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Application for Certification
(15-AFC-01)

Puente Power Project (P3)
Oxnard, CA

Responses to City of Oxnard Data Requests Set 2 (47-67)

October 2015

Submitted to:
The California Energy Commission

Prepared by: AECOM

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RESPONSES TO CITY OF OXNARD DATA REQUESTS SET 2

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APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS USED IN RESPONSES

AFC	Application for Certification
CalEMA	California Emergency Management Agency
CCC	California Coastal Commission
CGS	California Geological Survey
FEMA	Federal Emergency Management Agency
GEV	generalized extreme value
LiDAR	Light Detection and Ranging
m^3	cubic meters
mg/L	milligrams per liter
MGS	Mandalay Generating Station
MHW	mean high water
MHHW	mean higher high water
MLLW	mean lower low water
mm/year	millimeters per year
msl	mean sea level
NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
P3	Puente Power Project
ppm	parts per million
SLR	sea-level rise
USACE	United States Army Corps of Engineers

On September 17, 2015, Applicant indicated that additional time was required to respond to City of Oxnard Data Request Nos. 59, 60, and 62. The outcome of analysis that is currently under way in order to respond to those Data Requests may in certain instances alter responses provided below on related issues. Applicant therefore reserves the right to modify the responses provided herein to the extent warranted by additional analysis currently under way.

Technical Area: Environmental Hazards

BACKGROUND: SEA-LEVEL RISE

The AFC evaluated the impact of sea level rise risk on the Project in Appendix N-2. The analysis considers combined effects of sea level rise risk and other sources of flooding that may occur simultaneously, including tidal flooding, wave and storm surge flooding, riverine inundation, dune erosion, and tsunami inundation. The impacts are concluded to not be significant and no mitigation is proposed. In contrast, the Preliminary Geotechnical Evaluation, AFC, Appendix A-9, recommends mitigation. AFC, Appendix A-9, p. 16.

The sea level risk analysis fails to consider the impact of simultaneous tsunami, wave and storm surge flooding, and riverine inundation. Without reporting any cumulative analysis, the AFC concludes: "The combined effects of SLR, potential erosion of the berm, wave events, and storm surge run-up that could occur during the life of the project through planning horizon 2050 are not expected to adversely impact the project." AFC, Appendix N-2, p. 6.

DATA REQUEST

47. Please revise the sea level rise analysis in Appendix N-2 to include the cumulative effect of a tsunami, wave and storm surge flooding, dune erosion, and riverine inundation. Your analysis should report the cumulative rise in feet above mean sea level for the combined impact.

RESPONSE

As requested, the cumulative effect of multiple potential sources of flooding was analyzed as described below. It should be noted that the cumulative effect, reported as the cumulative rise in feet above mean sea level (MSL), although not impossible to occur over the life of the project (conservatively assumed to be from 2020 through 2050), is extremely unlikely. It is also worth noting that the cumulative effect as defined in Data Request 47 is different, and more conservative than the combined flood hazard zones described in the *Coastal Resilience Study Ventura* developed for the Nature Conservancy (ESA-PWA, 2013). The *Coastal Resilience Study Ventura* report, which is not intended for project-level analysis, shows areas that are subject to each of these hazards, but not necessarily simultaneously. Although the combined hazard zones provide information on the possible hazards that could occur at a site, which may be considered useful for planning purposes, this type of analysis does not take into account the probability of simultaneously occurring events. However, cumulative effect implies both possibility and probability; therefore, both need to be considered as part of the analysis. Lastly, the cumulative effect of multiple hazards exceeds the normal practice for design standards for power plants that would normally be designed for a 100-year to 500-year standard.

As requested, the Applicant has evaluated the combined effects of the following events:

- tsunami
- wave and storm surge
- dune erosion
- riverine inundation
- sea level rise (SLR)

All elevations unless otherwise noted are relative to the North American Vertical Datum of 1988 (NAVD88) datum. To adjust elevations to MSL, subtract 2.415 feet from the NAVD88 elevation (i.e., El NAVD88- 2.415 = El MSL).

Tsunami

This section provides a brief summary of tsunamis. More details will be provided in the responses to Data Requests 59, 60, and 62.

As shown on AFC Figure 4.4-4, the proposed project site is not included in the inundation area shown on the existing *Tsunami Inundation Map for Emergency Planning* (CalEMA, 2009), implying that the site is not in danger of significant inundation from tsunamis, based on information available at the time the map was created. The inundation area on the map represents inundation from combining inundation results for an ensemble of source events affecting the Ventura County coastline, including the Goleta Landslide–generated tsunami. The source events used to develop the map are listed on the map (see Attachment 2 in AFC Appendix N-2).

One of the major sources of inundation shown on this map is from the Goleta Landslide. The maximum onshore run-up elevation associated with a tsunami reported in the California Geological Survey Special Report 236 (CGS, 2014) for Oxnard is 10 feet (no datum is given). The *2009 Tsunami Inundation Map* used topographic data adjusted to Mean High Water (MHW). At the Santa Barbara tide gage, MHW is 4.51 feet above NAVD88. At the Santa Monica tide gage, MHW is 4.5 feet above NAVD88. Therefore, the maximum run-up at Oxnard near the project site would be approximately 14.5 feet NAVD88 (run-up of 10 feet plus MHW of 4.5 feet) assuming the tsunami occurs at high tide. At Santa Barbara, the difference between MHW and mean low water (MLW) is 3.7 feet. Therefore, if the tsunami occurs at MHW, the run-up elevation would be approximately 14.5 feet; and if it occurs at MLW, the run-up elevation would be approximately 10.8 feet. It was assumed that there would be a 50 percent chance that the tsunami would occur at high water; and a 50 percent chance that it would occur during low water. The CGS (2014) report emphasizes the importance of tidal conditions during the tsunami, especially during the first 5 hours. As reported by CGS, "*during the 2010 and 2011 tsunamis in California, the first five hours after the initial wave arrival were the most important for capturing the highest actual tsunami amplitude for most locations in California. During both tsunamis, inundation of dry land was essentially nonexistent in the state because this peak tsunami activity occurred in conjunction with low-tide conditions.*"

The likelihood of tsunamis affecting the Ventura Coast is extremely remote. The return period for the Goleta Landslide tsunami is estimated to be approximately 10,000 to 15,000 years (the equivalent annual probability[1] is 0.0001 to 0.00007) (Lee et al., 2004). Recent analysis (e.g.,

1 The annual probability is the probability of the event occurring in any given year. An annual probability of 0.01 has a 1% chance of occurring in any year or on average once in 100 years (1 divided by 0.01). An annual probability of 0.0001 has a 0.01% chance of occurring in any year or on average once every 1/0.0001 years or 10,000 years.

