this effort was to analyze the existing conditions and document the associated conditions with five proposed bridge locations. A hydraulic analysis was performed for the purpose of designing bridge structures and at grade fords at creek crossings on the PVSF project that will provide emergency access (fire trucks and/or rescue personnel) to the entire facility during a 100 year flood event. Following size reductions and modifications to the PVSF project, two crossings of Waters of the U.S. are needed for the project.

Five bridge models are being analyzed at both creek crossing (Figure1). The first bridge model is a ford crossing that requires laying back the slope and crossing at grade. The second bridge model is a multi-barreled, concrete box culvert structure. The third bridge model is a free span bridge that has abutments 100 feet distant from the top of bank on either side of the channel. This structure is intended to span the channel and both overbank areas. It will, however require approach fills at both ends to allow for a minimum of 3 feet of clearance below the bridge superstructure. The fourth bridge model is a multi-span structure with abutments near the top of channel banks and a pier in the channel. The fifth bridge option is a single span bridge with abutments near the top of channel banks.

REGULATORY STANDARDS

The PVSF project is within a regulatory Federal Emergency Management Agency (FEMA) floodplain. The crossing sites are located within a Zone A region which is defined as "Special flood hazard areas subject to inundation by the 1% annual chance flood, no base flood elevation determined". If a particular scenario demonstrates a no-rise scenario, regulatory standards will easily be satisfied. However, if backwater occurs, negotiations with the appropriate authorities, San Benito County and FEMA, will be required. FEMA may defer to the local authorities. It may be possible to negotiate allowing a backwater rise, most likely limited to one foot.



WHPacific

SHEET NUMBER		DRAWING INFO		SHEET INFO	
FIG 1	PANOCHE VALLEY SOLAR FACILITY VICINITY MAP SAN BENITO COUNTY, CALIFORNIA		035916-VIC NTS	DRAWN	DLB
				CHECKED	DLB
				LAST EDIT	2/18/2014
				PLOT DATE	2/18/2014

WHPacific

BASIN RESEARCH

Three major creeks flow through the PVSF project. A unnamed creek flows from the northern edge of the project and joins Las Aguilas Creek near the center of the project. Panoche Creek flows along the southern edge of the project and forms a confluence with Las Aguilas Creek near the southeast corner of the project (Figure 1). Las Aguilas Creek flows from northwest to southeast and has a drainage basin of approximately 9.9 square miles above crossing site numbered 4. Panoche Creek flows from west to east and has a drainage basin of approximately 44.7 square miles above crossing site 5. The Las Aguilas Creek watershed varies in elevation from about 1415 feet at crossing site 4 to a maximum of 3639 feet. The Panoche Creek watershed varies in elevation from about 1345 feet at crossing site 5 to a maximum of 3969 feet. The watershed is subject to winter storms in which precipitation is mainly in the form of rain. High flows if they occur typically occur in the winter months.

SITE INVESTIGATION

A site investigation of the study area was conducted by John R. Marks and Paul Tappana of WHPacific on June 27, 2012 and then again on September 24, 2013. The purpose of the site investigation was to review the sites for hydrologic, hydraulic and scour concerns that may affect the proposed creek crossings. Survey mapping of the area was completed by WHPacific survey crew. The survey also included a digital terrain model (DTM) that was used to develop cross sections needed in the hydraulic modeling. Google Earth data was used to supplement elevation data for the extensive floodplain outside the extents of the survey. The following observations were made during the site visit.

1. **Lateral Channel Stability**
   The creek alignment meanders slightly within moderately moving channel boundaries of the adjacent grass land.
2. **Aggradation /Degradation**
   The relatively low slope condition of the creek channel and the steepness of the channel's banks indicate that both aggradation and degradation will be unlikely.
3. **Manning's *n***
   The left and right overbank areas through all reaches consist of grassland. A Manning's n value of 0.030 was assigned for this condition. The main channel throughout consists of silt, sand and gravel with scattered cobbles. A Manning's n value of 0.030 was assigned for the channel.
4. **Riprap**
   No riprap is present.
5. **Bed Material**
   The bed material was observed to be silt, sand and gravel with scattered cobbles with an estimated D_{50} of 0.1 mm.
6. **Evidence of Scour**
   There is some evidence of isolated scour on the outside of bends on both creeks.

7. **Abutment Alignment**
   There are no bridges at the proposed bridge sites.
8. **Hydraulic Controls**
   No hydraulic controls are present.
9. **High Water Marks**
   No high water marks were observed.
10. **Debris**
    The woody debris potential for the watershed appears to be moderate to high.

Based on this information WHPacific also looked at long term scour and have included additional removal and fill to help stabilize the long term features of the crossings due to erosion.

HYDROLOGY

The peak discharges for these ungauged watersheds have been taken from a USGS online application called StreamStats for California (http://streamstats.usgs.gov/california.html). Storm event flows were provided at standard intervals. The discharges used in the hydraulic analysis of the proposed crossing structures are provided below:

Crossing Site 4

Q_2 = 25 cfs
Q_5 = 115 cfs
Q_{10} = 243 cfs
Q_{25} = 498 cfs
Q_{50} = 793 cfs
Q_{100} = 1170 cfs
Q_{500} = 2470 cfs

Crossing Site 5

Q_2 = 105 cfs
Q_5 = 473 cfs
Q_{10} = 970 cfs
Q_{25} = 1940 cfs
Q_{50} = 3070 cfs
Q_{100} = 4430 cfs
Q_{500} = 9090 cfs

HYDRAULICS

The US Army Corps of Engineers, Hydrologic Engineering Centers River Analysis System computer program (HEC- RAS Version 4.1.0) was used to compute the channel hydraulics. Hydraulic models were developed for the "natural channel" conditions of the sites and the requested bridge/culvert alternatives. Ten stream cross-sections were used to develop the hydraulic models at sites 4 and 5. The cross-sections were selected to adequately model flow through the site locations for both Las Aguilas Creek and Panoche Creek.

The proposed alternatives, except for the free span bridges, were modeled to provide maximum conveyance through the sites with using minimal approach fill. The single and multi-span structures were modeled with approach fills to elevate the superstructure above the overbank area. The water surface elevations for each model were calculated using the provided flow data from StreamStats. It should be noted that on the bridge profile sheets where water surface elevations are depicted, that some storms which are higher than the stated maximum conveyable storm for a site may appear as though it can "fit" under the bridge or culvert. However, what is not seen is that these storms cover the approach roadway past the extents of the profile window. Detailed printouts of the results are provided in the Appendix.

TABLE 1. Hydraulic Data Sheet for the Existing Condition and Proposed Bridges at Site 4.

	Natural Conditions			56-Foot Multi-span		56-Foot Single-span	
	25-Year Flood	50-Year Flood	100-Year Flood	Conveyable Storm Event for Site[5]	100-Year Flood	Conveyable Storm Event for Site[5]	100-Year Flood
Discharge (ft^3/s)	498	793	1170	498	1170	498	1170
Recurrence Interval (yrs)	25	50	100	25	100	25	100
Approach Section H.W. Elevation with Natural Channel[1] (ft)	1415.98	1416.38	1416.74	1415.98	1416.74	1415.98	1416.74
Approach Section H.W. Elevation with Bridge[1]	-	-	-	1416.12	1417.10	1416.07	1417.09
Backwater (ft)	-	-	-	0.14	0.36	0.09	0.35
H.W. Elevation at Upstream Face of Bridge[2] (ft)	1415.34	1415.75	1416.19	1415.32	1417.15	1415.28	1417.14
H.W. Elevation at Downstream Face of Bridge[3] (ft)	1414.90	1415.37	1415.79	1414.90	1417.05	1414.84	1417.03
Waterway Area at Downstream Face of Bridge[3,4] (ft^2)	73.5	109.4	149.5	68.0	413.1	67.4	415.9
Average Velocity at Downstream Face of Bridge[3] (ft/s)	6.8	7.2	7.8	7.3	2.8	7.4	2.8

[1] Approach section is the location where the flow within the cross section is fully effective. The approach section for this bridge was determined to be 56 feet upstream of the edge of proposed bridge.

[2] Located at upstream face of proposed bridge along the embankment.

[3] Located at downstream face of proposed bridge opening.

[4] Area normal to channel centerline.

[5]This hydraulic analysis studied only the 2, 5, 10, 25, 50, 100, and 500 year event storms. No iteration was performed to calculate the design storm (defined as the road overtopping event).

TABLE 2. Hydraulic Data Sheet for the Existing Condition and Proposed Bridges at Site 5.

	Natural Conditions			56-Foot Multi-span		56-Foot Single-span	
	25-Year Flood	50-Year Flood	100-Year Flood	Conveyable Storm Event for Site[5]	100-Year Flood	Conveyable Storm Event for Site[5]	100-Year Flood
Discharge (ft^3/s)	1940	3070	4430	1940	4430	1940	4430
Recurrence Interval (yrs)	25	50	100	25	100	25	100
Approach Section H.W. Elevation with Natural Channel[1] (ft)	1350.15	1351.53	1351.92	1350.15	1351.92	1350.15	1351.92
Approach Section H.W. Elevation with Bridge[1]	-	-	-	1351.15	1352.83	1350.15	1352.00
Backwater (ft)	-	-	-	0.0	0.91	0.00	0.08
H.W. Elevation at Upstream Face of Bridge[2] (ft)	1350.60	1351.39	1351.80	1350.55	1352.41	1350.58	1352.40
H.W. Elevation at Downstream Face of Bridge[3] (ft)	1350.50	1351.77	1352.18	1350.37	1352.32	1350.50	1352.06
Waterway Area at Downstream Face of Bridge[3,4] (ft^2)	209.70	276.85	291.90	209.72	305.90	209.7	291.90
Average Velocity at Downstream Face of Bridge[3] (ft/s)	9.25	6.50	7.18	9.25	7.07	9.25	7.18

[1] Approach section is the location where the flow within the cross section is fully effective. The approach section for this bridge was determined to be 56 feet upstream of the edge of proposed bridge.

[2] Located at upstream face of proposed bridge along the embankment.

[3] Located at downstream face of proposed bridge opening.

[4] Area normal to channel centerline.

[5]This hydraulic analysis studied only the 2, 5, 10, 25, 50, 100, and 500 year event storms. No iteration was performed to calculate the design storm (defined as the road overtopping event).

SUMMARY

The conclusions drawn from the hydraulic analysis at each site are as follows:

Site 4		
Type	Conveyable Storm Event for Site (yr.)	Backwater Rise @ 100 yr. Event (ft.)
Multi-span (2 - 28' spans)	25	0.36
Single-span	25	0.35

The multi-span and single-span structures passed the 10-year, 25 year, 50-year and 100-year storm events, respectively. The only structure that presents a "no-rise" water surface for the 100-year flood at the approach section to the structure is the free span structure. The multi-span caused a 0.36 foot water surface rise and the single-span caused a 0.35 foot water surface rise, respectively, at the approach section.

Site 5		
Type	Conveyable Storm Event for Site (yr.)	Backwater Rise @ 100 yr. Event (ft.)
Multi-span (2 – 28' spans)	25	0.91
Single-span	25	0.08

The multi-span and single-span structures passed the 10-year, 25 year, 50-year and 100-year storm events, respectively. The only structure that presents a "no-rise" water surface for the 100-year flood at the approach section to the structure is the free span structure. The multi-span caused a 0.91 foot water surface rise and the single-span caused a 0.08 foot water surface rise, respectively, at the approach section.

