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Application for Certification
(15-AFC-01)

Puente Power Project (P3)
Oxnard, CA

Responses to City of Oxnard Data Requests Set 5

April 2016

Submitted to:
The California Energy Commission

Prepared by:

nrg AECOM

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RESPONSES TO CITY OF OXNARD DATA REQUESTS SET 5 (Amended)

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LIST OF ACRONYMS AND ABBREVIATIONS USED IN RESPONSES

AFC	Application for Certification
CEC	California Energy Commission
GEV	generalized extreme value
HH	higher high
HL	higher low
LARWQCB	Los Angeles Regional Water Quality Control Board
LiDAR	Light Detection and Ranging
LH	lower high
LL	lower low
mgd	million gallons per day
MGS	Mandalay Generating Station
MLLW	mean lower low water
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
P3	Puente Power Project
USACE	United States Army Corps of Engineers

Technical Area: Environmental Hazards

BACKGROUND: COASTAL INUNDATION AND SEA-LEVEL RISE

The City's Data Requests, Set 4 requested that the applicant provide additional information related to sea level rise, tsunami, and other coastal hazards which threaten the Puente site. On January 4, 2016, the applicant submitted responses to these requests. The following data requests seek additional information and clarification regarding the applicant's responses to the City's data requests for the environmental hazards analysis.

DATA REQUEST

95. ***Table 83-1 contains eight years of dredge data for Ventura Harbor (2008-2015) that was obtained "from personal communication[s] with the U.S. Army Corps of Engineers." That table also lists 11 years of dredge data for Channel Islands Harbor (2005-2015) as "not available." Please describe the efforts that the applicant has undertaken to obtain the 11 years of missing dredge data for Channel Islands Harbor. If this data is also available through personal communications with the U.S. Army Corps of Engineers, please provide the data.***

RESPONSE

As requested, Applicant recently contacted the United States Army Corps of Engineers (see Appendix 95-1). Additional dredging data for the 11 years requested (2005-2015) for Channel Islands Harbor is summarized below in Table 95-1.

Table 95-1
Volume of Material Dredged from Channel Island Harbors (2005–2015)

Year[1]	Volume Dredged from Channel Islands Harbor[2] (cubic yards)
2005	2,141,000
2006	0
2007	1,171,000
2008	0
2009	2,198,000
2010	0
2011	969,000
2012	0
2013	600,000
2014	0
2015	2,369,000

Notes:
1 The dredging volume data from Patsch and Griggs, 2007 presented in Table 83-1 appears to have been reported in water years, not calendar years; therefore, the 2005-2015 data provided by USACE and summarized in this table have been provided on a water year basis for consistency with Table 83-1.
2 Channel Island Harbor dredging volumes for 2005-2015 from personal communication with the USACE (see Appendix 95-1).
USACE = United States Army Corps of Engineers

DATA REQUEST

96. ***Some of the figures included in the applicant's data responses still lack information that is needed to interpret these figures. For instance, it is not clear the date that the LIDAR data was collected. Previous responses to this data request have referred to the 2013 merged LIDAR however this is the date of the data product, not the date of collection. In addition, while the image in Figure 54-2 contains elevation contours, those contours stop before the right-hand edge of the image. Consequently, the image lacks full elevation contours for either the project site or even the crest of the dunes. Please reproduce Figure 54-2 with a full set of elevation contours for the entire image. Please also reproduce Figure 49-3 with a legend.***

RESPONSE

Applicant does not have any additional information on the Light Detection and Ranging (LiDAR) data other than what has been submitted to date. The data and metadata can be obtained at the National Oceanic and Atmospheric Administration's (NOAA's) Digital Coast web site, available online at: https://coast.noaa.gov/dataviewer/index.html?action=advsearch&qType=in&qFld=ID&qVal=2612 (most recently accessed on March 29, 2016).

The intent of Figure 54-2 was to show the contours of the beach. However, to be responsive to this Data Request, please see revised Figure 54-2 with the contours extended toward the east.

Figure 49-3 shows the locations of the three canal profiles shown on the graph in Figure 49-2. Please see revised Figure 49-3 with a legend added.

DATA REQUEST

97. ***The applicant's response to City Data Request 87 references the Komar et al. (1999) method for calculating wave run up. Please provide any and all calculations, including but not limited to calculations using the Komar et al. (1999) method, that the applicant or its consultants have performed to calculate wave run up on beach in front of the Puente site.***

RESPONSE

The response to City of Oxnard Data Request 93 provides details on the calculations of runup using the method described in Komar et al. (1999). Appendix 97-1 provides a more detailed explanation of the calculations.

DATA REQUEST

98. ***The applicant's response to City Data Request 88 states that the active portion of Mandalay beach is "modified by flow from the Mandalay Generating Station [MGS] outfall." Please describe how the beach is modified by the outfall flow. Please include all data and ground photographs (with date and time stamps) used in formulating the response to this data request.***

RESPONSE

Due to sand accumulation on the beach, discharge from the Mandalay Generating Station (MGS) can become obstructed, which can result in ponding and a flow path toward the south or north. This can be seen in the photographs submitted with Applicant's responses to Data Requests.

A large volume of sediment is transported down Mandalay Beach, with the dominant direction of transport running from the north to the south. Data provided in several previous responses to Data Requests on the volume of sediment transported on Mandalay Beach indicate that about 1 million cubic yards per year on average is transported between the Santa Clara River mouth and Channel Islands Harbor (see responses to City of Oxnard Data Requests 83 and 95). This sediment builds up in front of the MGS outfall when it is not operating. In the absence of sand removal, the discharge from the MGS outfall is not large enough to erode a direct path through the built up sand to the ocean, and the outflow is diverted primarily to the south and occasionally to the north. The discharge flows south (or north) until it can erode a path to the ocean. The path eroded by the flow results in a "depression" in the beach, an area where the beach is higher towards the ocean. The depression can be seen in the beach profiles previously provided in response to City of Oxnard Data Request 87 (see Figure 87-4, where the depression is located between stations about 1500 and 1800).

Applicant has annotated several aerial photographs previously provided showing where the beach has been modified by the MGS outflow. Figure 98-1 is the 2012 aerial photograph from the Application for Certification (AFC), Appendix N-2. The figure shows the locations where the beach has been modified by the MGS outflow. Figure 98-2 shows an aerial photograph from April 19, 2013 (previously submitted with Applicant's response to City of Oxnard's Data Request 90), also showing the flow going south and remnant ponded water to the north, possibly from a previous instance of the flow going north. Figure 98-3, from January 14, 2014, again shows the flow going south.