Ryan et al., 2015) indicates that the project site might be in the tsunami inundation area for more frequent, although still infrequent, local earthquakes. One of the more recently identified local sources of tsunamis is the Ventura-Pitas Point fault and adjacent structures system. A tsunami due to a large earthquake on this fault system could potentially cause inundation of the project site. Return periods for a large earthquake on this system are estimated to be between 400 and 2,600 years (0.0025 to 0.00038 annual probability) (Hubbard et al., 2014). The depth of inundation will be discussed in more detail in the responses to Data Requests 59, 60, and 62.

On September 16, 2015, a tsunami was generated by a powerful earthquake that occurred off the coast of central Chile. According to the United States Geological Survey (USGS), the quake registered Magnitude 8.3. Tsunami advisories were issued for parts of Southern California, including the Ventura Coast. Waves up to 13 inches reached Ventura Harbor by the following morning. No damage or impacts along the California coast were reported (Accuweather, 2015). No damage or impacts to the beach or dunes in front of Mandalay Generating Station (MGS) were observed.

Over the more than 60 years that the MGS has been in operation, there have been no impacts or damage to the dunes from tsunamis.

Wave and Storm Surge

Waves and storm surge could potentially cause flooding at the project site if the combination of storm surge and the waves were large enough to completely erode the dunes, which is highly unlikely.

Over the more than 60 years that the MGS has been in operation, there have been no impacts or damage to the dunes from waves or storm surges.

Storm Surge and Tides

Data on extreme water levels were reviewed. Table 47-1 lists the available extreme observed water levels for Port San Luis, north of Oxnard; and at Santa Monica, south of Oxnard. Data on extreme water levels were not available for the Santa Barbara gage. The maximum recorded surge varied from 0.62 foot (7.4 inches) to 1.54 feet (18.5 inches), with an average of 1.1 feet. However, the storm surge at the peak tidal elevation is usually less than the maximum storm surge, because the peak surge typically does not occur at the peak water level. The storm surge at the peak tidal elevation varied from 0.25 foot (3 inches) to 1.14 feet (13.7 inches), with an average of 0.65 foot (7.8 inches).

Twelve years of tide data are available from the Santa Barbara tide gage. These data were fit to the generalized extreme value (GEV) probability distribution, which provides a probability associated with extreme water levels that include storm surge. Figure 47-1 shows the probability distribution for the data. Because only limited data were available for Santa Barbara, the National Oceanic and Atmospheric Administration (NOAA) report also included 2-year, 10-year, and 100-year water levels for Santa Monica, Port San Luis, Rincon Island, and Los Angeles on the graph. The upper 95 percent confidence bound is also provided from the Los Angeles data, because it has the longest period of record (90 years). The results show that the 100-year extreme tide level at the site is about 7.8 feet.

Table 47-1
Extreme Water Levels and Surge in and Near Ventura County

Station and Date	Maximum Predicted Water Level (feet)	Maximum Observed Water Level (feet)	Maximum Observed-Maximum Predicted (feet)	Maximum Storm Surge (feet)
Port San Luis (#9412110)				
January 1, 1948	6.83	7.32	0.49	0.66
December 9, 1969	6.71	7.32	0.61	1.54
January 8, 1970	6.84	7.32	0.48	1.04
November 29, 1970	6.20	7.02	0.82	1.20
January 18, 1973	6.70	7.57	0.87	0.96
January 8, 1974	6.85	7.10	0.25	0.62
January 9, 1978	6.69	7.39	0.70	0.87
January 27, 1983	6.81	7.95	1.14	1.54
August 8, 1983	6.86	7.34	0.48	0.87
January 10, 2005	6.97	7.59	0.62	1.38
Santa Monica (#9410840)				
January 10, 2005	6.92	7.66	0.74	0.95
Source: NOAA, 2015b Note: Elevations are referenced to NAVD88				

Waves

Seymour (1996) provides a list of extreme waves, greater than 4 meters in height, measured off the coast of Ventura County. The wave height and period from this data set were fit to the GEV distribution. A comparison between the wave height and period indicated no correlation between wave height and period for the large waves included in the Seymour dataset, indicating wave height and period are independent; therefore, each was fit to its own distribution. Figure 47-2 shows the probability distribution for wave height. The resulting probability distributions were used to generate a random set of wave run-up values using an average beach slope of 0.024. The average slope was estimated from five profiles cut along Mandalay Beach from the 2013 LiDAR data.

This 7.3-meter wave event occurred on January 27, 1983. It is one of the most damaging waves on record because of its height and long period. It caused damage to Oxnard Shores, but no recorded damage at the MGS facility. This El Niño storm, and other large storm events, have occurred in the past, and the resulting waves and storm surges have had no flood impact to MGS operations.

A review of Seymour 1996, cited as the source for the 7.3-meter (24-foot) significant wave height, shows the 7.3-meter 22-second significant wave to be the ninth highest wave recorded between 1900 and 1995 at Platform Harvest, west of Point Conception, and the second-longest period. The period is significant because wave energy, and therefore wave run-up, increases with period. Therefore, the 22-second period can be considered to be roughly analogous to the wave conditions expected during a 100-year event.

River Inundation

The current effective Federal Emergency Management Agency (FEMA) maps show the northern portion of the MGS property, where the proposed project will be sited, in a minimal flooding zone; and the remaining portion of the MGS property in the 0.2 percent annual floodplain (commonly referred to as the 500-year floodplain). Based on a detailed review of the FEMA flood map, it appears the 500-year floodplain is due to local flooding, and is not associated with the Santa Clara River floodplain. Therefore, no riverine water levels were considered (see Figure 47-3). The 1 percent annual chance flood is shown to be contained within the Edison Canal.