Some depth of approach fill is used to raise the superstructure of the bridges. Raising the brides allows debris to pass underneath and limits the rise of the watersurface.

In addition to this hydraulic analysis there are various other factors that should be considered in assessing the bridge crossing. Below are two tables, Table 4 - "General Pros and Cons of Crossing type", and Table 5 - "General Considerations of Crossing Type". Additionally, Table 6 includes calculations of disturbed areas and materials for each crossing and each alternative within the ordinary high water (OHW) and top-of-bank to top-of-bank limits.

Table 4 - GENERAL PROS AND CONS OF CROSSING TYPE		
Crossing Type	Pros	Cons
Ford	- no change in existing hydraulic conditions - satisfies "no-rise" condition - lowest construction and maintenance costs	- crossing is not available during a high hydraulic event - significant disturbance to creek bed and bank habitat during construction
Culvert	- crossing is available during a low hydraulic event - lowest construction and maintenance costs	- crossing is not available during a high hydraulic event - significant disturbance to the creek bed and bank habitat during construction
Free Span	- crossing is available during high water events - satisfies "no-rise" situation	- moderate upland habitat disturbance during construction and lifecycle - very high cost to benefit ratio - high maintenance cost - visual impact structure is out of place for environment - other specie impacts such as perching habitat for raptors and significant shading.
Multi-span	- crossing is available during high water events - moderate construction and maintenance costs	- moderate disturbance to bed and bank habitat during construction due to excavation and foundation installation and equipment
Single-span	- crossing is available during high water events - moderate construction and maintenance costs	- low disturbance to bed and bank habitat during construction due to excavation and foundation installation and equipment

Table 5 - GNEREAL CONSIDERATION OF CROSSING TYPE	
Ford	- will pass the 100-year flood event - a "no-rise" will result for the 100-year flood event - will require excavation of bank material to reduce slopes and excavation below existing ground to accommodate armoring and achieve an all-weather road - made of articulated concrete block mattress cabled together - increase in hydraulic opening - increase in hydraulic opening
Culvert	- excavation is required in the creek channel for a culvert bottom or footings - fill is required at the ends of the culverts to avoid removing native material only to replace it with a concrete structure that is buried - spread footings or solid bottom culvert
Free Span	- chose a +/-3' clearance from the existing ground to allow any maintenance that might be required, passes a larger hydraulic event, avoids maintenance problems if the structure is off the ground surface, caused by acidity and high water / debris - fill is required at each end of the span to accommodate the higher deck elevation - pile foundation assumed - truss type structure chosen to minimize beam depth under the bridge
Multi-span	- minimal excavation is required for abutments and disturbance in the creek channel due to pile installation - precast, pre-stressed concrete slabs chosen because they are simple, inexpensive and readily available - pile foundation assumed because geotechnical report indicated low bearing capacity on the surface soil, but will require further geotechnical investigation, assumed 40' deep pile - precast slabs assumed to be 15" thick to minimize hydraulic interference
Single-span	- minimal excavation is required for abutments and disturbance in the creek channel due to pile installation - precast, pre-stressed concrete slabs chosen because they are simple, inexpensive and readily available - pile foundation assumed because geotechnical report indicated low bearing capacity on the surface soil, but will require further geotechnical investigation, assumed 40' deep pile - precast slabs assumed to be 18" thick to minimize hydraulic interference

Additionally, the table below includes calculations of disturbed areas and materials for each crossing and each alternative within the ordinary high water (OHW) and top-of-bank to top-of-bank limits

TABLE 6 - DISTURBED CHANNEL QUANTITIES

Site 4	Outside OHW								Inside OHW			
	Outside Top of Bank				Within Top of Bank							
Crossing Type	Cut Area (SF)	Fill Area (SF)	Fill Vol. (CY)*	Cut Vol. (CY)*	Cut Area (SF)	Fill Area (SF)	Fill Vol. (CY)*	Cut Vol. (CY)*	Cut Area (SF)	Fill Area (SF)	Fill Vol. (CY)*	Cut Vol. (CY)*
Ford	0	0	0	0	1792	1200	62	98	962	962	46	46
Culvert	0	0	0	0	421	1113	39	38	1337	1337	24	37
Free Span	0	4550	520	0	0	0	0	0	0	0	0	0
Multi-Span	0	1140	90	0	96	96	27	15	48	48	10	4
Single Span	0	1510	150	0	96	96	10	10	32	32	6	5

Site 5	Outside OHW								Inside OHW			
	Outside Top of Bank				Within Top of Bank							
Crossing Type	Cut Area (SF)	Fill Area (SF)	Fill Vol. (CY)*	Cut Vol. (CY)*	Cut Area (SF)	Fill Area (SF)	Fill Vol. (CY)*	Cut Vol. (CY)*	Cut Area (SF)	Fill Area (SF)	Fill Vol. (CY)*	Cut Vol. (CY)*
Ford	0	0	0	0	2400	2400	130	319	1200	1200	45	45
Culvert	0	0	0	0	838	1698	35	112	920	1096	10	12
Free Span	0	4550	500	0	0	0	0	0	0	0	0	0
Multi-Span	0	1140	90	0	160	96	27	15	48	48	20	15
Single Span	0	1510	150	0	160	160	10	10	24	24	10	10

*Displaced volume includes fill and excavation of soil or other material

In addition to the hydraulic parameters addressed in this report, the selection of the best solution for a creek crossing, may also consider cost, accessibility, environmental impact, and other relevant factors.

Rock armoring (riprap) was considered in the volume calculations to protect both the single-span and multi-span bridges. This armoring is recommended at the abutments and piers to protect the long term life of the structure and to ensure the bridges are available for use during and immediately following a significant rainfall event. Below are typical details of the rock armoring to be used. If larger rock (Based on Velocity) is un-available grouting would be required.

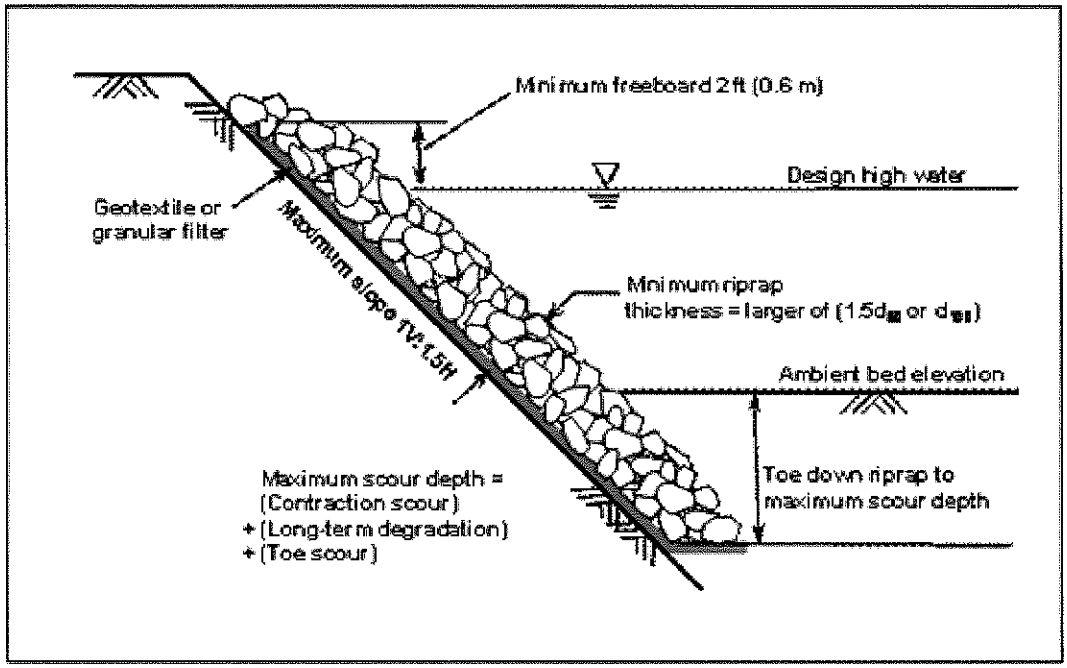


Figure 1. Riprap revetment with buried toe.

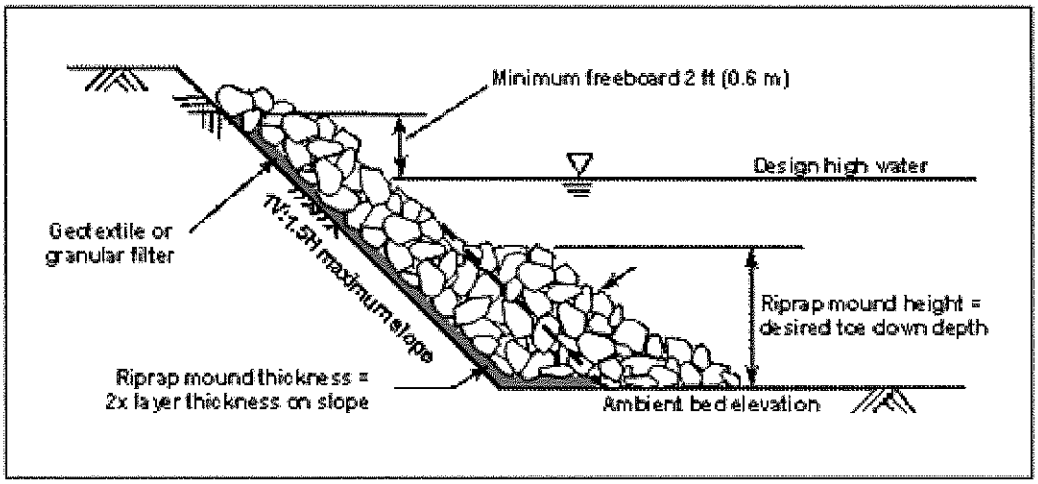


Figure 2. Riprap revetment with mounded toe.

REFERENCES

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Waananen, A.O. and Crippen, J.R., 1977, Magnitude and frequency of floods in California: U.S. Geological Survey Water-Resources Investigations Report 77-21, 102p.