The shutdown of MGS Units 1 and 2 by the end of 2020 will result in a substantial reduction of MGS' wastewater discharge associated with the once-through cooling system. Remaining discharges from MGS will primarily be intermittent maintenance-associated flow from the circulation pumps, Unit 3 bearing cooling water and stormwater. These flows will be intermittent. Discharges from the Puente Power Project (P3) will also be minimal and infrequent. The future discharges from MGS and P3 will not have as great an effect on the beach as the current discharge from MGS Units 1 and 2. In the future, after MGS Units 1 and 2 are shut down, the beach will look more natural, similar to the beach characteristics south of the plant. NRG will continue its sand management program, as needed, to maintain a direct connection to the ocean (see response to California Energy Commission [CEC] Data Request 75).

DATA REQUEST

99. ***The applicant's response to City Data Request 89 refers to photographs contained in Appendices 64-l and 90-1. Please provide the date and if available timestamps for these photographs as well as any available information about the tide and wave conditions at the date and time that these photographs were taken.***

RESPONSE

The photographs included in Appendices 64-1 and 90-1 are dated, but the timestamps are unknown; therefore, the tidal conditions for the day of the photograph are provided in Table 99-1. Tidal information for the tide station at Santa Barbara (nearest station to Project site) is unavailable before 2005; therefore, the tidal data from the tide station at Santa Monica were used from 1987 to present. Prior to 1987, no nearby tidal gage data are available; therefore, the predicted tide from the program WXTide32 (available online at: http://wxtide32.com/) was used. As shown on Figure 99-1, the tidal prediction from WXTide32, when compared to the observed tide at Santa Monica for January 11, 1987, through January 14, 1987, provides similar results.

Wave conditions for the day the photos were taken are provided in Table 99-1 for the dates available. Data on wave conditions were obtained from the National Data Buoy Center for buoy Station 46053, East Santa Barbara, located about 12 nautical miles southwest of Santa Barbara. The depth of water at the buoy location is about 427 meters.

Table 99-1
Tidal Conditions for Date of Aerial Photographs Provided in Appendices 64-1 and 90-1

Photo Date	Date and Time for Tide	Tidal Elevation (feet) (MLLW)	Tide Stage	Average Significant Wave Height (feet)	Average wave period (seconds)
5/16/78[1]				3.51	8.1
	5/16/78 00:06	2.2	HL		
	5/16/78 5:15	3.4	LH		
	5/16/78 11:52	0.8	LL		
	5/16/78 18:36	4.3	HH		
6/15/1981[1]					
	6/15/1981 3:32	-0.1	LL		
	6/15/1981 9:42	3.5	LH		
	6/15/1981 14:35	1.9	HL		
	6/15/1981 20:47	5.7	HH		
1/11/1984[1]					
	1/11/1984 3:36	4.2	HH		
	1/11/1984 10:40	2.1	HL		
	1/11/1984 15:36	2.8	LH		
	1/11/1984 21:14	1.8	LL		

Table 99-1
Tidal Conditions for Date of Aerial Photographs Provided in Appendices 64-1 and 90-1 (Continued)

Photo Date	Date and Time for Tide	Tidal Elevation (feet) (MLLW)	Tide Stage	Average Significant Wave Height (feet)	Average wave period(s)
1/12/1987[2]					
	1/12/1987 0:36	2.605	HL		
	1/12/1987 7:18	5.745	HH		
	1/12/1987 14:36	-0.676	LL		
	1/12/1987 21:24	3.527	LH		
5/23/1989[2]					
	5/23/1989 6:00	-0.764	LL		
	5/23/1989 13:00	3.054	LH		
	5/23/1989 16:30	2.507	HL		
	5/23/1989 23:06	5.574	HH		
9/19/1992[2]					
	9/19/92 5:18	3.255	LH		
	9/19/92 8:54	3.107	HL		
	9/19/92 15:06	5.056	HH		
	9/19/92 23:42	0.735	LL		
11/30/1994[2]				3.51	8.1
	11/30/1994 0:06	1.325	HL		
	11/30/1994 6:18	6.417	HH		
	11/30/1994 13:24	-0.633	LL		
	11/30/1994 19:36	4.245	LH		
10/7/1999[2]				4.74	5.8
	10/7/1999 2:48	-0.154	LL		
	10/7/1999 9:06	5.203	LH		
	10/7/1999 14:54	0.735	HL		
	10/7/1999 21:00	5.443	HH		

Table 99-1
Tidal Conditions for Date of Aerial Photographs Provided in Appendices 64-1 and 90-1 (Continued)

Photo Date	Date and Time for Tide	Tidal Elevation (feet) (MLLW)	Tide Stage	Average Significant Wave Height (feet)	Average wave period(s)
7/23/2002[2]				3.35	4.3
	7/23/2002 4:00	-1.007	LL		
	7/23/2002 10:36	4.088	LH		
	7/23/2002 15:12	2.395	HL		
	7/23/2002 21:24	6.591	HH		
4/19/2013[2]				3.41	5.32
	4/19/13 4:48	3.619	LH		
	4/19/13 11:48	0.558	LL		
	4/19/13 18:48	3.914	HH		
	4/20/13 0:18	2.142	HL		

Notes:
1 Tide from tide prediction program, WXTide32, Version 4.7 February 2007. Station Ventura (reference station Los Angeles, CA)
2 Tide from NOAA station Santa Monica #9410840
3 Tide stage:
HH = higher high
LH = lower high
HL = higher low
LL = lower low

MLLW = mean lower low water

Technical Area: Land Use and Agriculture

BACKGROUND: COASTAL LAND USE

AFC Section 4.6 states that the applicant plans to use the existing outfall at the Mandalay Generating Station to discharge process wastewater from the Puente facility. See AFC at 4.6-13. Water discharged from the outfall currently crosses the beach in front of the Mandalay site, including public tidelands within the jurisdiction of the California State Lands Commission.

DATA REQUEST

100. ***Please provide a copy of any lease and all other entitlements held by the applicant that permit the applicant to use the existing outfall at Mandalay Generating Station or otherwise discharge wastewater onto public tidelands.***

RESPONSE

As explained in Applicant's response to CEC Data Request 75 (see Docket # TN 210302), the existing MGS outfall structure is located on land owned by NRG. Because the MGS outfall structure is not on State Lands, no lease is required.

The facility's National Pollutant Discharge Elimination System (NPDES) (LARWQCB, 2015) permit authorizes the discharge of wastewater to the ocean; therefore, no lease or entitlement agreements are required. Furthermore, the plant has obtained grading permits, and will continue to do so, when necessary to do maintenance or sand management on the beach.

Reference

LARWQCB (Los Angeles Regional Water Quality Control Board), 2015. CA0001180 Order No. R4-2015-0201. Waste Discharge Requirements for the NRG California South LLP Mandalay Generating Station. Available online at: http://www.waterboards.ca.gov/losangeles/board_decisions/adopted_orders/year.shtml.