Sea-Level Rise

SLR impacts the average sea level at any given location. All predictions of the future are uncertain by definition; however, the mean of the sea-level predictions for the coast of California (relative to year 2000) is estimated to be 17.5 inches by 2030, and 55.9 inches by 2100 (NRC, 2012).

The National Research Council (NRC) report is consistent with, but broader than, the Intergovernmental Panel on Climate Change predictions (IPCC, 2013). The NRC report also provides the basis of the California Coastal Commission (CCC) SLR guidance policy (CCC, 2015).

AFC Appendix N-2 presented the SLR projections from the *Ventura County Resilience Study* (ESA-PWA, 2013). Predicted SLR, compared to year 2010, is estimated to range from 2.3 inches by year 2030 (low SLR scenario) to as much as 25.3 inches by year 2060 (high SLR scenario). These projections are similar to the results from NRC (2012), which projected SLR increase of 1.57 inches (low estimate) for the year 2030 to a high estimate for the year 2050 of 24 inches. Note that the Resilience Study and the NRC study have different base years: 2010 versus 2000.

A comparison between actual measured SLR was shown on AFC Appendix N-2, Figure 2, and the 2030 predictions illustrates the conservatism in the predictions. The 14-year record of actual SLR (based on Figure 2 and the 2000 to 2009 rate of 2.66 millimeters per year [mm/year]) is approximately 1.47 inches. Making a conservative assumption that the rate of SLR increases to three times the average twentieth-century rate (2.1 mm/year) to 6.3 mm/year for the next 16 years, the increment would only be 3.97 inches, for a total 2000 to 2030 rise of 5.4 inches. This is lower than the lower-bound of the NRC predictions.

Combined Inundation

Table 47-2 shows the water-surface elevation for selected return periods and annual probabilities for various inundation sources. This allows estimates of water levels for different combinations of inundation sources. For example, the maximum water level, assuming a

100-year tide with storm surge plus 100-year wave, is 17.91 feet, with a return period of 10,000 years (100 years times 100 years). For the case with a tsunami from the Goleta #2 landslide plus a 100-year extreme tide plus a 100-year high wave, the water level would be 32 feet, with a return period of 100 million years (10,000 ´ 100 ´ 100).

The data in the table can also be used to define a scenario with a given return period, and calculate the water level. Scenario examples with a 100-year return period could include:

- 50-year extreme tidal elevation with a 2-year wave height would have an estimated water level of 13.6 feet.
- 50-year wave height with a 2-year extreme tidal elevation would have an estimated water level of 16.68 feet.

Examples of inundation scenarios with a 500-year return period could include:

- 50-year extreme tidal elevation with a 10-year wave height would have an estimated water level of 15.4 feet.
- 50-year wave height with a 10-year extreme tidal elevation would have an estimated water level of 16.84 feet.

Note that the above return periods are based on annual probabilities, indicating the combined return period for the simultaneous occurrence within the same year, not necessarily the same day; therefore, they provide a conservative estimate of return period. Also, even if an extreme wave occurs, it is just as likely to occur during low tide as high tide, thereby reducing the predicted combined water level by several feet.

Table 47-2 also includes the calculated values of wave run up and maximum potential erosion (discussed in more detail under Applicant's response to DR 54) based on a monte carlo analysis of the probabilities of the input data shown in the table. This means that the values for run up and dune erosion for a given return period are not associated with the input values for that same return period. For example, the 10-year run up is not a function of the 10-year wave height and 10-year tidal elevation.

The wave run up scenarios for the 100-year and 500-year events would result in water levels well below the top of the beach dunes which are at approximately 20 to 35 feet. Therefore, the proposed project would not be impacted by a 100-year or 500-year flood event.

The 100-year flood event has a 1 percent chance of occurring in any given year and a 26 percent chance of occurring over the 30-year project life. The 500-year flood event has a 0.2 percent chance of occurring in any given year and 6 percent chance of occurring over the 30-year project life.

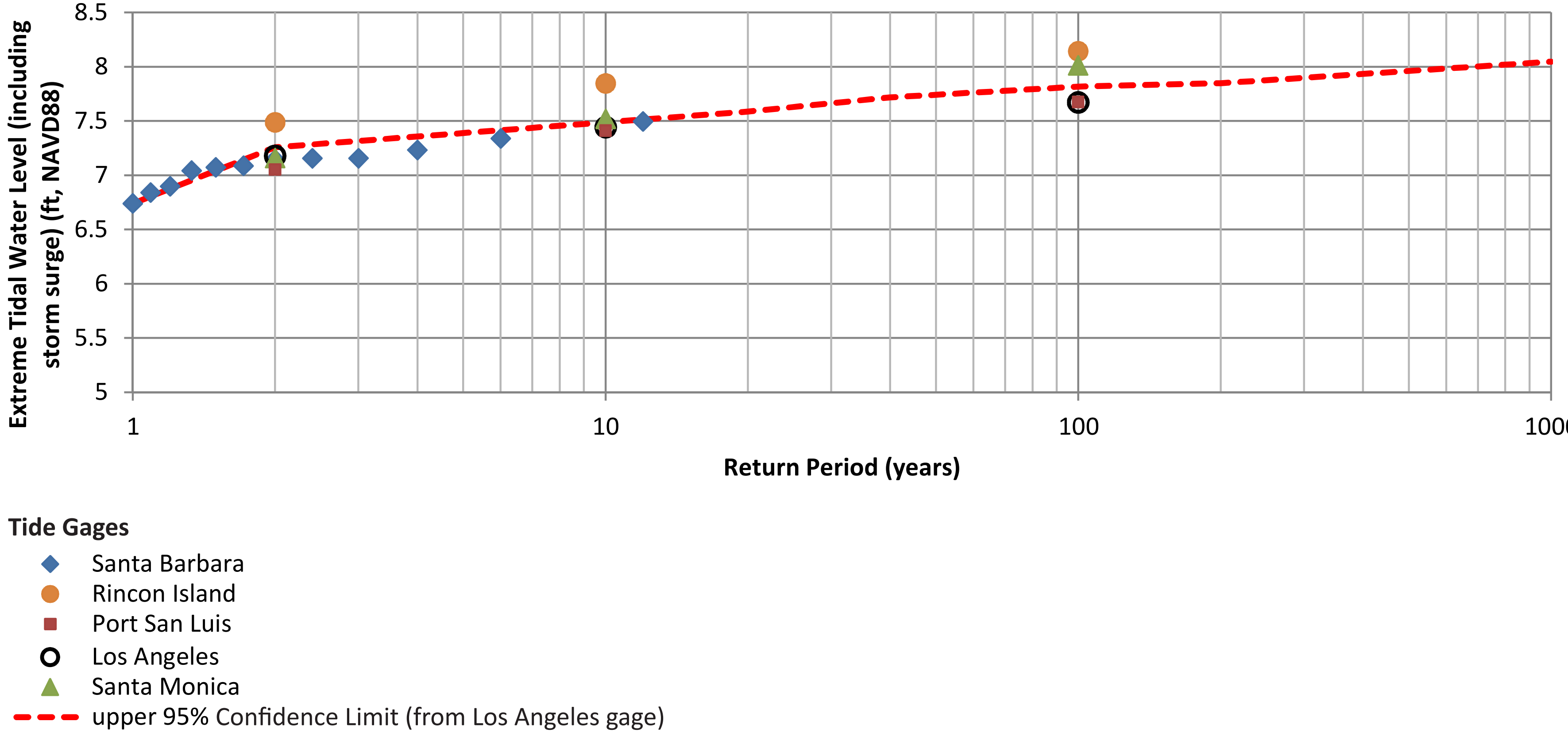
Any predictions of SLR beyond the next decade and beyond the "Low" or "Medium" projections are inherently very uncertain. Nevertheless, with the high-scenario SLR, the total water level (tide plus runup) elevations shown in Table 47-2 would be increased by approximately 2.8 feet (i.e., assuming approximately 24 inches of SLR by 2050).