CONCEPTUAL CROSSING 4 - FORD COST ESTIMATE

PROJECT		CLIENT
Panoche Valley Solar Farm		ENERGY RENEWAL PARTNERS
ALTERNATIVE	DATE	Prepared by:
Crossing 4 Ford	2/13/2014	WHPACIFIC, INC

	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL
	MOBILIZATION	LS	All	8.0% Biddable	$ 3,262.80
	EXCAVATION	CUYD	165.00	$ 45.00	$ 7,425.00
	3/4 INCH - 0 AGGREGATE BASE	CUYD	40.00	$ 12.00	$ 480.00
	ARTICULATING CONCRETE BLOCK MATTRESS	SQFT	2160.00	$ 15.00	$ 32,400.00
	EMBANKMENT GEOTEXTILE	SQYD	240.00	$ 2.00	$ 480.00
SUBTOTAL, BIDDABLE ITEMS					**$ 44,047.80**
	CONTINGENCIES, for all work listed			25.0%	$ 11,011.95
CONSTRUCTION COST					**$ 55,059.75**

CONCEPTUAL CROSSING 4 - CULVERT COST ESTIMATE

PROJECT		CLIENT	
Panoche Valley Solar Farm		ENERGY RENEWAL PARTNERS	
ALTERNATIVE	DATE	Prepared by:	
Crossing 4 Culvert	2/13/2014	WHPACIFIC, INC	

	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL
	MOBILIZATION	LS	All	8.0% Biddable	$ 11,318.40
	EMBANKMENT	CUYD	45.00	$ 25.00	$ 1,125.00
	STRUCTURE EXCAVATION	CUYD	125.00	$ 45.00	$ 5,625.00
	REINFORCEMENT	LS	All	$ 9,480.00	$ 9,480.00
	REINFORCED CONCRETE BOX CULVERT	FOOT	96.00	$ 700.00	$ 67,200.00
	WINGWALLS AND APRONS	CUYD	60.00	$ 830.00	$ 49,800.00
	W BEAM STEEL RAIL	LS	All	$ 8,250.00	$ 8,250.00
SUBTOTAL, BIDDABLE ITEMS					**$ 152,798.40**
	CONTINGENCIES, for all work listed			25.0%	$ 38,199.60
CONSTRUCTION COST					**$ 190,998.00**

CONCEPTUAL CROSSING 4 - FREE SPAN COST ESTIMATE

PROJECT		CLIENT
Panoche Valley Solar Farm		ENERGY RENEWAL PARTNERS
ALTERNATIVE	DATE	Prepared by:
Crossing 4 - 275' Free Span Bridge	2/13/2014	WHPACIFIC, INC

	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL
	MOBILIZATION	LS	All	8.0% Biddable	$ 114,957.60
	FURNISH PILE DRIVING EQUIPMENT	LS	All	$ 18,000.00	$ 18,000.00
	FURNISH PP 12-3/4 X 0.375 STEEL PILES	FOOT	320.00	$ 45.00	$ 14,400.00
	DRIVE PP 12-3/4 X 0.375 STEEL PILES	EACH	8.00	$ 650.00	$ 5,200.00
	GENERAL STRUCTURAL CONCRETE, CLASS 3300	LS	All	$ 17,850.00	$ 17,850.00
	REINFORCEMENT	LS	All	$ 5,520.00	$ 5,520.00
	PREFABRICATED STEEL TRUSS	FOOT	275.00	$ 4,800.00	$ 1,320,000.00
	FURNISH CRANE FOR LIFTING TRUSS	LS	All	$ 50,000.00	$ 50,000.00
	ASHPALT PAVING	TON	60.00	$ 100.00	$ 6,000.00
SUBTOTAL, BIDDABLE ITEMS					**$ 1,551,927.60**
	CONTINGENCIES, for all work listed			25.0%	$ 387,981.90
CONSTRUCTION COST					**$ 1,939,909.50**

CONCEPTUAL CROSSING 4 - MULTI-SPAN BRIDGE COST ESTIMATE

PROJECT			CLIENT	
Panoche Valley Solar Farm			ENERGY RENEWAL PARTNERS	
ALTERNATIVE		DATE	Prepared by:	
Crossing 4 - 2 Span 56' Bridge		2/13/2014	WHPACIFIC, INC	

	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL
	MOBILIZATION	LS	All	8.0% Biddable	$ 9,560.40
	STRUCTURE EXCAVATION	CUYD	75.00	$ 45.00	$ 3,375.00
	FURNISH PILE DRIVING EQUIPMENT	LS	All	$ 18,000.00	$ 18,000.00
	FURNISH PP 12-3/4 X 0.375 STEEL PILES	FOOT	360.00	$ 45.00	$ 16,200.00
	DRIVE PP 12-3/4 X 0.375 STEEL PILES	EACH	9.00	$ 650.00	$ 5,850.00
	GENERAL STRUCTURAL CONCRETE, CLASS 3300	LS	All	$ 21,000.00	$ 21,000.00
	REINFORCEMENT	LS	All	$ 6,360.00	$ 6,360.00
	15 INCH PRECAST PRESTRESSED SLABS	FOOT	224.00	$ 180.00	$ 40,320.00
	W BEAM STEEL RAIL	LS	All	$ 8,400.00	$ 8,400.00
SUBTOTAL, BIDDABLE ITEMS					**$ 129,065.40**
	CONTINGENCIES, for all work listed			25.0%	$ 32,266.35
CONSTRUCTION COST					**$ 161,331.75**

CONCEPTUAL CROSSING 4 - SINGLE SPAN BRIDGE COST ESTIMATE

PROJECT		CLIENT
Panoche Valley Solar Farm		**ENERGY RENEWAL PARTNERS**
ALTERNATIVE	DATE	Prepared by:
Crossing 4 - Single Span 56' Bridge	**2/13/2014**	**WHPACIFIC, INC**

	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL
	MOBILIZATION	LS	All	8.0% Biddable	$ 9,174.00
	STRUCTURE EXCAVATION	CUYD	65.00	$ 45.00	$ 2,925.00
	FURNISH PILE DRIVING EQUIPMENT	LS	All	$ 18,000.00	$ 18,000.00
	FURNISH PP 12-3/4 X 0.375 STEEL PILES	FOOT	300.00	$ 45.00	$ 13,500.00
	DRIVE PP 12-3/4 X 0.375 STEEL PILES	EACH	10.00	$ 650.00	$ 6,500.00
	GENERAL STRUCTURAL CONCRETE, CLASS 3300	LS	All	$ 15,750.00	$ 15,750.00
	REINFORCEMENT	LS	All	$ 4,800.00	$ 4,800.00
	26 INCH PRECAST PRESTRESSED SLABS	FOOT	224.00	$ 200.00	$ 44,800.00
	W BEAM STEEL RAIL	LS	All	$ 8,400.00	$ 8,400.00
SUBTOTAL, BIDDABLE ITEMS					**$ 123,849.00**
	CONTINGENCIES, for all work listed			25.0%	$ 30,962.25
CONSTRUCTION COST					**$ 154,811.25**

CONCEPTUAL CROSSING 5 - FORD COST ESTIMATE

PROJECT		CLIENT
Panoche Valley Solar Farm		ENERGY RENEWAL PARTNERS
ALTERNATIVE	DATE	Prepared by:
Crossing 5 Ford	2/13/2014	WHPACIFIC, INC

	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL
	MOBILIZATION	LS	All	8.0% Biddable	$ 4,736.80
	EXCAVATION	CUYD	320.00	$ 45.00	$ 14,400.00
	3/4 INCH - 0 AGGREGATE BASE	CUYD	55.00	$ 12.00	$ 660.00
	ARTICULATING CONCRETE BLOCK MATTRESS	SQFT	2900.00	$ 15.00	$ 43,500.00
	EMBANKMENT GEOTEXTILE	SQYD	325.00	$ 2.00	$ 650.00
SUBTOTAL, BIDDABLE ITEMS					**$ 63,946.80**
	CONTINGENCIES, for all work listed			25.0%	$ 15,986.70
CONSTRUCTION COST					**$ 79,933.50**

CONCEPTUAL CROSSING 5 - CULVERT COST ESTIMATE

PROJECT		CLIENT
Panoche Valley Solar Farm		ENERGY RENEWAL PARTNERS
ALTERNATIVE	DATE	Prepared by:
Crossing 5 Culvert	2/13/2014	WHPACIFIC, INC

	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL
	MOBILIZATION	LS	All	8.0% Biddable	$ 11,441.20
	EMBANKMENT	CUYD	5.00	$ 25.00	$ 125.00
	STRUCTURE EXCAVATION	CUYD	50.00	$ 45.00	$ 2,250.00
	REINFORCEMENT	LS	All	$ 10,440.00	$ 10,440.00
	REINFORCED CONCRETE BOX CULVERT	FOOT	80.00	$ 850.00	$ 68,000.00
	WINGWALLS AND APRONS	CUYD	65.00	$ 830.00	$ 53,950.00
	W BEAM STEEL RAIL	LS	All	$ 8,250.00	$ 8,250.00
SUBTOTAL, BIDDABLE ITEMS					**$ 154,456.20**
	CONTINGENCIES, for all work listed			25.0%	$ 38,614.05
CONSTRUCTION COST					**$ 193,070.25**

CONCEPTUAL CROSSING 5 - FREE SPAN COST ESTIMATE

PROJECT		CLIENT	
Panoche Valley Solar Farm		**ENERGY RENEWAL PARTNERS**	
ALTERNATIVE	DATE	Prepared by:	
Crossing 5 - 275' Free Span Bridge	**2/13/2014**	**WHPACIFIC, INC**	

	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL
	MOBILIZATION	LS	All	8.0% Biddable	$ 114,957.60
	FURNISH PILE DRIVING EQUIPMENT	LS	All	$ 18,000.00	$ 18,000.00
	FURNISH PP 12-3/4 X 0.375 STEEL PILES	FOOT	320.00	$ 45.00	$ 14,400.00
	DRIVE PP 12-3/4 X 0.375 STEEL PILES	EACH	8.00	$ 650.00	$ 5,200.00
	GENERAL STRUCTURAL CONCRETE, CLASS 3300	LS	All	$ 17,850.00	$ 17,850.00
	REINFORCEMENT	LS	All	$ 5,520.00	$ 5,520.00
	PREFABRICATED STEEL TRUSS	FOOT	275.00	$ 4,800.00	$ 1,320,000.00
	FURNISH CRANE FOR LIFTING TRUSS	LS	All	$ 50,000.00	$ 50,000.00
	ASHPALT PAVING	TON	60.00	$ 100.00	$ 6,000.00
SUBTOTAL, BIDDABLE ITEMS					**$ 1,551,927.60**
	CONTINGENCIES, for all work listed			25.0%	$ 387,981.90
CONSTRUCTION COST					**$ 1,939,909.50**

CONCEPTUAL CROSSING 5 - MULTI-SPAN BRIDGE COST ESTIMATE

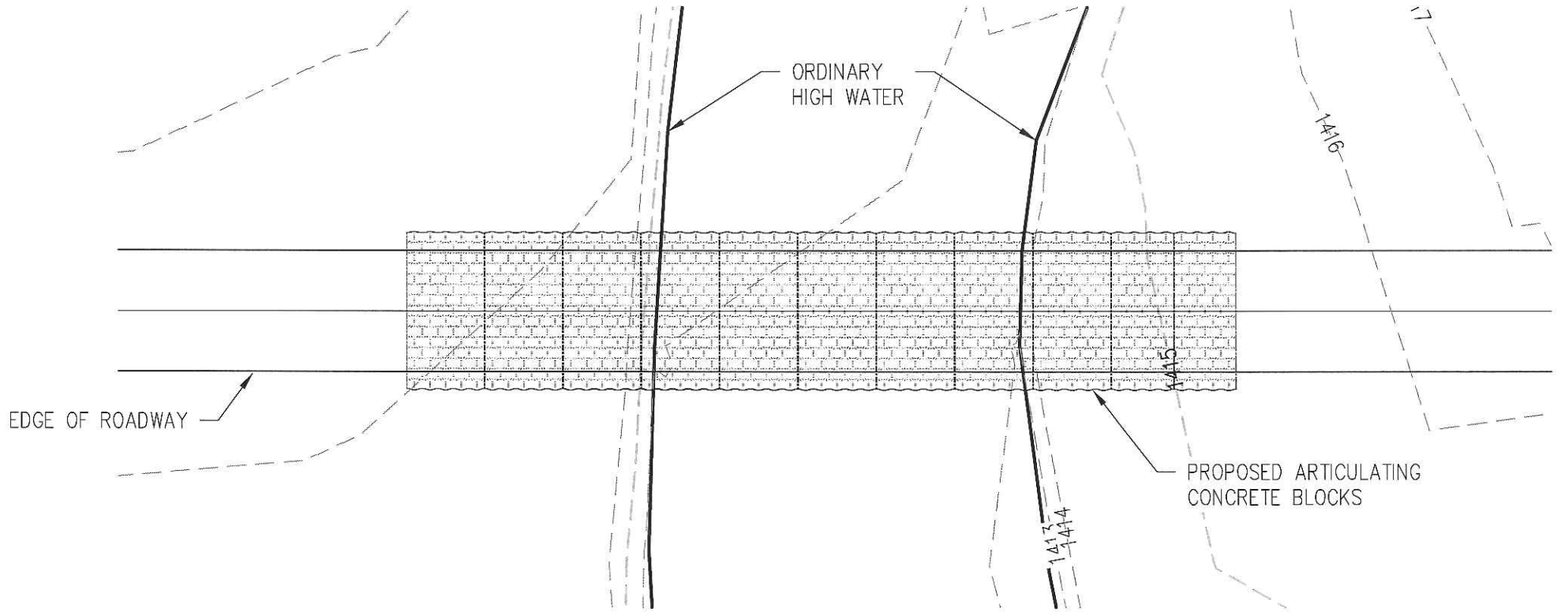
PROJECT			CLIENT	
Panoche Valley Solar Farm			ENERGY RENEWAL PARTNERS	
ALTERNATIVE		DATE	Prepared by:	
Crossing 5 - 2 Span 54' Bridge		2/13/2014	WHPACIFIC, INC	