Technical Area: Wastewater

BACKGROUND

During the 2015/16 winter season, sand has accumulated and blocked the existing outfall and associated discharge channel at the Mandalay Generating Station. NRG has sought emergency sand management permits from the Coastal Commission to remove this sand. NRG is proposing to continue using the existing outfall to discharge wastewater from the proposed Puente facility.

DATA REQUEST

101. ***After the Puente facility is constructed, how often and when does NRG project that it will discharge water through the outfall at Mandalay Generating Station? Can NRG operate Puente if it is unable to discharge wastewater through this outfall due to sand accumulation or another factor? If yes, how long can Puente operate without discharging wastewater?***

RESPONSE

P3 will be a peaking facility that will be dispatched and used only when needed. Process wastewater will include softener regeneration waste, reverse osmosis concentrate, and evaporative cooler blowdown. P3 will discharge process wastewater and stormwater to the existing MGS retention basins and reuse that water to the extent possible. What is not reused will be discharged in accordance with MGS' existing Waste Discharge Requirements Order No. R4-2015-0201, NPDES No. CA0001180, Effective Date: 2016-01-01 (LARWQCB, 2015).

The estimated maximum daily discharge for P3 is approximately 0.036 million gallons per day (mgd), which will be substantially less than the permitted maximum discharge flows of 255.3 mgd for MGS (i.e., 255 mgd for once-through cooling water and 0.3 mgd for other miscellaneous wastewater discharges, which includes discharge from MGS Unit 3).

The project has been designed to use a very small amount of water, less than 20 acre-feet per year. Evaporative coolers will be used occasionally (i.e., when ambient temperatures exceed 59 degrees Fahrenheit and the unit is operating at base load) for power augmentation. In addition, the project includes backup water storage. Service water will be stored on site in an existing 445,000-gallon service water tank that has sufficient capacity for 102 hours of operation at base-load peak demand. In addition, each of the two demineralized water storage tanks provides sufficient capacity for approximately 96 hours of peak-load operation, with evaporative cooling that would coincide with an outage of the water treatment system.

Stormwater runoff from approximately 3 acres of the P3 site will be managed and reused, to the extent possible, to offset potable water use and reduce stormwater discharge. Preliminary calculations (see AFC Appendix A-7) indicate that the North and South Basins could contain the stormwater runoff from the entire site for a 2-year, 24-hour storm event (approximately 2.5 acre-feet). The amount of stormwater to be collected from the P3 site for reuse on an annual basis will depend on the timing, the amount of rainfall, and the operation of the basins; the preliminary estimate, based on annual rainfall, suggests that up to 80,000 gallons could be collected for reuse annually.

Operation of P3 is not dependent on the ability to discharge; because P3 has onsite storage, it can operate without needing to discharge wastewater. As needed, NRG will continue its sand management outside the outfall riprap to enable discharge in accordance with NRG's NPDES permit.

References

LARWQCB (Los Angeles Regional Water Quality Control Board), 2015. CA0001180 Order No. R4-2015-0201. Waste Discharge Requirements for the NRG California South LLP Mandalay Generating Station. Available online at: http://www.waterboards.ca.gov/losangeles/board_decisions/adopted_orders/year.shtml.

DATA REQUEST

102. ***How many days during the 2015/16 winter season has the Mandalay Generating Station been unable to operate because the outfall and/or discharge channel was filled with sand? How many times has NRG removed sand from the channel or outfall in the past six months?***

RESPONSE

MGS has not experienced any restrictions or forced outages due to the outfall and/or discharge channel being temporarily obstructed by sand. In the past 6 months, sand removal has occurred on two occasions to restore flow connectivity to the ocean.

DATA REQUEST

103. ***What is the current physical condition of the Mandalay Generating Station outfall's concrete, revetment, and fencing? Is it scheduled for repair in the foreseeable future? How often and to what extent does the outfall need to be repaired and/or rebuilt?***

RESPONSE

The concrete outfall structure has some visible deterioration; however, the structure remains safe and functional. Over the past 30 years, the structure has undergone minor patch repairs and replacement of concrete. Only minor repairs on an as-needed basis have been made to the revetment and fencing. Major repairs to the outfall are not scheduled or anticipated for the foreseeable future. In general, the MGS outfall structure is observed weekly and inspected approximately every 5 years.

FIGURES

03/30/16 hk \\1578sr-w2kf03\gis\Graphics\NRG Puente Power Project\DataRequest\Figs_DR_Mar16.indd

LEGEND

Canal Profiles (see Figure 49-2)