Table 47-2
Cumulative Inundation Sources
at the P3 Site and Corresponding Annual Probabilities

		Input Values				Calculated Values	
Return Period (years)	**Annual Probability of Exceedance**	**Tsunami Water Surface Elevation[1] (feet)**	**Extreme Tidal Elevation (feet)**	**Wave Height (feet)**	**Wave Period (second)**	**Wave Run Up[2] (feet)**	**Maximum Potential Erosion[3] (feet)**
2	0.5	0	7.28	6	18.25	7.6	24.3
5	0.20	0	7.39	7.1	20.2	8.7	70.5
10	0.10	0	7.44	7.8	21.3	9.4	95.2
25	0.04	0	7.53	8.7	22.3	10.0	125
50	0.02	0	7.60	9.4	23.0	10.5	145
75	0.013	0	7.8	9.7	23.3	10.8	155
100	0.01	0	7.81	10.1	23.5	11.0	163
200	0.005	0	7.85	10.7	23.9	11.5	179
500	0.002	TBD	8.0	11.6	24.4	12.1	204
1,000	0.001	TBD	8.05	12.3	24.6	12.5	229
10,000	0.0001	14.5[1]	8.5	14.5	25.3	13.1	304

Notes:

1. Assumes the tsunami occurs at high tide.
2. Excludes tsunami.
3. Maximum potential erosion for annual probabilities shown in table based on Komar (1999) method to calculate dune erosion. See response to DR 54.



Source: NOAA, 2015.

PROBABILITY DISTRIBUTION FOR EXTREME TIDAL WATER LEVEL WITH STORM SURGE

NRG
Puente Power Project
Oxnard, California

October 2015

FIGURE 47-1

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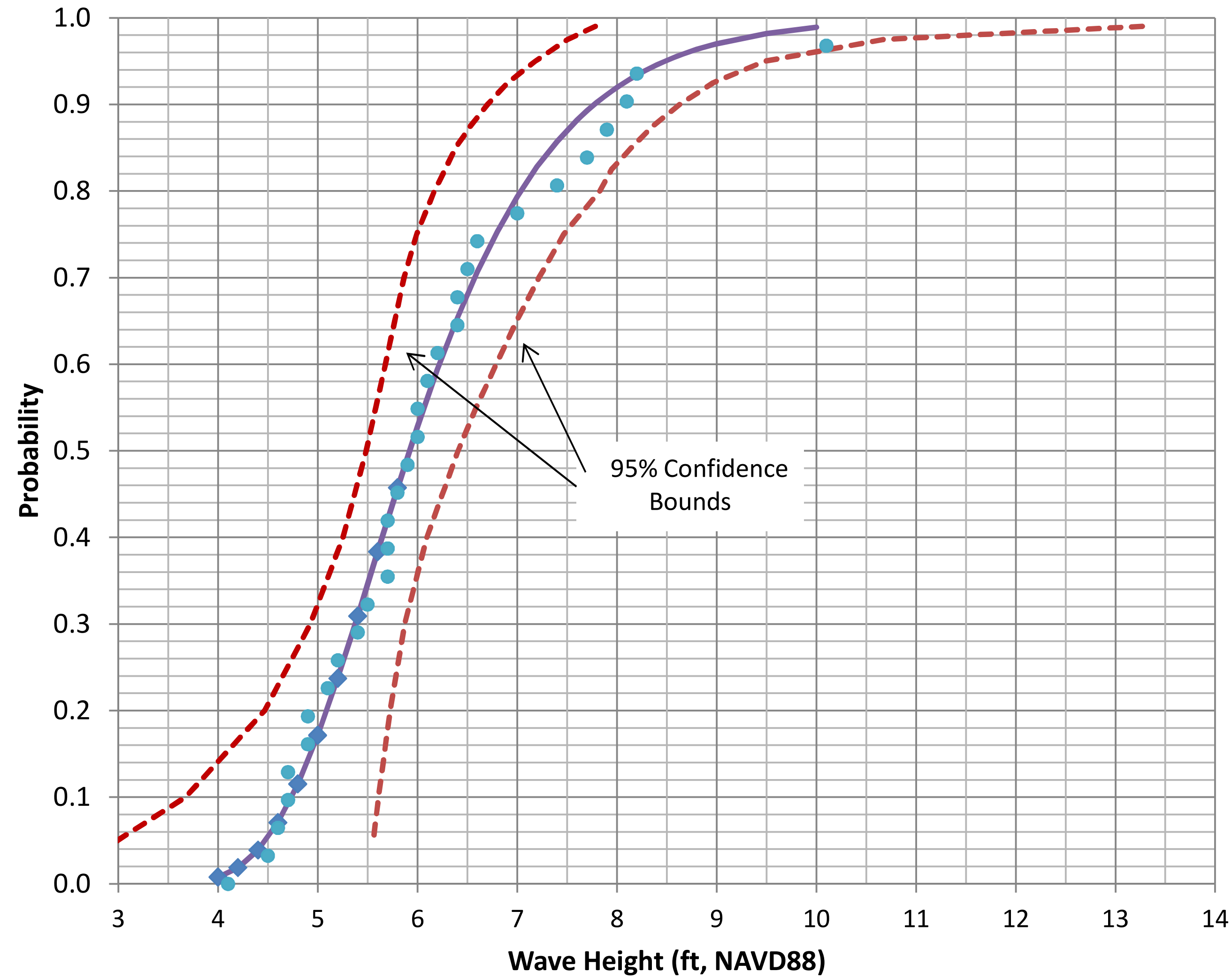


Source: Seymour, 1996.