	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL
	MOBILIZATION	LS	All	8.0% Biddable	$ 9,385.20
	STRUCTURE EXCAVATION	CUYD	65.00	$ 45.00	$ 2,925.00
	FURNISH PILE DRIVING EQUIPMENT	LS	All	$ 18,000.00	$ 18,000.00
	FURNISH PP 12-3/4 X 0.375 STEEL PILES	FOOT	360.00	$ 45.00	$ 16,200.00
	DRIVE PP 12-3/4 X 0.375 STEEL PILES	EACH	9.00	$ 650.00	$ 5,850.00
	GENERAL STRUCTURAL CONCRETE, CLASS 3300	LS	All	$ 21,000.00	$ 21,000.00
	REINFORCEMENT	LS	All	$ 6,360.00	$ 6,360.00
	15 INCH PRECAST PRESTRESSED SLABS	FOOT	216.00	$ 180.00	$ 38,880.00
	W BEAM STEEL RAIL	LS	All	$ 8,100.00	$ 8,100.00
SUBTOTAL, BIDDABLE ITEMS					**$ 126,700.20**
	CONTINGENCIES, for all work listed			25.0%	$ 31,675.05
CONSTRUCTION COST					**$ 158,375.25**

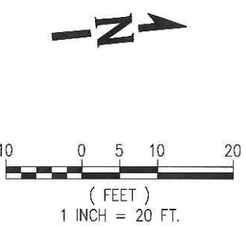
CONCEPTUAL CROSSING 5 - SINGLE SPAN BRIDGE COST ESTIMATE

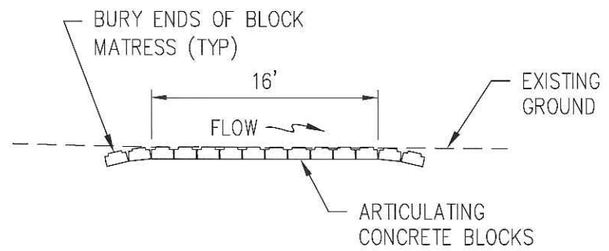
PROJECT		CLIENT
	Panoche Valley Solar Farm	**ENERGY RENEWAL PARTNERS**
ALTERNATIVE	DATE	Prepared by:
Crossing 5 - Single Span 54' Bridge	**2/13/2014**	**WHPACIFIC, INC**

	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL
	MOBILIZATION	LS	All	8.0% Biddable	$ 9,022.00
	STRUCTURE EXCAVATION	CUYD	65.00	$ 45.00	$ 2,925.00
	FURNISH PILE DRIVING EQUIPMENT	LS	All	$ 18,000.00	$ 18,000.00
	FURNISH PP 12-3/4 X 0.375 STEEL PILES	FOOT	300.00	$ 45.00	$ 13,500.00
	DRIVE PP 12-3/4 X 0.375 STEEL PILES	EACH	10.00	$ 650.00	$ 6,500.00
	GENERAL STRUCTURAL CONCRETE, CLASS 3300	LS	All	$ 15,750.00	$ 15,750.00
	REINFORCEMENT	LS	All	$ 4,800.00	$ 4,800.00
	26 INCH PRECAST PRESTRESSED SLABS	FOOT	216.00	$ 200.00	$ 43,200.00
	W BEAM STEEL RAIL	LS	All	$ 8,100.00	$ 8,100.00
SUBTOTAL, BIDDABLE ITEMS					**$ 121,797.00**
	CONTINGENCIES, for all work listed			25.0%	$ 30,449.25
CONSTRUCTION COST					**$ 152,246.25**



PLAN





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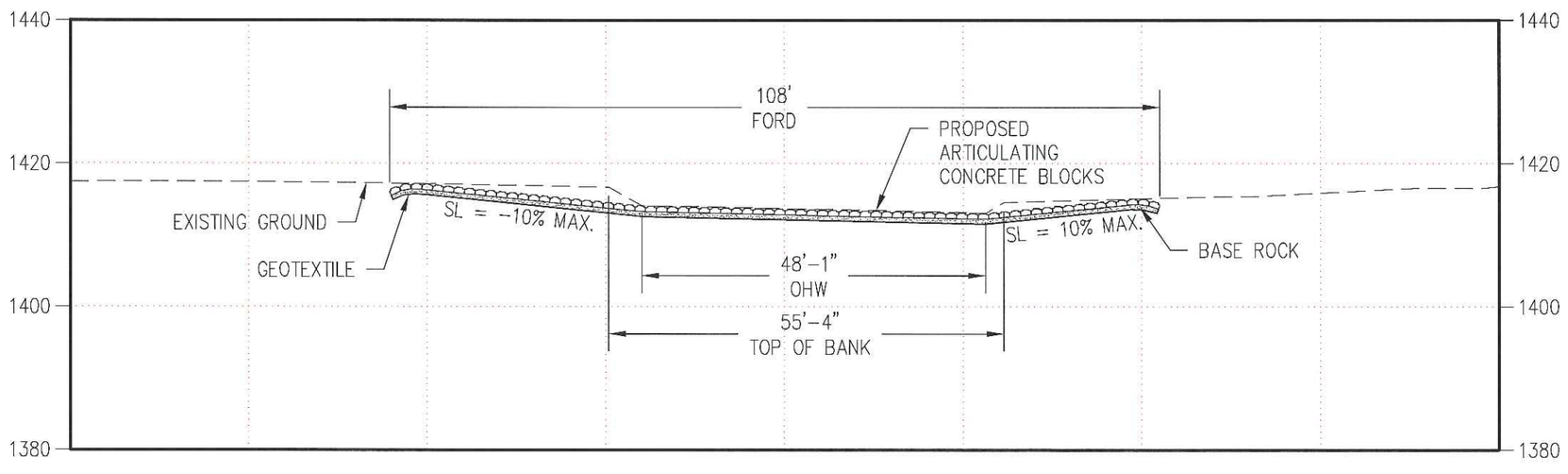

ELEVATION

CROSSING 4 - FORD

PANOCHE VALLEY SOLAR FARM
PLAN, ELEVATION AND TYPICAL SECTION

WHPacific

PROJECT NUMBER	DRAWING FILE NAME	DATE
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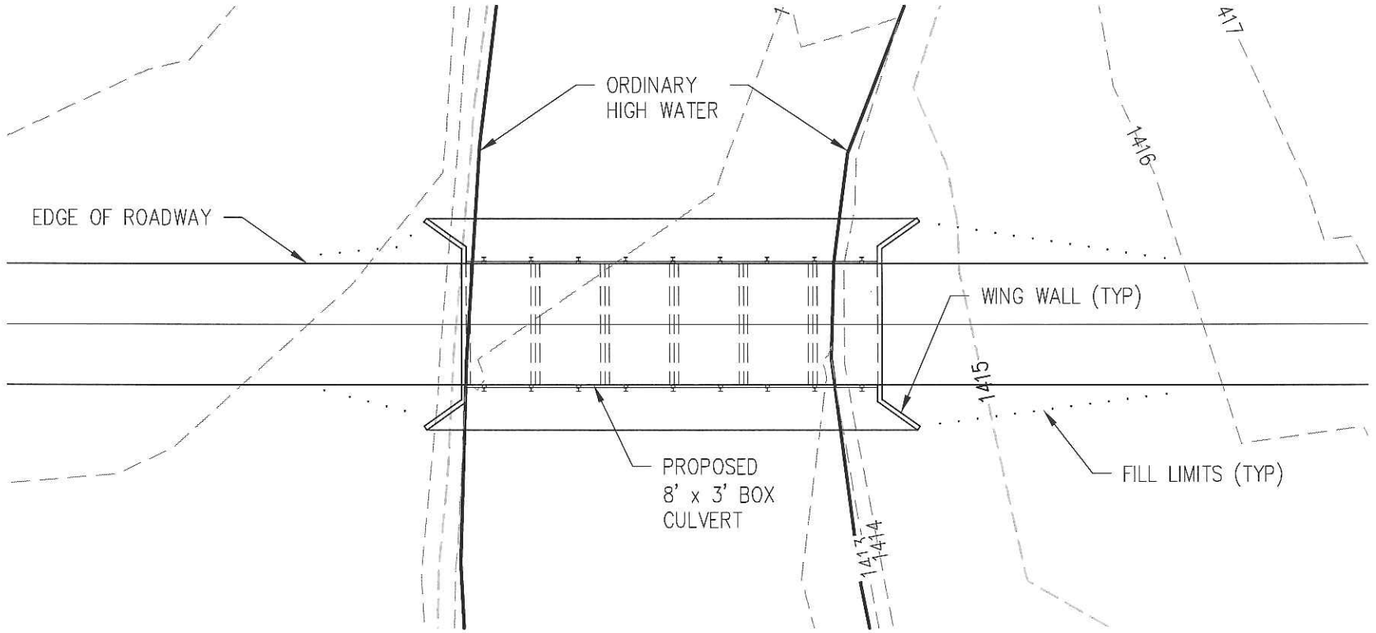