#1

#2

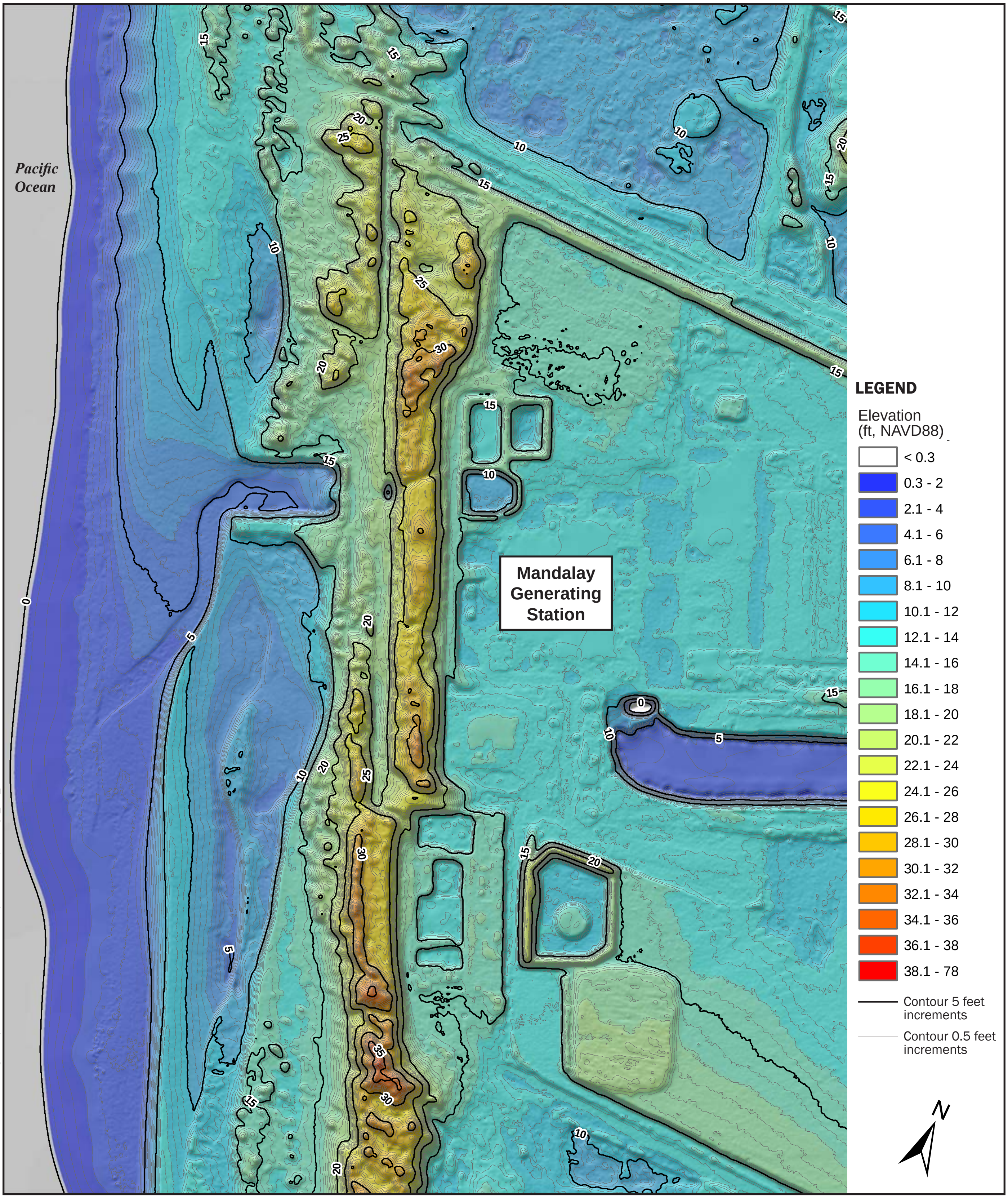
#3

CANAL SECTION LOCATIONS

NRG
Puente Power Project
Oxnard, California

April 2016

REVISED FIGURE 49-3



03/30/16 hk \\1578sr-w2kf03\gis\Graphics\NRG Puente Power Project\DataRequest\Figs_DR_Mar16.indd

TOPOGRAPHIC MAP OF MANDALAY BEACH

NRG
Puente Power Project
Oxnard, California

April 2016

REVISED FIGURE 54-2

04/06/16 hk \\1578sr-w2kf03\gis\Graphics\NRG Puente Power Project\DataRequest\DR_98_apr16\Figs_DR_98_Apr16.indd

Source: EDR, January 22, 2015. The EDR Aerial Photo Decade Package. (see AFC, Appendix N-2)

ANNOTATED AERIAL PHOTOGRAPH, 2012

NRG
Puente Power Project
Oxnard, California

April 2016

FIGURE 98-1

04/06/16 hk \\1578sr-w2kf03\gis\Graphics\NRG Puente Power Project\DataRequest\DR_98_apr16\Figs_DR_98_Apr16.indd

Source: Channel Islands Regional GIS Collaborative http://www.esri.com/metadata/esriprofy80.html.

ANNOTATED AERIAL PHOTOGRAPH
APRIL 19, 2013

NRG
Puente Power Project
Oxnard, California

April 2016

FIGURE 98-2

04/06/16 hk \\1578sr-w2kf03\gis\Graphics\NRG Puente Power Project\DataRequest\DR_98_apr16\Figs_DR_98_Apr16.indd

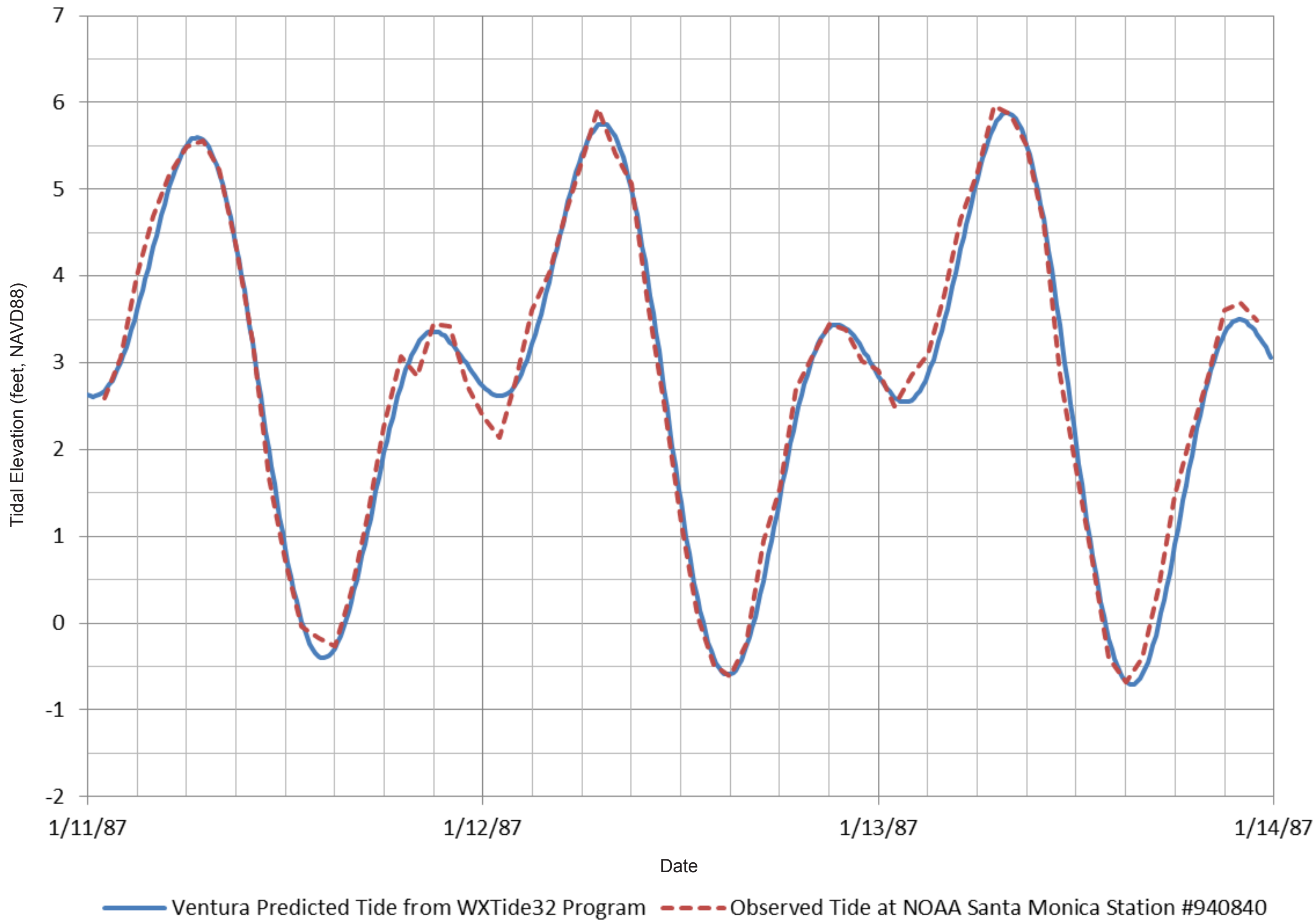
Source: Focal Flight, 2014.