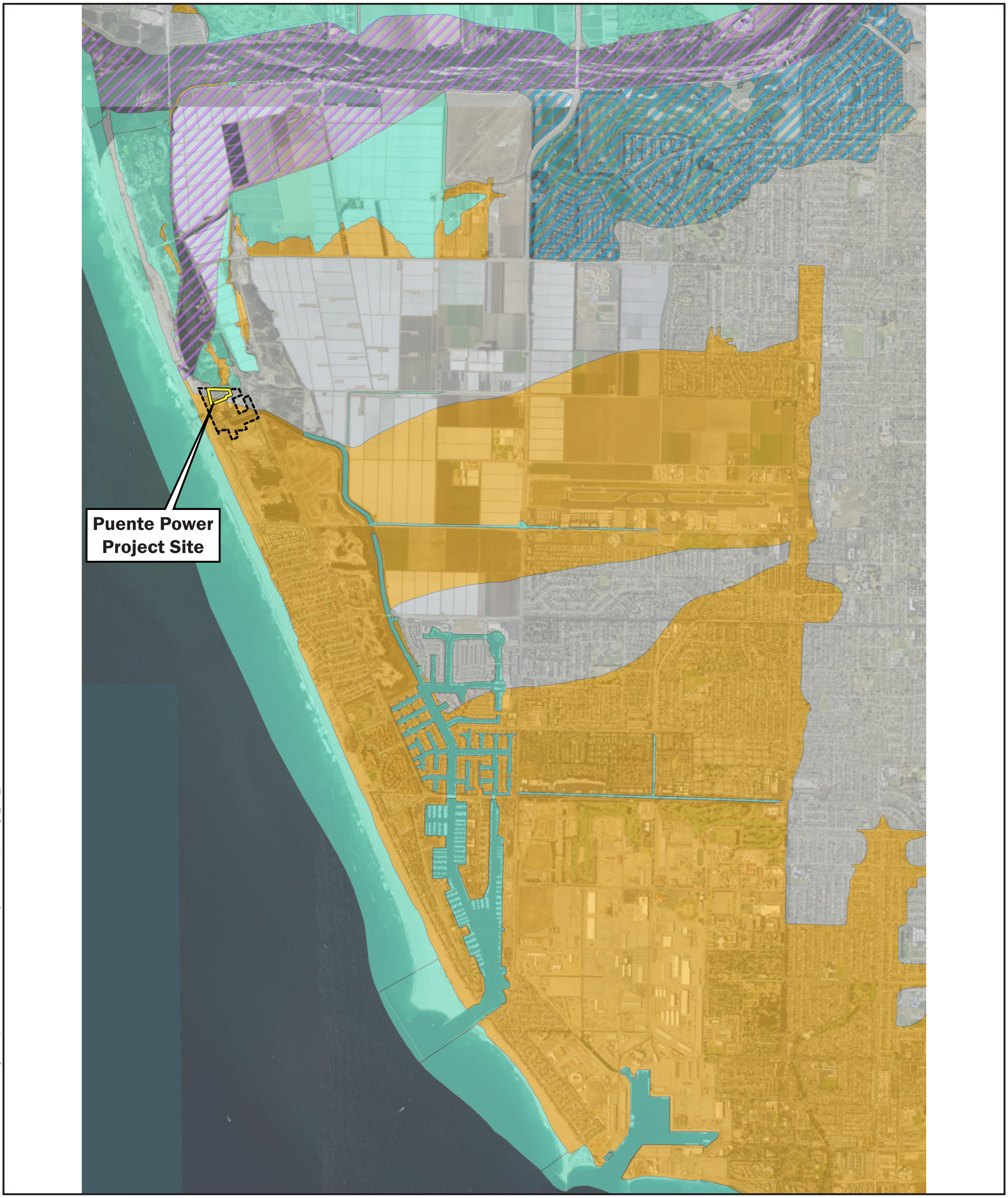
10/01/15 hk \\1578sr-w2kf03\gis\Graphics\NRG Puente Power Project\DataRequest\Figs_DR_Oct15.indd

GENERALIZED EXTREME VALUE PROBABILITY DISTRIBUTION FOR STORM WAVE HEIGHT

NRG
Puente Power Project
Oxnard, California

October 2015

FIGURE 47-2



Source: FEMA Flood Map Service Center (https://msc.fema.gov/portal/search?AddressQuery=oxnard%2C%20california), 2015.

Flood Hazard Zones

- 1 PCT ANNUAL CHANCE FLOOD HAZARD
- 0.2 PCT ANNUAL CHANCE FLOOD HAZARD
- AREA OF MINIMAL FLOOD HAZARD
- AREA WITH REDUCED FLOOD RISK DUE TO LEVEE
- REGULATORY FLOODWAY

0 1/2 1 MILES

FEMA FLOOD HAZARD MAP

NRG
Puente Power Project
Oxnard, California

October 2015

FIGURE 47-3

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DATA REQUEST

48. Please provide the NOAA LiDAR data used in the sea level rise Technical Memorandum. Appendix N-2, p. 5.

RESPONSE

The Light Detection and Ranging (LiDAR) data and bathymetry data can be obtained from the following link:

2013 NOAA Coastal California TopoBathy Merge Project Department of Commerce, NOAA, National Ocean Service, Office for Coastal Management, (PUBLICATION DATE 2015-02-18

PUBLICATION PLACE: Charleston, South Carolina

PUBLISHER: NOAA's National Ocean Service, Office for Coastal Management

ONLINE LINKAGE: http://coast.noaa.gov/dataviewer/index.html?action=advsearch&qType=in&qFld=ID&qVal=2612

ONLINE LINKAGE: ftp://coast.noaa.gov/pub/DigitalCoast/lidar1_z/geoid12a/data/2612

ONLINE LINKAGE: http://coast.noaa.gov/dataviewer

ONLINE LINKAGE: http://coast.noaa.gov

DATA REQUEST

49. The sea level rise analysis failed to consider the impact of flooding from the Edison Canal. Please revise the analysis to consider the cumulative effect of a tsunami, wave and storm surge flooding, riverine inundation, dune erosion, and Edison Canal flooding.