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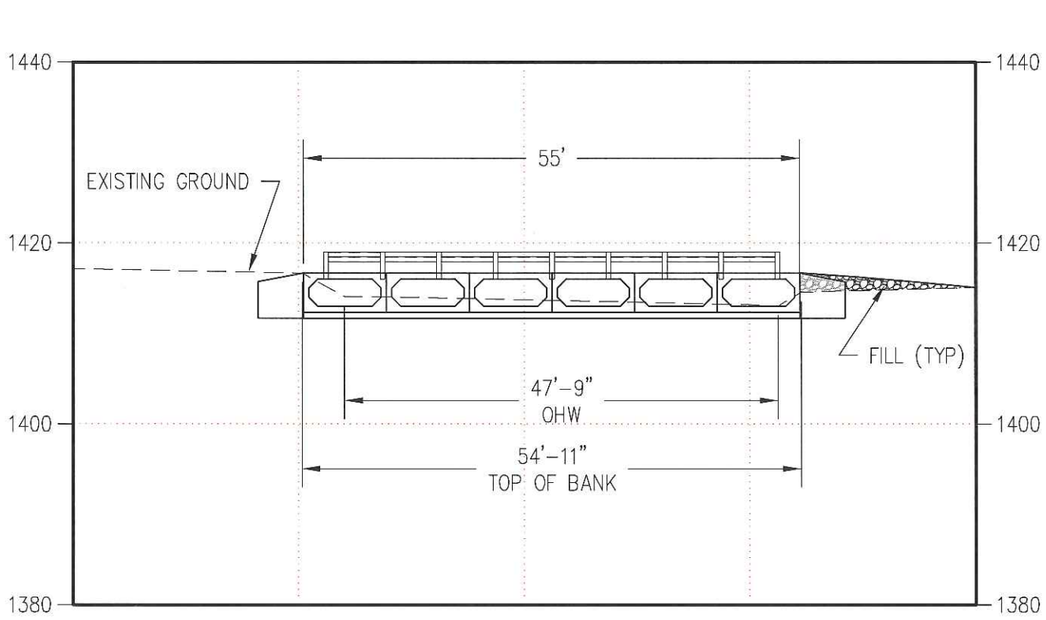

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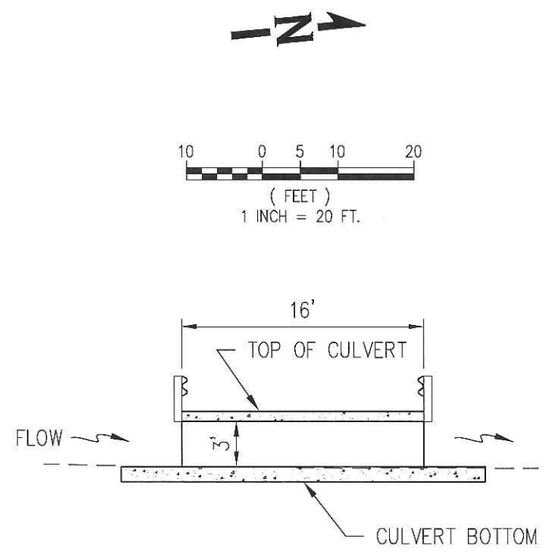

TYPICAL SECTION
NOT TO SCALE

CROSSING 4 - CULVERT

PANOCHE VALLEY SOLAR FARM
PLAN, ELEVATION AND TYPICAL SECTION

WHPacific

PROJECT NUMBER	DRAWING FILE NAME	DATE
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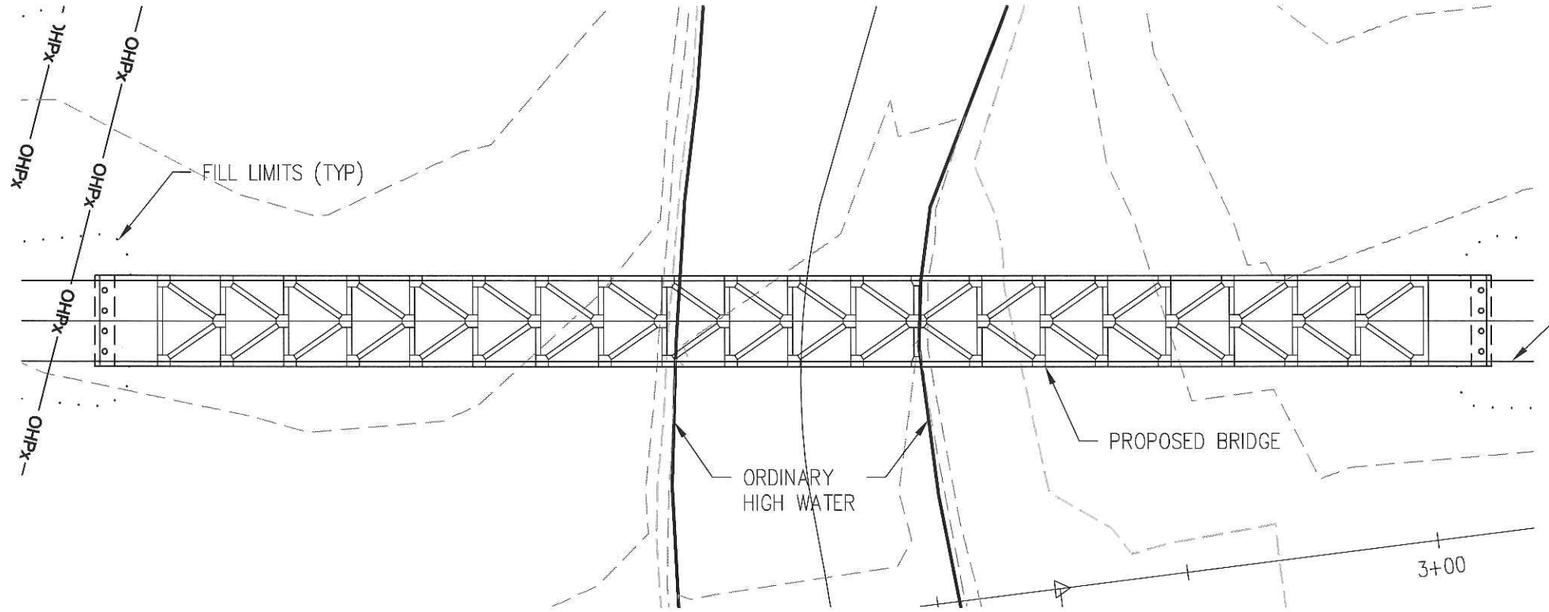

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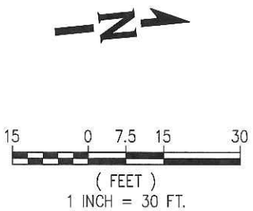

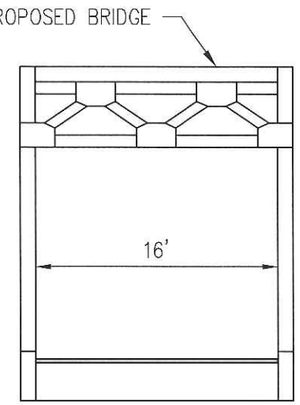

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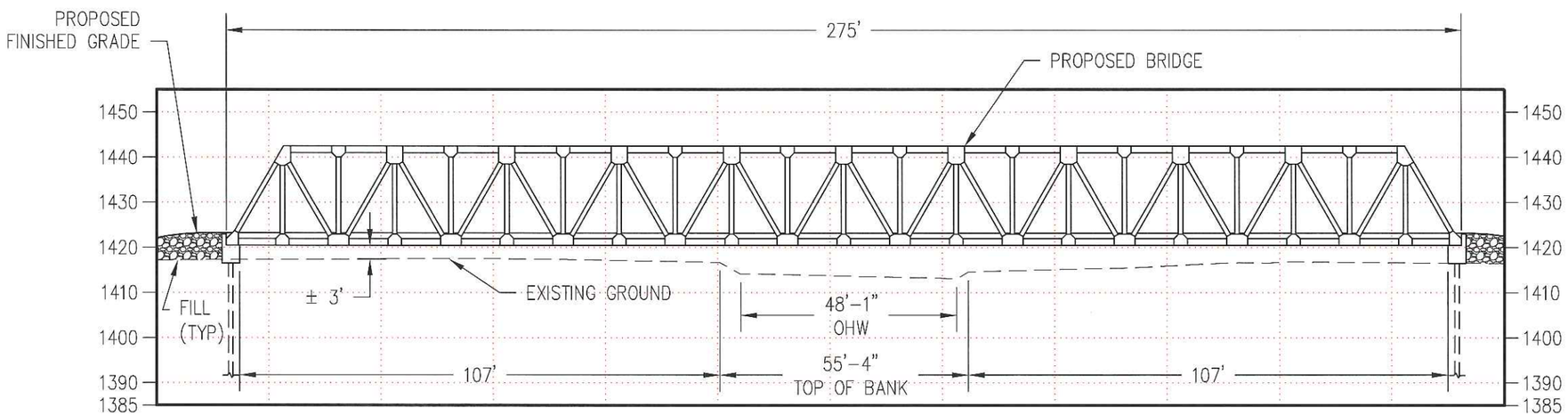

ELEVATION

CROSSING 4 - FREE SPAN

PANOCHE VALLEY SOLAR FARM
PLAN, ELEVATION AND TYPICAL SECTION

WHPacific

PROJECT NUMBER	DRAWING FILE NAME	DATE
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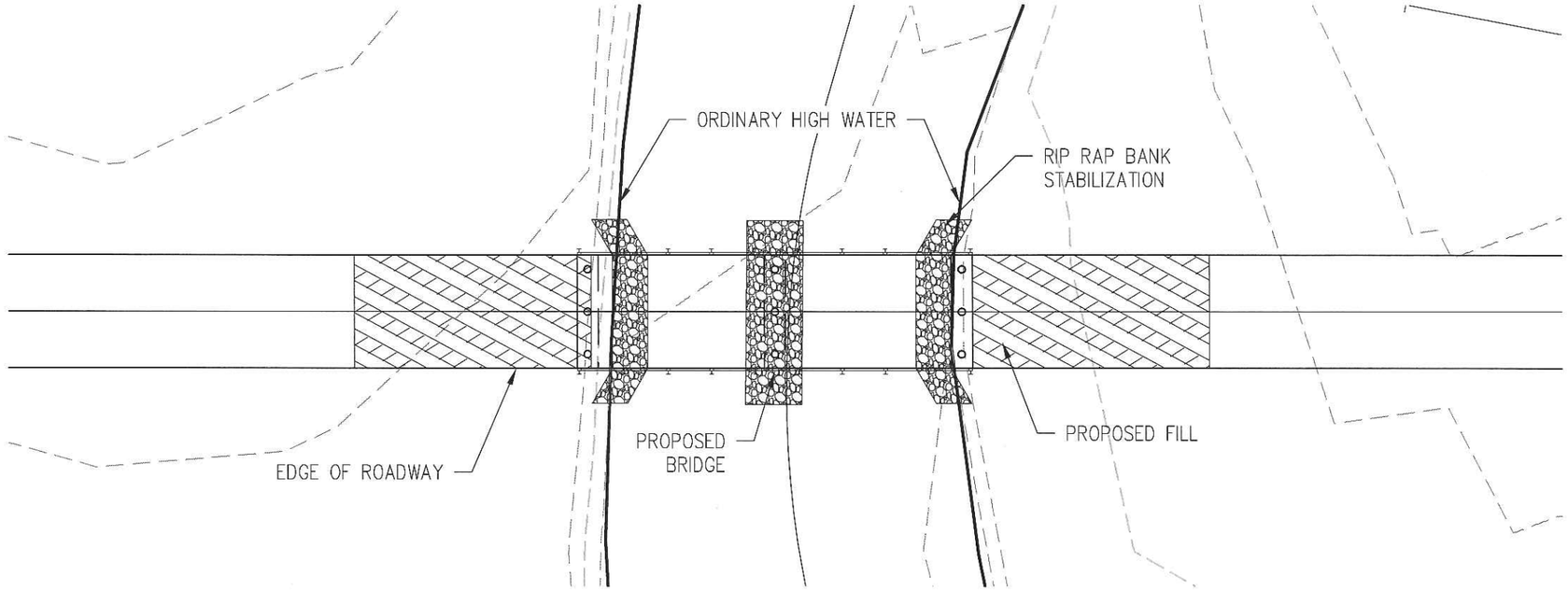