ANNOTATED AERIAL PHOTOGRAPH
JANUARY 14, 2014

NRG
Puente Power Project
Oxnard, California

April 2016

FIGURE 98-3



Notes:
1. Predicted tidal elevation at Ventura based on the WXTide32 program.
2. Observed tidal elevation from the NOAA Santa Monica Tide Station #940840.

COMPARISON BETWEEN PREDICTED AND OBSERVED TIDAL ELEVATIONS

NRG
Puente Power Project
Oxnard, California

April 2016

FIGURE 99-1

APPENDICES

APPENDIX 95-1
CHANNEL ISLANDS HARBOR DREDGING CORRESPONDENCE

Bayer, Kelly

From: Ryan, Joseph A SPL <Joseph.A.Ryan@usace.army.mil>
Sent: Monday, March 21, 2016 1:38 PM
To: Bayer, Kelly
Cc: Cole, Jeffrey C SPL
Subject: FW: Dredging records for Channel Harbor Islands
Attachments: Table 83_1.docx; Channel Is. & Hueneme Dredging History 1960-2015.pdf

Kelly,

See attached Channel Islands Harbor dredge history.

Joe Ryan
Corps of Engineers – Los Angeles District.
Coastal Engineering Section.
(213) 452-3679
joseph.a.ryan@usace.army.mil

From: Bayer, Kelly [mailto:kelly.bayer@aecom.com]
Sent: Monday, March 21, 2016 1:07 PM
To: Cole, Jeffrey C SPL <Jeffrey.C.Cole@usace.army.mil>; Ryan, Joseph A SPL <Joseph.A.Ryan@usace.army.mil>
Subject: [EXTERNAL] Dredging records for Channel Harbor Islands

Jeff and Joe,

I previously contacted you regarding dredge volume records for Ventura Harbor. Similarly, I am looking for dredge volume data for Channels Harbor Islands. We were able to obtain some information from other sources (see center column in attached table). Would you be able to provide volumes for any year the Channels Harbor Islands was dredged where we don't presently have a volume in the table (since 2005)?

Please feel free to call if you have any questions.

Kelly Bayer
Senior Environmental Planner
AECOM *(URS Corporation is now part of AECOM)*
Post Montgomery Center
One Montgomery Street, Suite 900
San Francisco, CA 94104
Main: (415) 896-5858
Direct: (415) 243-3840
kelly.bayer@aecom.com

16-Mar-15

DRAFT

Joe Ryan (213) 452-3679

Corps of Engineers - Los Angeles District

Channel Islands Harbor Dredging History 1990 - 2015

	Start	End	Pay Volume Dredged cubic yards	Volume Placed at Hueneme Beach (cubic yards)		Contractor	Notes
16	Jan-91	Mar-91	1,430,000	1,230,000	*	Western Pacific Dredging	
17	Dec-92	Feb-93	1,112,000	910,000	*	Maintenance - Manson	
18	Sep-94	Nov-94	875,000	675,000	*	Maintenance - Manson	First Cycle
19	Sep-96	Nov-96	1,338,000	1,140,000	*	Maintenance - Manson	Second Cycle
20	Jan-98	Apr-98	1,609,000	1,400,000	*	Emergency Dredging - Manson	Out of Cycle
21	Dec-98	Mar-99	1,117,000	920,000	*	Maintenance - Manson	Third Cycle
22	Oct-00	Nov-00	1,236,000	986,000		Maintenance - Manson	First Cycle
23	Sep-02	Nov-02	2,062,000	1,915,000		Maintenance - Manson	Second Cycle
24	Oct-04	Dec-04	2,141,000	1,910,000		Maintenance - Manson	Third Cycle
25	Dec-06	Jan-07	1,171,000	1,171,000		Maintenance - Manson	First Cycle
26	Sep-08	Feb-09	2,198,000	2,000,000		Maintenance - Manson	Second Cycle
27	Dec-10	Jan-11	969,000	732,000		Maintenance - Manson	Third Cycle
28	Jan-13	Feb-13	600,000	400,000		Maintenance - Manson	First Cycle
29	Oct-14	Jan-15	2,369,000	2,170,000		Maintenance - Manson	Second Cycle
		TOTAL	**20,227,000**	**17,559,000**			

Port Hueneme Harbor Dredging History 1990 - 2013

Start	End	Volume Dredged (cubic yards)	Volume Placed at Hueneme Beach (cubic yards)	Contractor	Area Dredged
Nov-90	*Jan-91*	*200,000*	*200,000*	*Western Pacific Dredging*	*Port Hueneme Channel*
Feb-99	*Mar-99*	*68,000*	*68,000*	*Maintenance - Manson*	*Port Hueneme Channel*
Dec-04	*Dec-04*	*27,500*	*27,500*	*Maintenance - Manson*	*Port Hueneme Channel*
Dec-08 to June -09		*687,000*	*818,000*	*Manson*	*CAD Area*
		288,000			*Contaminated Areas*
		131,000			*Entrance Channel*

Notes:

1. Since 1992, Manson Construction has performed all of the maintenance dredging at Channel Islands and Port Hueneme.
2. Since 1994, the maintenance dredging contracts have been for 3 dredge cycles.
3. Dec 2008 to June 2009 was the Port Hueneme Maintenance Dredging & Confined Aquatic Disposal project. The 687,000 cubic yards of CAD material was placed on Hueneme Beach. CAD = Confined Aquatic Disposal
4. Material dredged from Channel Islands Harbor that is not placed at Hueneme Beach is placed at Silver Strand Beach.
5. 1991 to 1999, it was assumed that 200,000 cy placed at Silver Strand for each dredge event, and remainder placed on Hueneme.

APPENDIX 97-1
CALCULATION OF DUNE EROSION

Appendix 97-1
Calculation of Dune Erosion

The response to City of Oxnard Data Request 93 provides details on the calculations of runup using the method described in Komar et al. (1999). Below is a more detailed explanation of the calculations. As described in Applicant's responses to City of Oxnard Data Requests 54 and 93, the Monte Carlo method was used to estimate the probability of erosion of the dunes. Though average or frequent occurrences can be estimated with a relatively small number of simulations (e.g., several hundred) the probability of extreme events occurring requires a larger number of simulations (e.g., extreme large wave with long period occurs during an extreme tide). Eleven thousand Monte Carlo runs were performed to estimate the probability of different levels of erosion. Table 97-1 provides the first 40-values generated by the Monte Carlo analysis. These are representative of the type of inputs generated by the Monte Carlo method and show how the calculation was conducted. Following is an explanation of the calculation used for each column in Table 97-1.