RESPONSE

Edison Canal is a 2.5-mile-long, manmade canal. The entrance to the canal is at the northern end of the Channel Islands Harbor under Channel Islands Boulevard; approximately 2 miles from the harbor entrance (see Figure 49-1).

The harbor entrance is between two jetties and is protected by a parallel offshore breakwater. There are two small beaches (Kiddie Beach and Hobie Beach) near the harbor entrance that the United States Army Corps of Engineers (USACE) created when it constructed the harbor. These beaches were specifically designed as surge beaches to absorb the impact of tidal surges that would otherwise damage facilities or boats in the harbor (LARWQCB, 2007).

As described in the Applicant's response to California Energy Commission (CEC) Data Request 41, the canal dimensions are approximately 10 feet deep and 40 to 100 feet wide in the vicinity of the MGS intake. The depth of water fluctuates with the tide and ranges from approximately 2.5 to 7.5 feet MLLW (or approximately 2.3 to 7.3 feet NAVD88)[2]. Profiles of the canal at three locations near MGS are provided in Figures 49-2 and 49-3, respectively. As shown on Figure 49-4, freeboard in the canal is on the order of approximately 6 to 7 feet.

Application for Certification (AFC) Figure 2.8-1 shows the topography in the vicinity of the canal. The MGS roads and parking lot near the canal are at elevation 12 feet NAVD88 or more. Most of the canal banks on the Mandalay property are greater than 14 feet in elevation, although they decrease to about 12 feet at the head of the canal. An extreme tidal elevation, as shown in Table 47-2, is unlikely to exceed 8 feet. The maximum observed water levels at NOAA gages at Los Angeles, Santa Barbara, Port San Luis, and Rincon Island are all less than 8 feet. The historical peak at Santa Monica is 8.3 feet NAVD88, or about 0.3 foot above the 100-year water level.

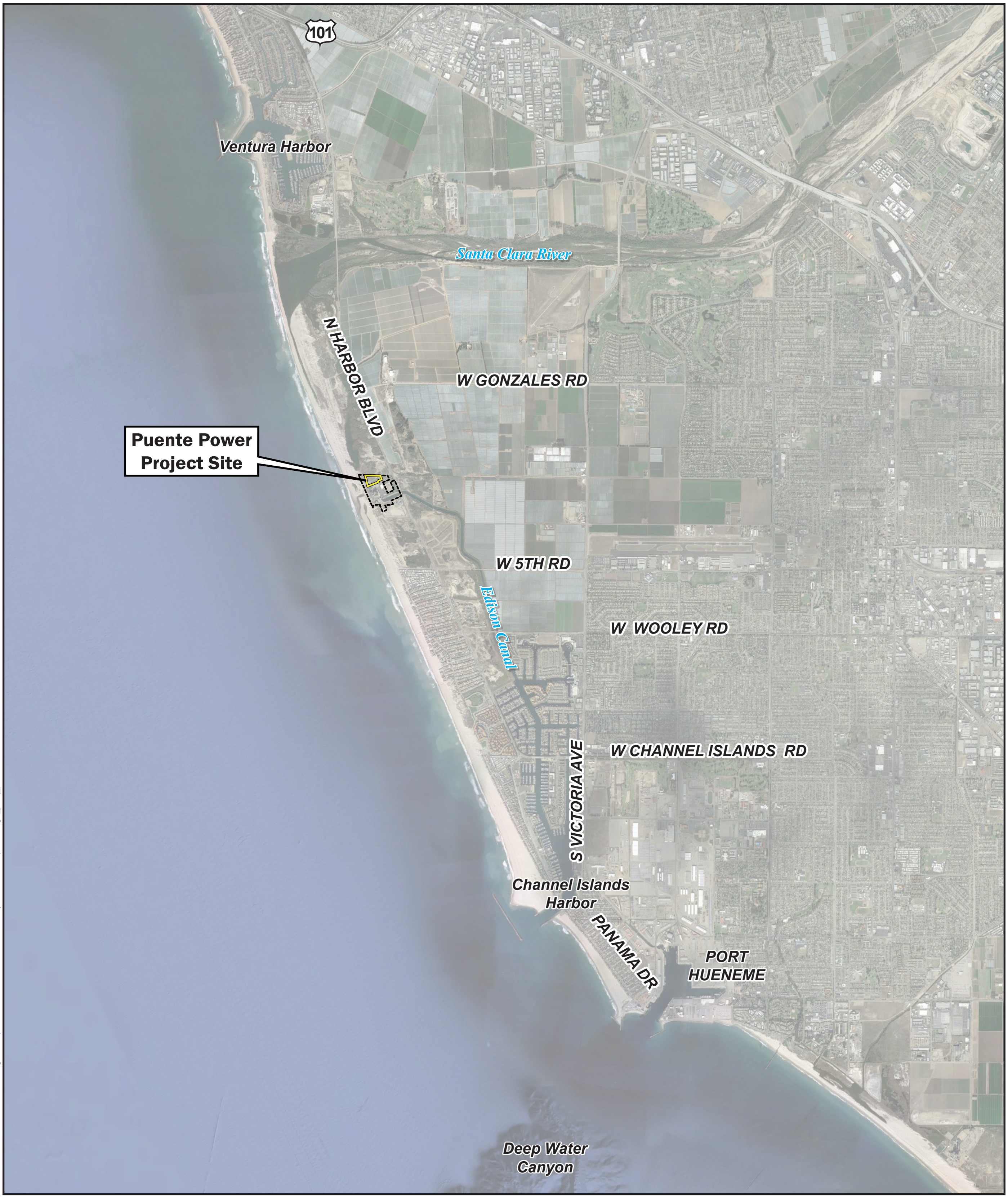
The Goleta #2 tsunami could have an elevation of over 14 feet if it occurs at high tide; if it occurs at low tide, it would only have an elevation of about 10 feet. However, it would be unlikely for the tsunami to enter the Channel Island Harbor and then travel up the Edison Canal without considerable loss of energy due to the physical geometry of the harbor, so the water surface elevation at the end of the canal would be less than 14 feet.