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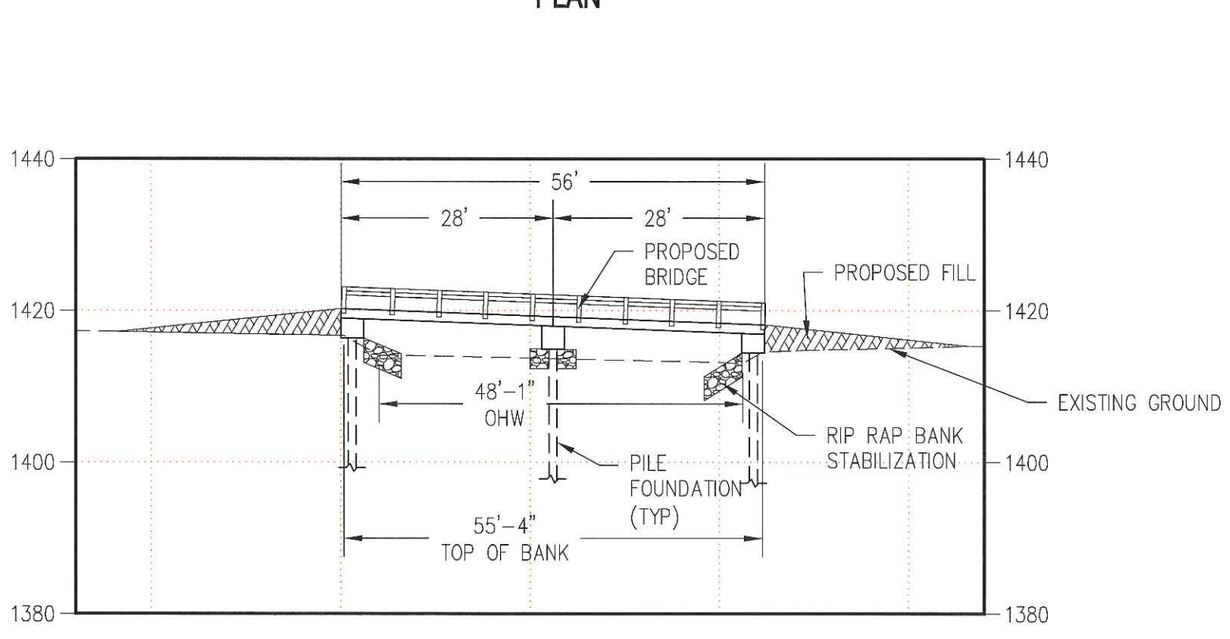

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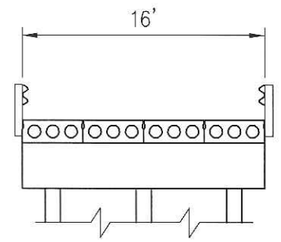

TYPICAL SECTION
NOT TO SCALE

CROSSING 4 - MULTI SPAN

PANOCHE VALLEY SOLAR FARM
PLAN, ELEVATION AND TYPICAL SECTION

WHPacific

PROJECT NUMBER	DRAWING FILE NAME	DATE
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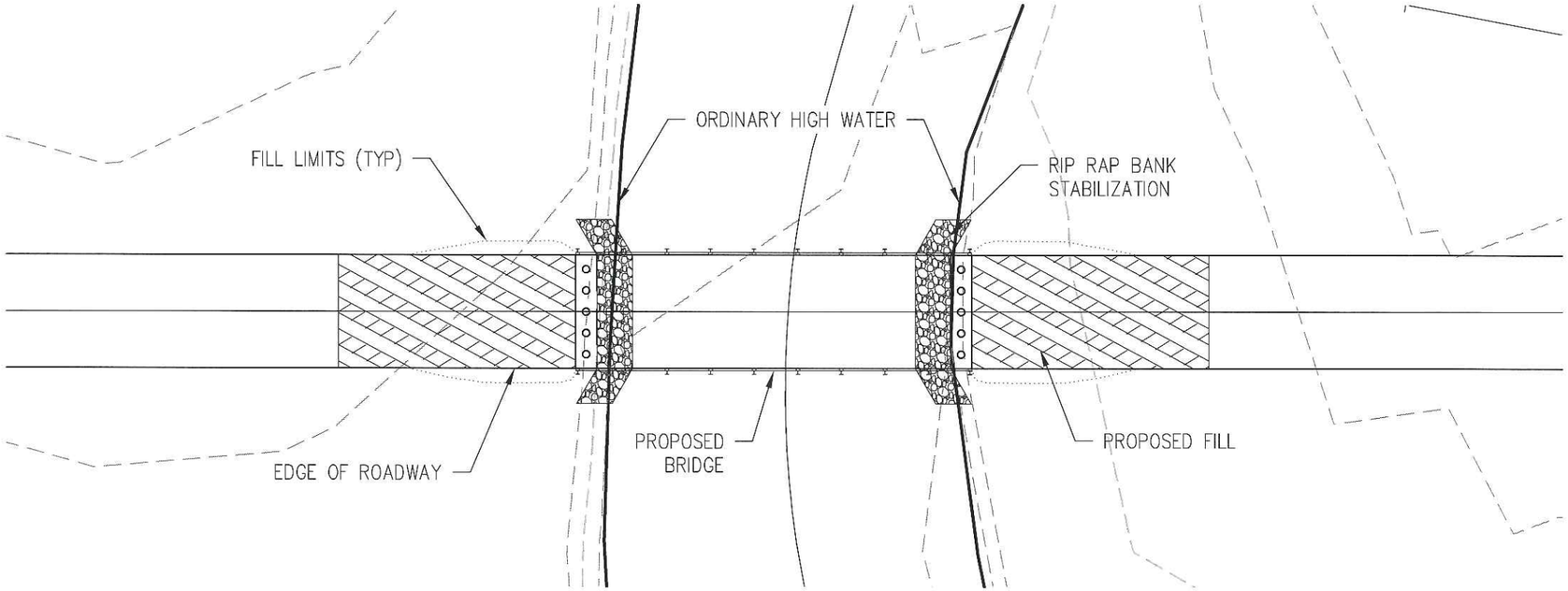
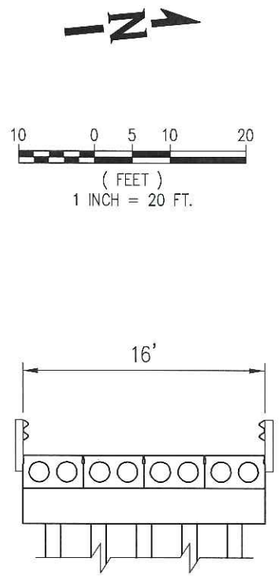


PLAN

ELEVATION



TYPICAL SECTION

NOT TO SCALE

CROSSING 4 - SINGLE SPAN

PANOCHE VALLEY SOLAR FARM
PLAN, ELEVATION AND TYPICAL SECTION

WHPacific

PROJECT NUMBER	DRAWING FILE NAME	DATE
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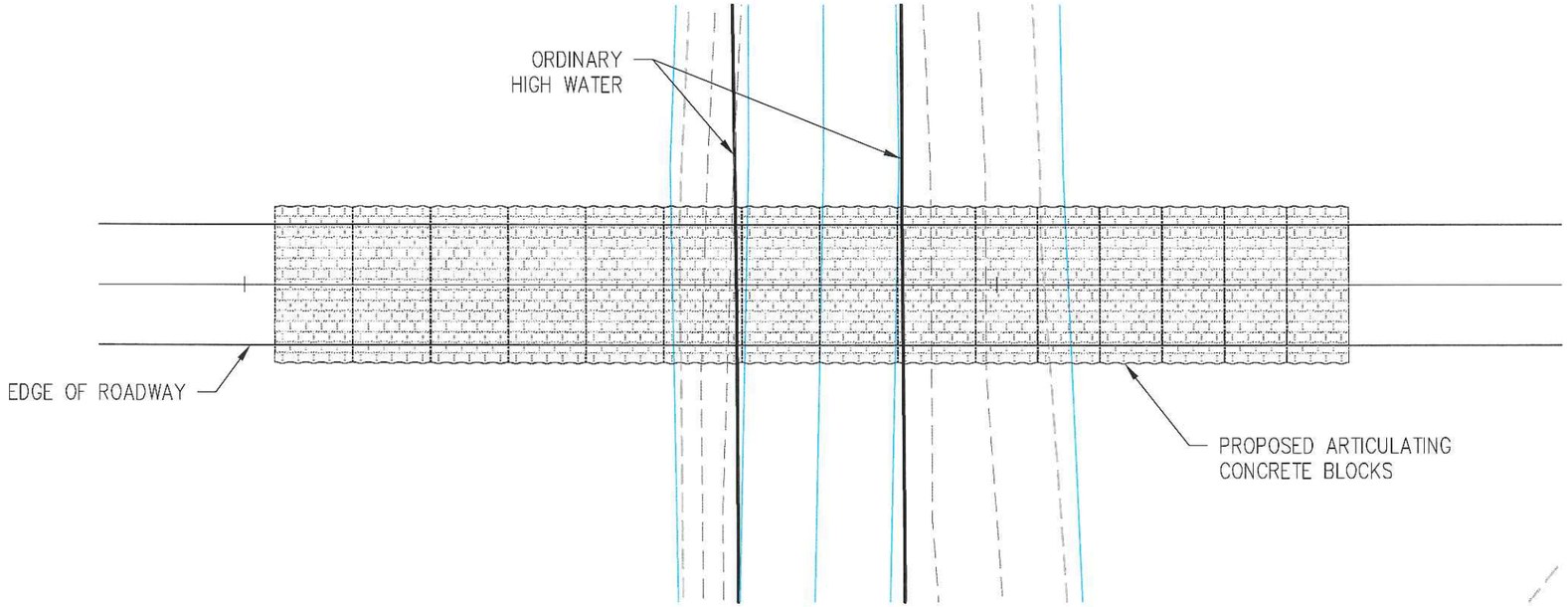

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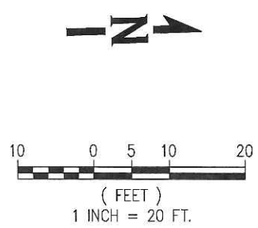