Column 1: Random number between 0 and 1 representing the probability, P, of extreme tidal elevation being equaled or exceeded.

Column 2: Extreme tidal elevation associated with probability generated in Column 1. Extreme tidal elevation was calculated using a rearranged probability equation provided in the response to Data Request 93. The rearranged equation solving for tide and wave period is:

$$\text{Tide or wave period} = \mu + \sigma((-\ln(P))^{-\xi}-1)/\xi$$

Since wave height is a zero value for the shape parameter the equation is slightly different:

$$\text{Wave height} = \mu - \sigma\ln(-\ln(P))$$

The parameters used in these equations are listed in Table 97-2, and were developed based on data collected at the Santa Barbara tide gage for tide and Seymour (1996) for wave height and period. Figure 97-1 shows the probability distribution for extreme tidal elevation based on data collected at the Santa Barbara tide gage. Return periods for various extreme tidal elevations were previously provided in Figure 47-1 in response to Data Request 47. Note: A different probability was used for tidal elevation, wave height and wave period, as the data indicated that extreme values for these parameters are independent.

Column 3: Random number between 0 and 1 representing the probability, P, of extreme wave height being equaled or exceeded.

Column 4: Extreme wave height associated with probability generated in Column 3. Wave height was calculated using the rearranged expression of the probability equation, as shown in the equation provided for Column 2. Figure 47-2 shows the probability distribution for extreme wave height. Parameters of the distribution are provided in Table 97-2.

Column 5: Random number between 0 and 1 representing the probability, P, of extreme wave period being equaled or exceeded.

Column 6: Extreme wave period associated with probability in column 5. Wave period was calculated using a rearranged expression of the probability equation, as shown in the equation for Column 2. Figure 97-2 shows the probability distribution for extreme wave period. Parameters of the distribution are provided in Table 97-2.

Column 7: Calculation of wave length using column 6 and the relationship under Step 5 in response to Data Request 93.

Columns 8 and 9: The wave runup was calculated using the relationships provided under Step 6 in the response to Data Request 93. An average slope of 0.024 was used to calculate wave runup. This is the average of Profiles 1 through 5 for the profiles provided in Figures 87-1 through 87-6 (see response to Data Request 87).

Column 10: The total water level is the tidal elevation plus the wave runup (Column 2 plus Column 8).

Column 11: Probability of the extreme tide, wave height, and wave period all occurring in the same year. It was calculated as (1- Column 1)*(1- Column 3)*(1-Column 5). This calculation is conservative, as the probability of the extreme tide, wave and period occurring at the same time would be much lower. Even if the extreme tide and extreme wave or period were to occur only 6 hours apart, the runup would be much less than predicted in Table 97-1.

Column 12: Annual return period for the probability in Column 11, equal to the inverse of the probability listed in Column 11.

Columns 13-18: Calculation of dune erosion using the Komar method, which is described in response to Data Request 54 and shown in Figure 54-1. Below the column number is the slope of the line used in the calculation and the assumed elevation of the toe of the dune. The Komar method is very sensitive to the elevation of the toe of the dune. For the calculations shown in Table 97-1 the lowest possible elevation for the toe was assumed. This results in the maximum erosion estimate (often more than is physically possible). If the actual elevation of the toe of the main dune body is used (about elevation 17 to 19 feet), the calculated erosion rate will be less than 20 feet for return periods less than 100 years. Erosion rates greater than 100 feet would be associated with return periods of many thousands of years. This is consistent with what has been observed, that is, there has been no noticeable erosion of the dunes in the 60 years of plant operation. In fact, the dunes have expanded during the period of plant operation.

Column 19: Average erosion rates for Profiles 3 through 5 (see response to City of Oxnard Data Request 87). These are the profiles located along the Mandalay Generating Station (MGS) property.

Column 20: Average erosion rates for all Profiles (profiles 1 through 6).

References

Komar, P.D., W. McDougal, J.J. Marra, and P. Ruggiero, 1999. The Rational Analysis of Setback Distances: Applications to the Oregon Coast. Shore & Beach Vol. 67, No. 1, pp. 41 49. January. Available online (for purchase) at: http://www.researchgate.net/publication/257921997_The_Rational_Analysis_of_Setback_Distances_Applications_to_the_Oregon_Coast

Seymour, R., 1996. Wave Climate Variability in Southern California. Journal of Waterway, Ports, Coastal and Ocean Engineering. July/August. pp: 182-186. Available online at: http://ascelibrary.org/doi/10.1061/%28ASCE%290733-950X%281996%29122%3A4%28182%29

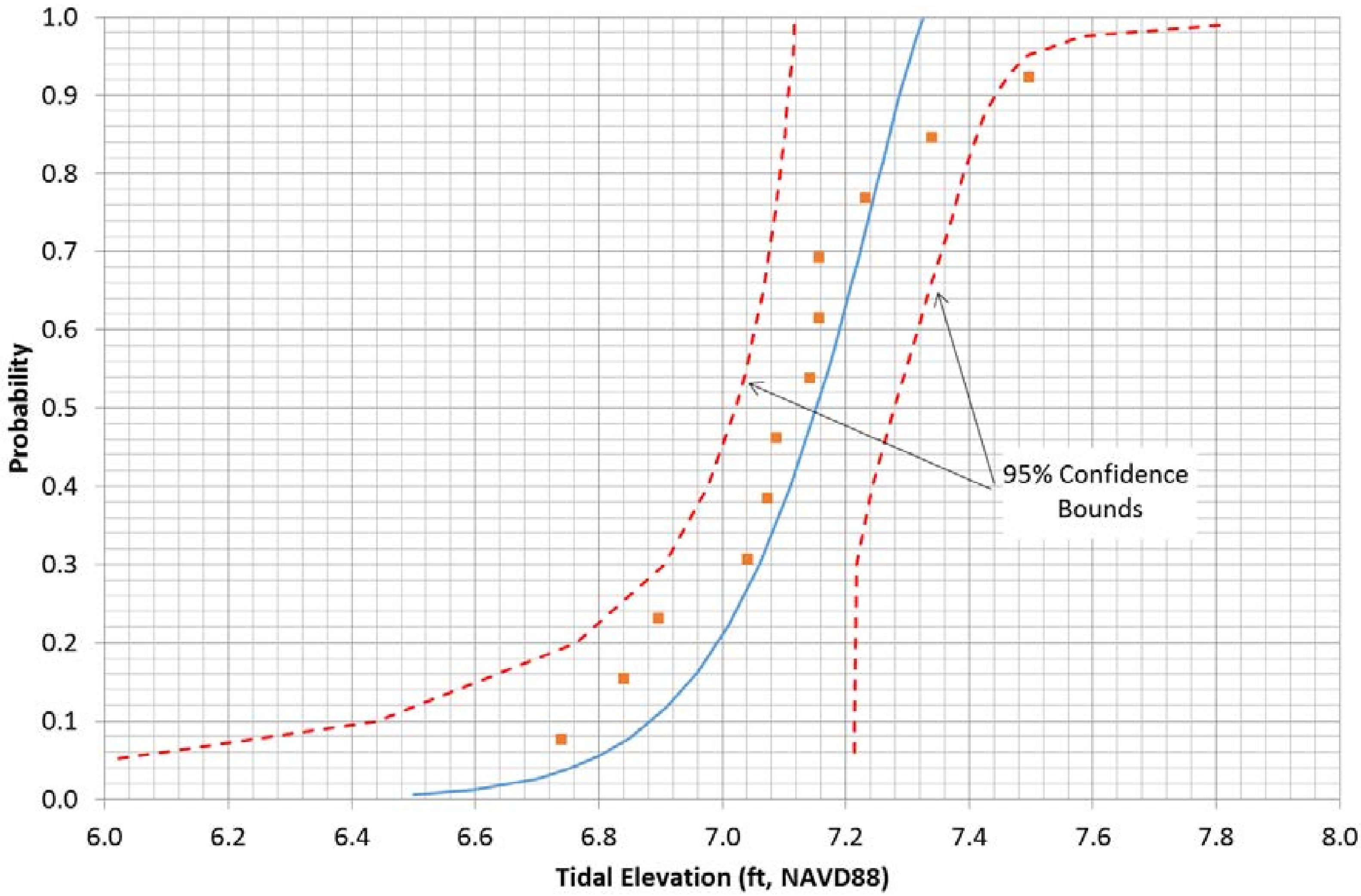
Table 97-1 Calculation of Dune Erosion based on Method from Komar (1999)