With SLR, the extreme tides would increase. Assuming an increase in sea level of 24 inches by the year 2050 the extreme water levels in the canal would be about 10 feet, that is, approximately 8 feet for a 100-year (or more) return period tide, plus 2 feet of high-scenario SLR. The water level would be expected to stay within the canal, but freeboard at the head of the canal (i.e., at the MGS inlet) would be reduced by about 2 feet.

[2] Conversion of elevation from MLLW to NAVD88 is shown on AFC Figure 2.8-1. Elevation in MLLW minus 0.155 equals elevation in NAVD88.

Because large waves could not travel through the harbor and up the canal, the water level in the canal would not be expected to increase due to waves from the Pacific Ocean.

FEMA maps (see Figure 47-3) do not indicate flooding along the Edison Canal from riverine sources, so there would be no increase in water level in the canal from riverine flooding.



10/01/15 hk \\1578sr-w2kf03\gis\Graphics\NRG Puente Power Project\DataRequest\Figs_DR_Oct15.indd

Source: Google Earth Pro., 2015.

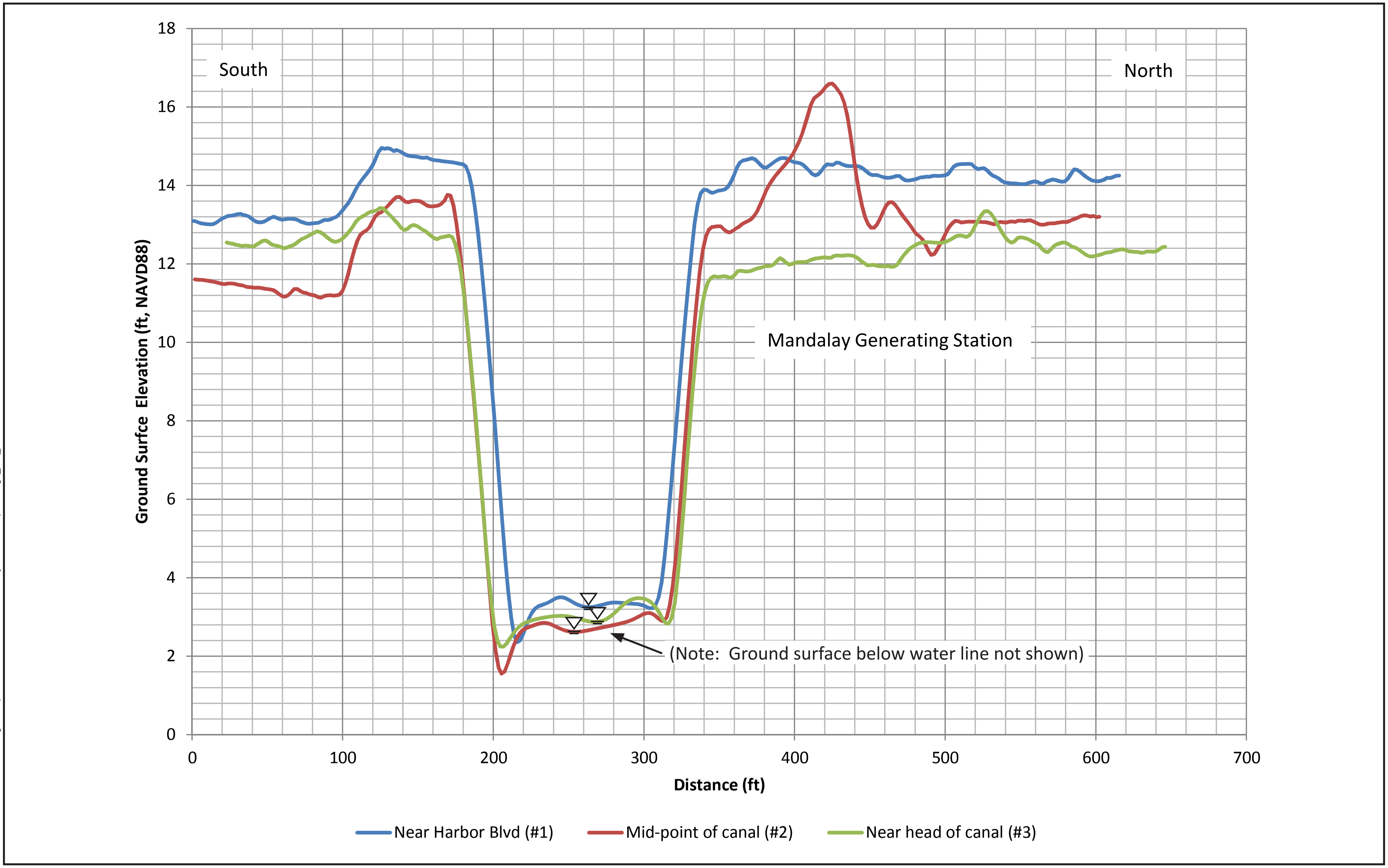
0 0.5 1 MILES

VENTURA COAST

NRG
Puente Power Project
Oxnard, California

October 2015

FIGURE 49-1



Source: NOAA, 2013.

Note: See Figure 49-3 for section locations.

CANAL PROFILES

NRG
Puente Power Project
Oxnard, California

October 2015

FIGURE 49-2

CANAL SECTION LOCATIONS

NRG
Puente Power Project
Oxnard, California

October 2015

FIGURE 49-3

Source: NRG, 2015.