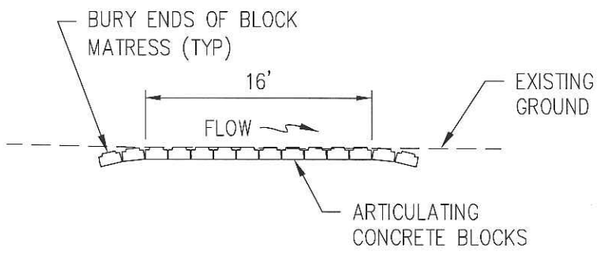

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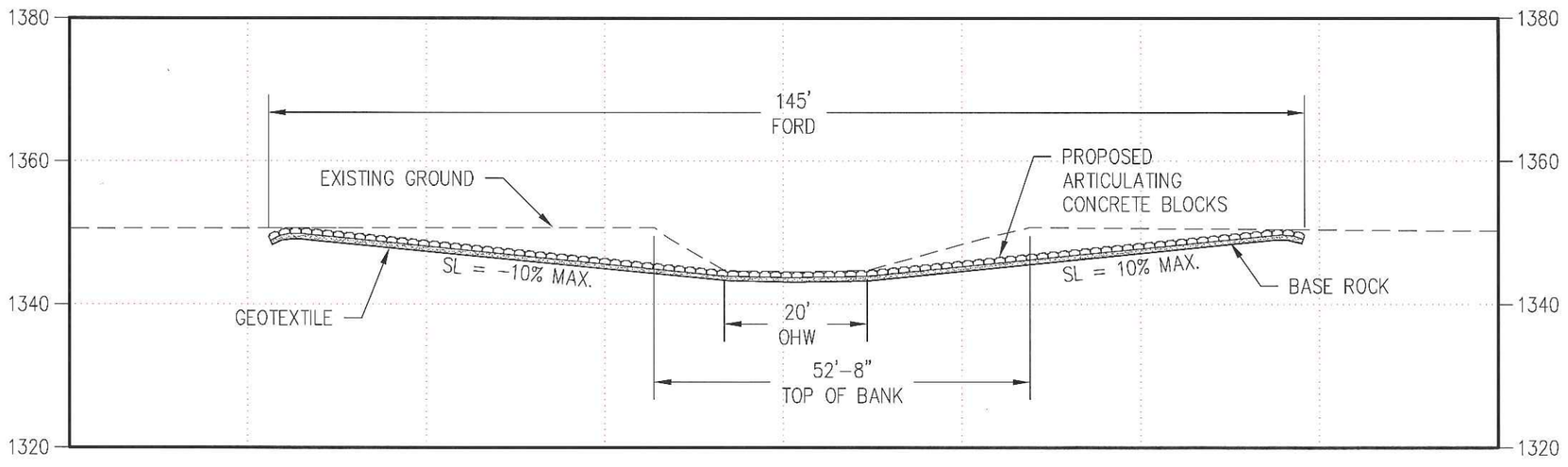

ELEVATION

CROSSING 5 - FORD

PANOCHE VALLEY SOLAR FARM
PLAN, ELEVATION AND TYPICAL SECTION

WHPacific

PROJECT NUMBER	DRAWING FILE NAME	DATE
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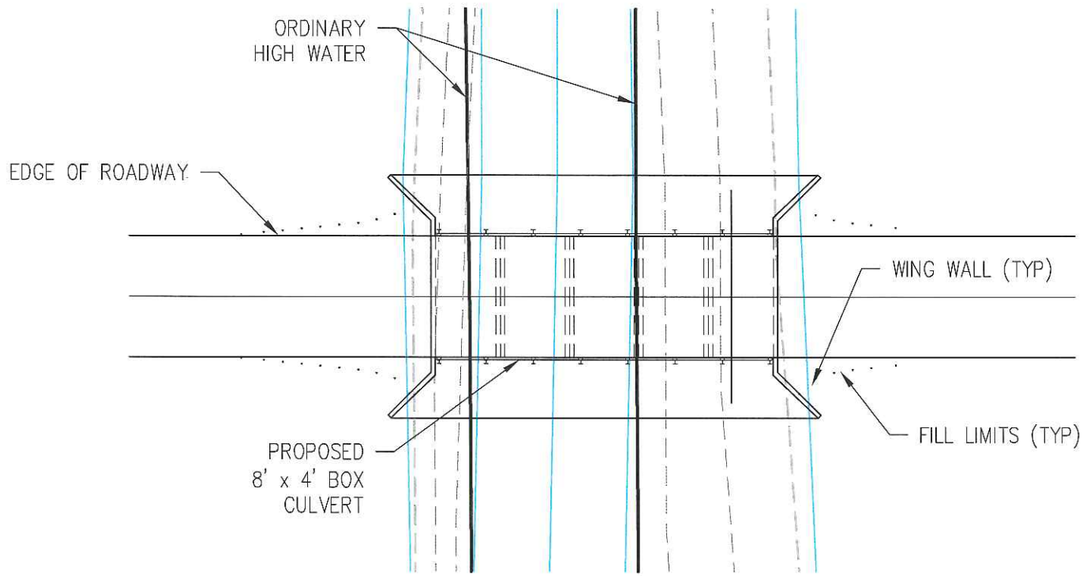

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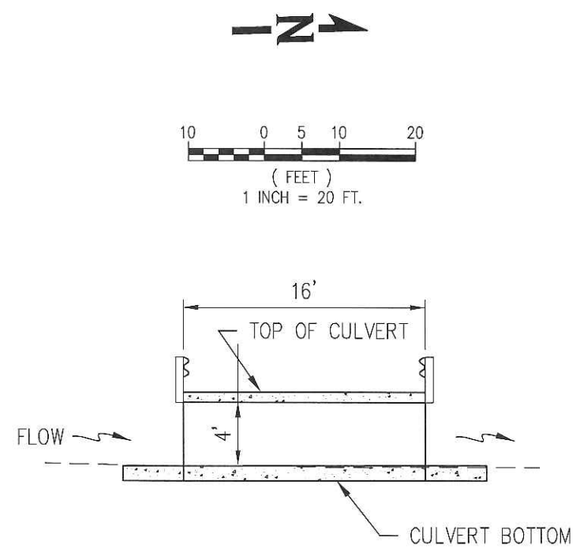

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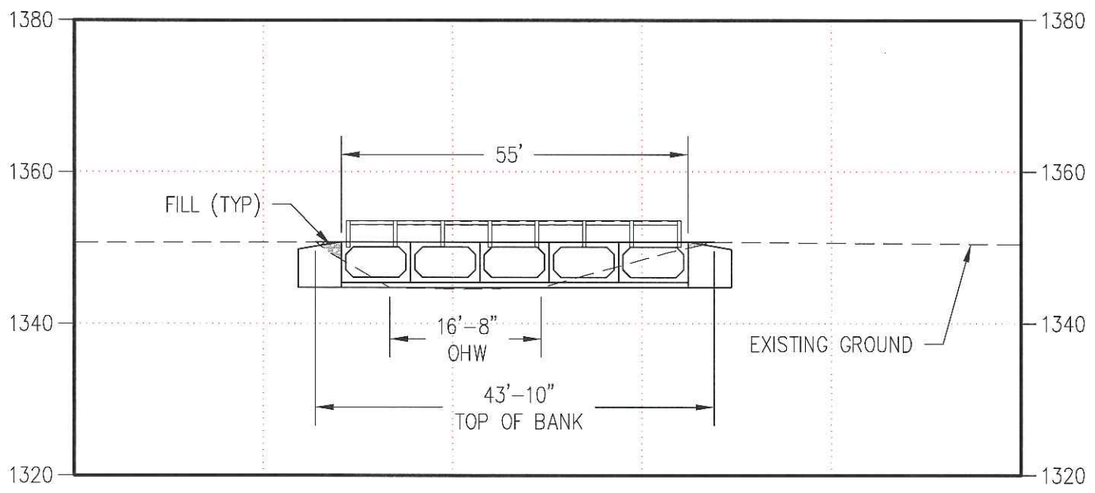


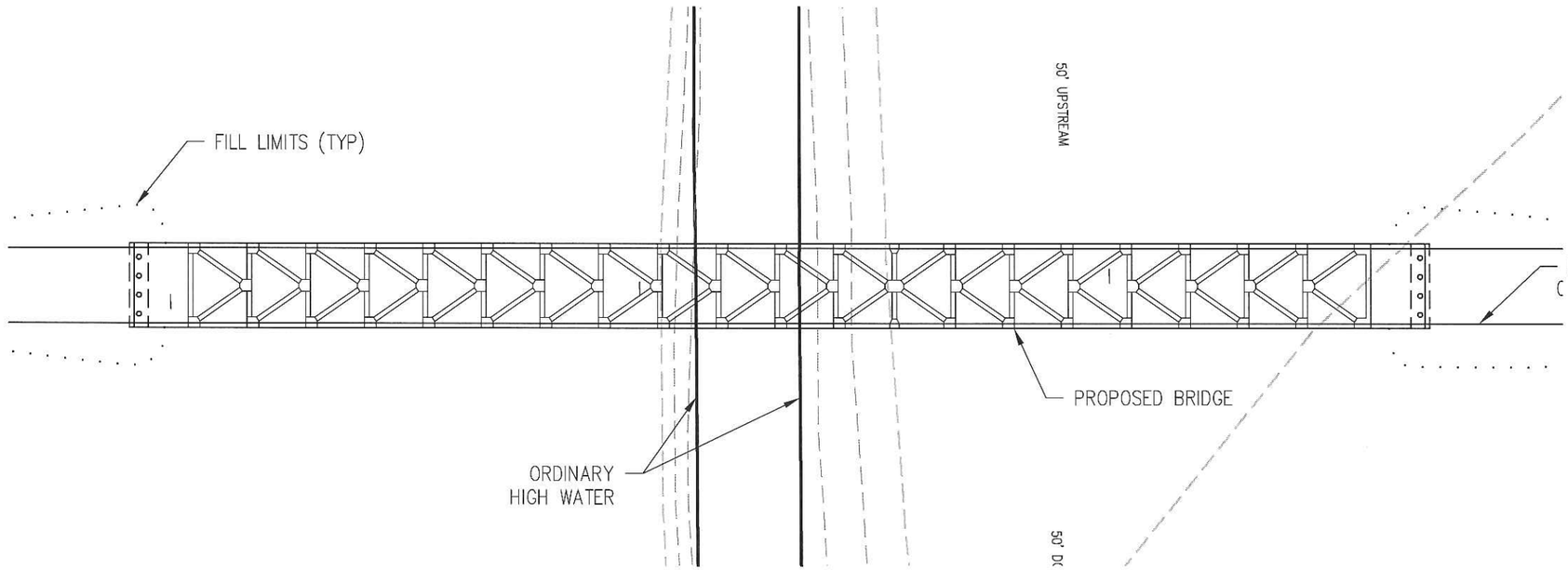
ELEVATION

CROSSING 5 - CULVERT

PANOCHE VALLEY SOLAR FARM
PLAN, ELEVATION AND TYPICAL SECTION

WHPacific

PROJECT NUMBER	DRAWING FILE NAME	DATE
035916	035916_EX03.dwg	10-08-13



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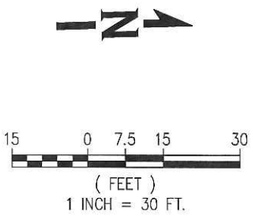