Tide Elevation		Height		Period			slope 0.024				Slope= Toe Elevation=	Dune Erosion using Method of Komar 0.025 15	0.014 8	0.019 10.5	0.026 15	0.031 17.5	0.063 12		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(13)	(15)	(16)	(17)	(18)	(19)	(20)
Random Prob (0<P<1)	Tide (ft) (from probability distribution in Figure 97-1)	Random Prob (0<P<1)	Random Wave Height (m) (from GEV probability distribution in Figure 47-2)	Random Prob (0<P<1)	Wave Period (s) (from probability distribution in Figure 97-2)	Wave Length (m)	R2% (m)	Stockton	Total Water Level (ft)	prob <	RP	Profile 1	Profile 2	Profile 3	Profile 4	Profile 5	Profile 6	average (Profiles 3,4 & 5)	average (Profiles 1-6)
0.5	7.15	0.85	7.3	0.95	22.10	762	3.31	3.50	18.01	0.0038	267	120	715	395	116	16	95	175.8	243.0
0.034	6.74	0.18	5.04	0.54	18.43	530	2.29	2.43	14.26	0.3634	3	0	447	198	0	0	36	65.9	113.4
0.396	7.11	0.53	5.99	0.89	21.13	697	2.87	3.03	16.51	0.0320	31	61	608	317	58	0	72	124.9	185.8
0.861	7.27	0.96	8.65	0.46	17.97	504	2.93	3.10	16.88	0.0032	316	75	634	336	72	0	77	136.1	199.2
0.943	7.30	0.09	4.71	0.21	16.30	415	1.96	2.07	13.73	0.0409	24	0	410	170	0	0	28	56.7	101.2
0.953	7.31	0.61	6.27	0.75	19.83	614	2.75	2.91	16.33	0.0046	220	53	595	307	51	0	69	119.4	179.2
0.775	7.25	0.92	7.95	0.54	18.46	532	2.89	3.05	16.71	0.0086	116	69	622	327	66	0	75	131.0	193.1
0.099	6.88	0.01	3.95	0.66	19.21	576	2.12	2.24	13.83	0.3027	3	0	416	175	0	0	29	58.4	103.4
0.835	7.27	0.03	4.37	0.36	17.35	470	2.01	2.12	13.86	0.1016	10	0	418	177	0	0	29	58.9	104.1
0.050	6.79	0.62	6.29	0.42	17.68	488	2.46	2.60	14.85	0.2095	5	0	490	229	0	0	45	76.4	127.3
0.229	7.01	0.71	6.59	0.33	17.13	458	2.44	2.58	15.02	0.1527	7	1	501	238	1	0	48	79.4	131.3
0.911	7.29	0.32	5.43	0.79	20.15	634	2.60	2.75	15.83	0.0128	78	33	559	280	32	0	61	104.0	160.8
0.206	7.00	0.01	4.07	0.46	17.98	505	2.01	2.13	13.59	0.4204	2	0	400	163	0	0	25	54.3	97.9
0.629	7.20	0.32	5.43	0.70	19.47	592	2.52	2.66	15.45	0.0753	13	18	532	261	17	0	55	92.7	147.3
0.988	7.32	0.83	7.21	0.64	19.07	568	2.84	3.00	16.63	0.0007	1361	65	616	323	63	0	73	128.4	190.0
0.021	6.67	0.94	8.27	0.30	16.95	448	2.70	2.86	15.53	0.0422	24	21	538	265	21	0	56	95.1	150.2
0.815	7.26	0.32	5.43	0.77	19.97	623	2.58	2.73	15.73	0.0291	34	29	552	275	28	0	59	101.0	157.2
0.615	7.19	0.91	7.90	0.63	19.02	565	2.96	3.13	16.92	0.0125	80	77	637	338	74	0	78	137.2	200.5
0.248	7.03	0.46	5.80	0.66	19.18	574	2.56	2.71	15.43	0.1391	7	17	531	260	17	0	54	92.0	146.4
0.667	7.21	0.060	4.54	0.95	22.06	760	2.61	2.76	15.76	0.0162	62	30	554	277	29	0	60	102.0	158.4
0.214	7.00	0.66	6.41	0.56	18.55	537	2.60	2.75	15.54	0.1193	8	22	539	265	21	0	56	95.4	150.5
0.229	7.02	0.32	5.43	0.77	20.01	625	2.58	2.73	15.49	0.1193	8	20	535	263	19	0	55	93.9	148.6
0.974	7.31	0.42	5.69	1.00	23.87	890	3.16	3.34	17.67	0.0001	13443	107	691	377	103	5	90	161.7	228.7
0.781	7.25	0.81	7.08	0.30	16.93	447	2.50	2.64	15.44	0.0295	34	18	531	260	17	0	55	92.3	146.8
0.791	7.25	0.42	5.69	0.47	17.99	506	2.38	2.52	15.06	0.0649	15	2	504	240	2	0	49	80.7	132.9
0.349	7.09	0.12	4.82	0.27	16.75	438	2.04	2.16	13.78	0.4169	2	0	413	172	0	0	28	57.5	102.2
0.598	7.19	0.06	4.54	0.78	20.10	630	2.37	2.51	14.97	0.0819	12	0	498	235	0	0	47	78.5	130.1
0.396	7.11	0.48	5.86	0.67	19.29	581	2.59	2.74	15.60	0.1023	10	24	543	269	23	0	57	97.2	152.6
0.004	6.47	0.46	5.82	0.59	18.73	547	2.50	2.65	14.68	0.2210	5	0	477	220	0	0	42	73.3	123.2
0.897	7.29	0.25	5.23	0.92	21.58	727	2.74	2.89	16.26	0.0061	163	50	590	303	48	0	68	117.1	176.5
0.208	7.00	0.97	8.86	0.08	14.96	349	2.47	2.61	15.09	0.0252	40	4	507	242	4	0	49	81.7	134.1
0.044	6.77	0.92	8.07	0.11	15.31	366	2.41	2.55	14.68	0.0641	16	0	477	220	0	0	43	73.3	123.3
0.921	7.29	0.37	5.57	0.41	17.62	485	2.31	2.44	14.86	0.0294	34	0	490	229	0	0	45	76.4	127.4
0.729	7.23	0.08	4.66	0.32	17.06	455	2.04	2.16	13.93	0.1698	6	0	424	181	0	0	31	60.2	105.8
0.254	7.03	0.02	4.18	0.84	20.64	665	2.34	2.47	14.71	0.1142	9	0	479	221	0	0	43	73.8	123.9
0.539	7.17	0.99	10.71	0.14	15.70	385	2.85	3.01	16.51	0.0021	474	60	608	316	58	0	72	124.9	185.8
0.350	7.09	0.83	7.19	0.22	16.39	420	2.44	2.58	15.08	0.0876	11	3	506	241	3	0	49	81.4	133.7
0.994	7.32	0.81	7.07	0.59	18.72	547	2.76	2.92	16.37	0.0004	2234	55	598	309	53	0	69	120.6	180.7
0.872	7.28	0.86	7.42	0.53	18.39	528	2.78	2.94	16.38	0.0084	119	55	599	310	53	0	70	121.0	181.1
0.057	6.81	0.31	5.40	0.01	13.00	264	1.67	1.77	12.30	0.6451	2	0	307	95	0	0	5	31.6	67.7