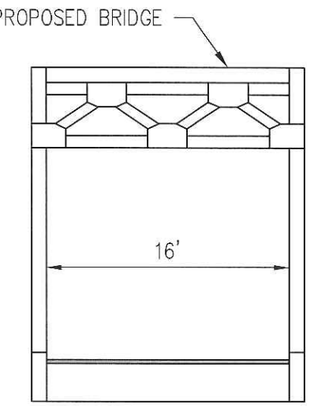

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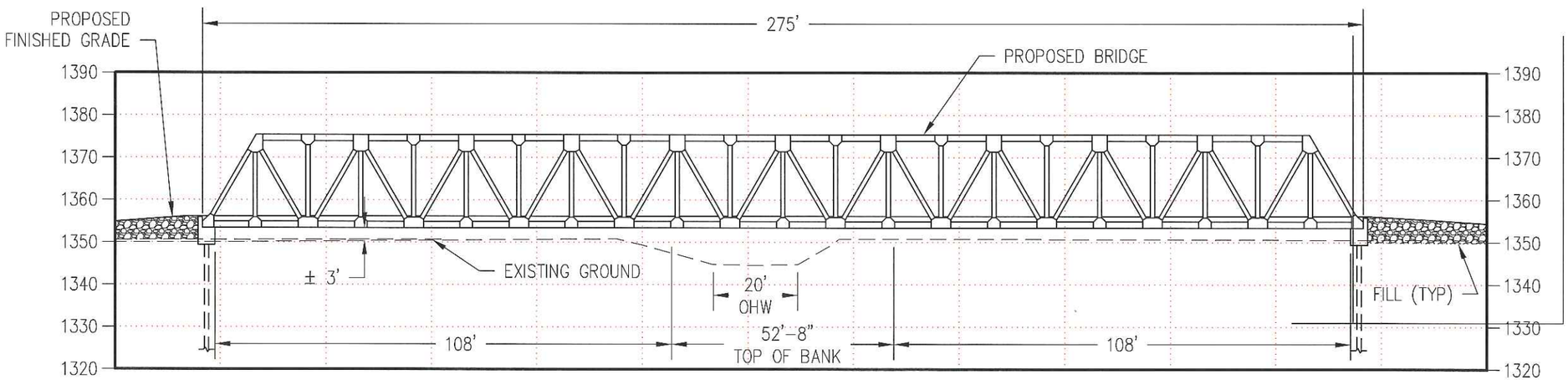

ELEVATION

CROSSING 5 - FREE SPAN

PANOCHE VALLEY SOLAR FARM
PLAN, ELEVATION AND TYPICAL SECTION

WHPacific

PROJECT NUMBER	DRAWING FILE NAME	DATE
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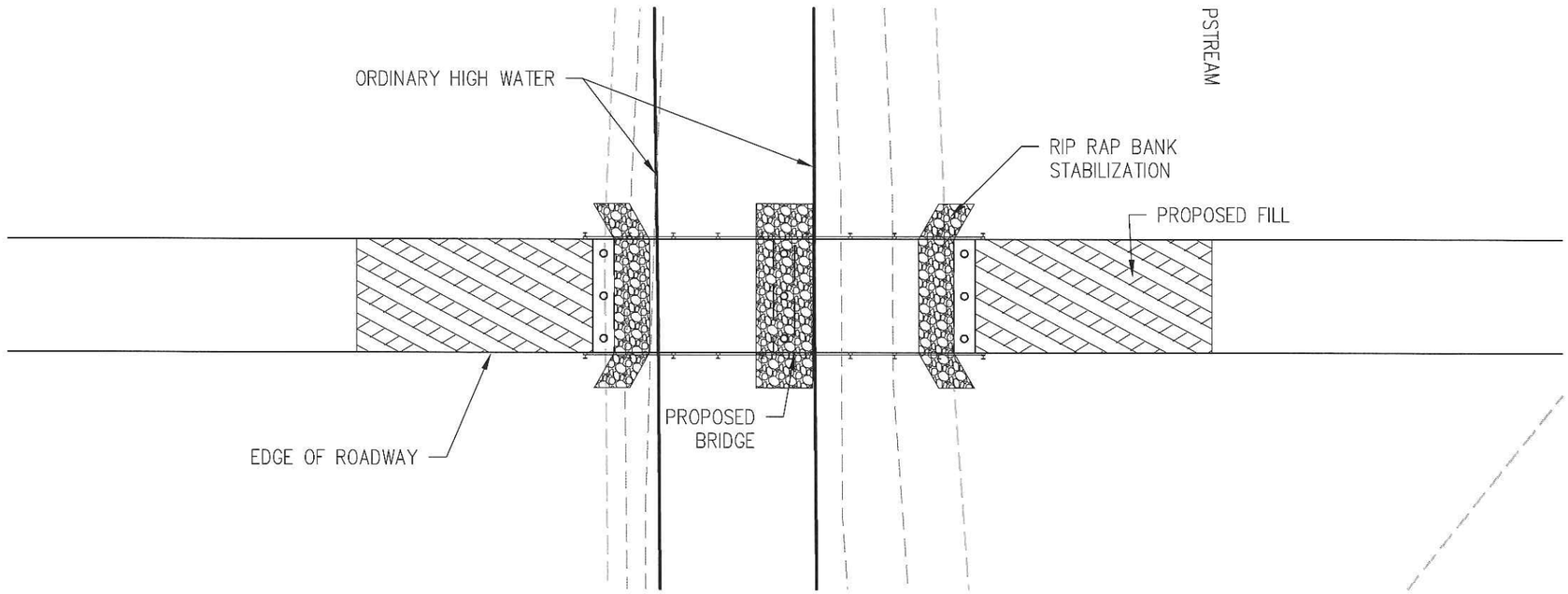

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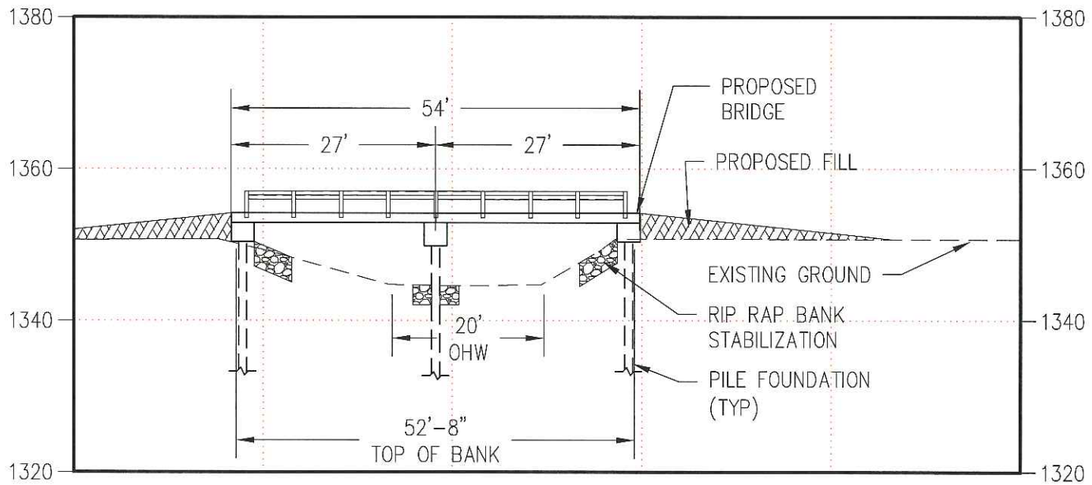
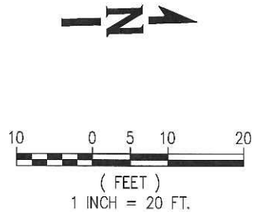
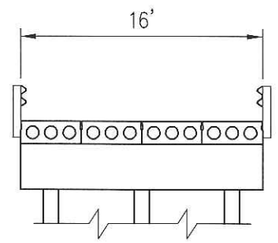


ELEVATION





TYPICAL SECTION
NOT TO SCALE

CROSSING 5 - MULTI SPAN

PANOCHE VALLEY SOLAR FARM
PLAN, ELEVATION AND TYPICAL SECTION

WHPacific

PROJECT NUMBER	DRAWING FILE NAME	DATE
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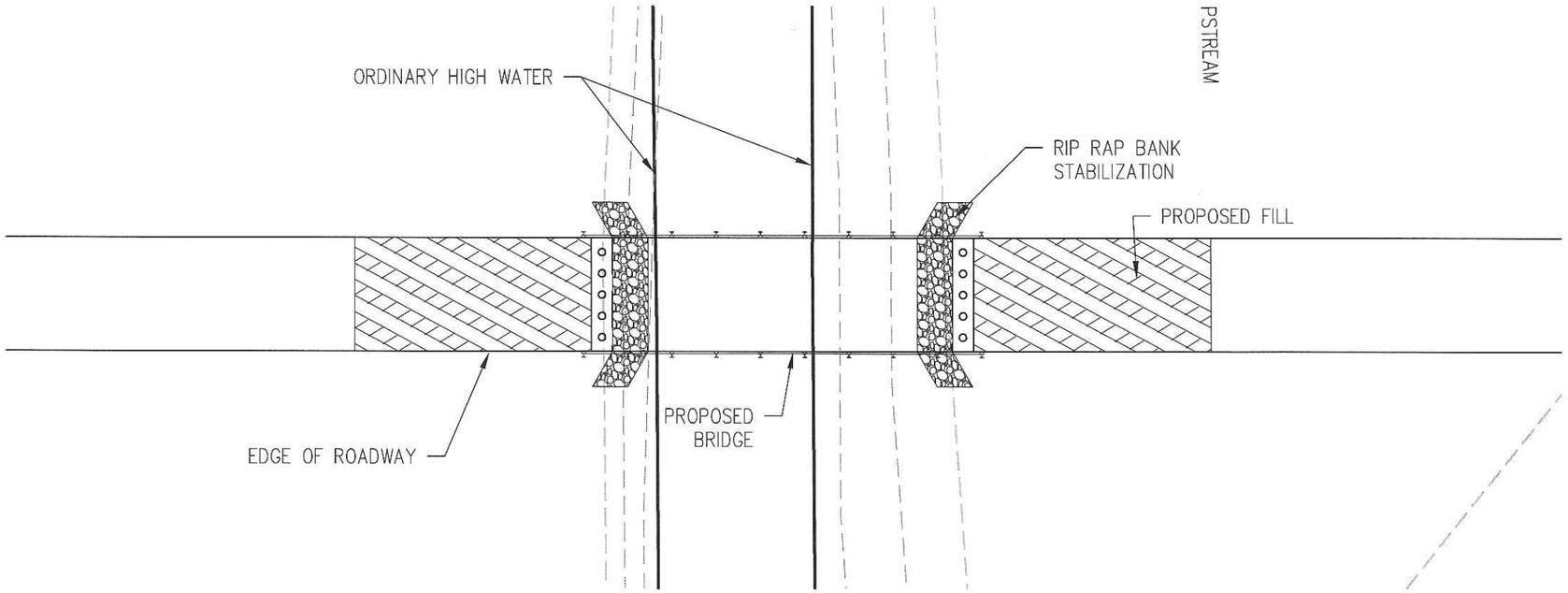
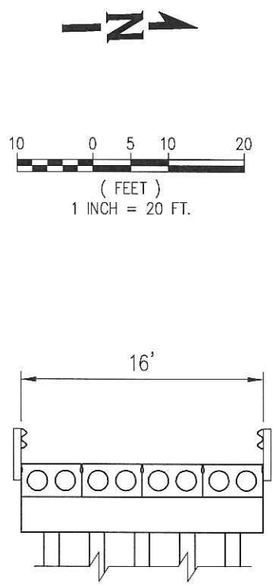


PLAN

ELEVATION



TYPICAL SECTION
NOT TO SCALE

CROSSING 5 - SINGLE SPAN

PANOCHE VALLEY SOLAR FARM
PLAN, ELEVATION AND TYPICAL SECTION

WHPacific

PROJECT NUMBER	DRAWING FILE NAME	DATE
035916	035916_EX02.dwg	10-08-13