Table 97-2
Parameters used in the GEV Distributions[1]

Parameter	Location (μ)	Scale (σ)	Shape (ξ)
Tide	7.096	0.179	-0.772
Wave Height	5.558	0.985	0.000
Wave Period	17.389	2.311	-0.272

Notes:
1. See response to City of Oxnard Data Request 93 for relationship between parameters.



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Note:
Probability distribution for annual maximum tide based on tide data measured at Santa Barbara

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FIGURE 97-1

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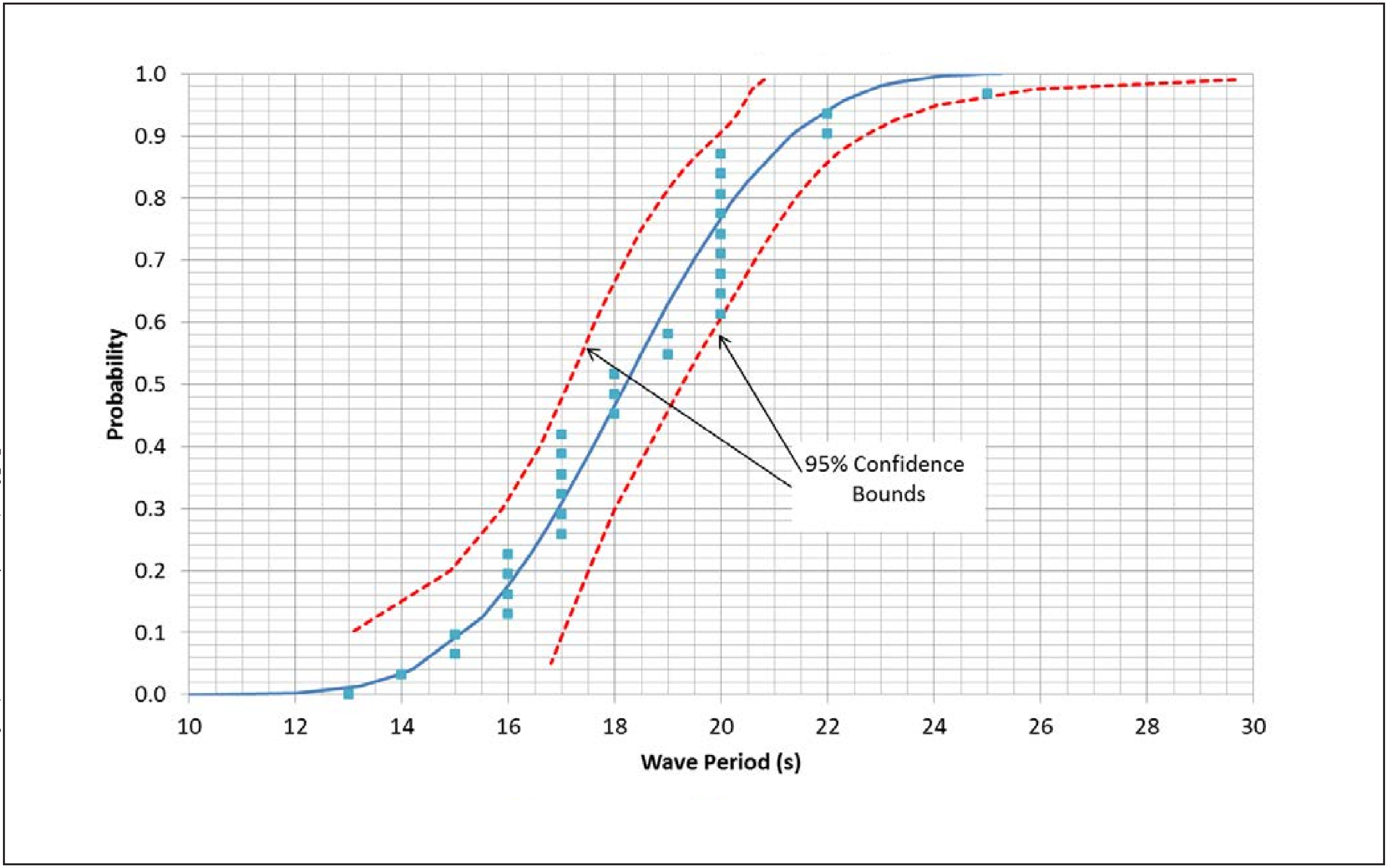

Note:
Probability distribution for annual maximum wave period based on wave data found in Seymour (1996)

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FIGURE 97-2