EDISON CANAL FREEBOARD AT HIGH TIDE

NRG
Puente Power Project
Oxnard, California

October 2015

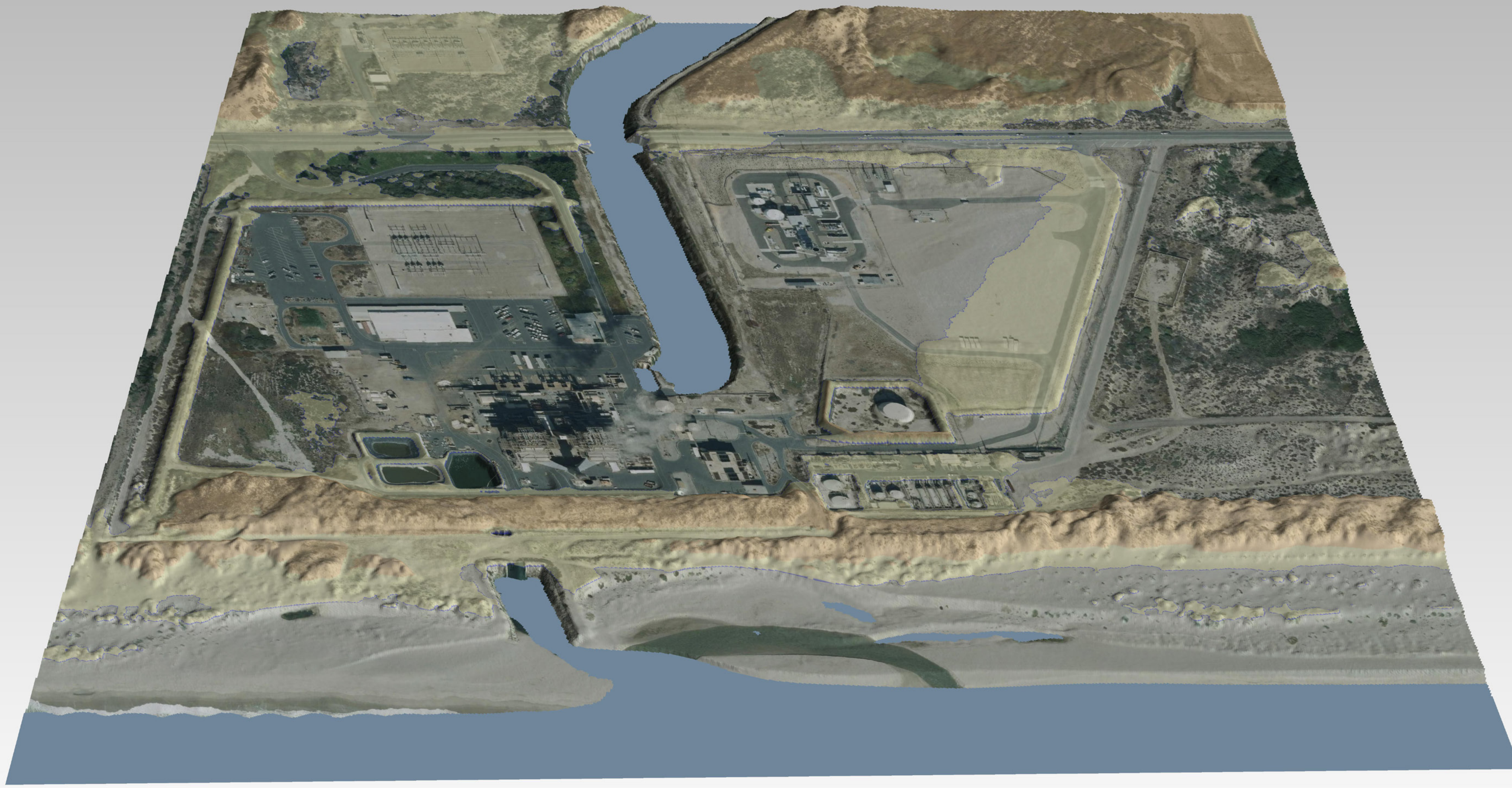
FIGURE 49-4

DATA REQUESTS

50. The sea level rise analysis is difficult to evaluate without a detailed topographic map showing the elevation of the dunes and levees protecting the Project site. Please provide a detailed topographic map and three dimensional diagram showing dune and levee elevation and project site elevations.

RESPONSE

The detailed existing topographic map for the entire MGS, including the proposed project site, is shown on AFC Figure 2.4-2. A three-dimensional image based on this topographic survey information and the LiDAR data is provided as Figure 50-1.



Source: Ground Elevation data 2013 NOAA Coastal California TopoBathy Merge Project, MHHW from NOAA Santa Barbara tide gage 9411340, http://tidesandcurrents.noaa.gov/datums.html?id=9411340

Notes:
1. Water level shown on image is existing MHHW.
2. Elevation is exaggerated 2x.

3-DIMENSIONAL IMAGE

NRG
Puente Power Project
Oxnard, California

October 2015

FIGURE 50-1

DATA REQUEST

51. The AFC's analysis of wave and storm surge flooding indicates the worst case run-up elevations would be 20 to 25 feet. Please identify the vertical datum used to calculate this height.

RESPONSE

The datum is NAVD1988, consistent with the topographic map referenced in the Response to Data Request 50, and included as AFC Figure 2.4-1.

DATA REQUEST

52. As the dune elevation ranges from 20 to 30 feet, the AFC's analysis indicates that sea level rise plus wave and storm surge flooding could overtop the dunes along sections that are 20 to 25 feet high. The AFC dismisses this potentially significant impact by arguing the beach is now stable and would not erode as assumed in the worst case scenario. AFC, Appendix N-2, p. 4. Even assuming this is correct, this is a significant impact that should be mitigated. Please identify the basis upon which you conclude that the beach is stable and not subject to erosion.

RESPONSE

In relation to the discussion below, and as presented in AFC Appendix N-2, beach stability refers to the medium to long-term trend in beach size and morphology. An erosive beach is one that is shrinking; and an accreting beach is one that is growing over the medium to long term. In the short term (e.g., one to several years), a stable beach may grow or shrink, just as an erosive beach may see growth under the right conditions. The Applicant concluded that the beach fronting the project site is stable, and not subject to medium- to long-term erosion. This conclusion is based on the following:

- There is no evidence that the beach and dunes were impacted by the large wave event that occurred in 1983. This event was highlighted in the 2013 *Coastal Resilience Ventura Coastal Hazards Mapping* report prepared for Nature Conservancy (ESA-PWA, 2013).

- Since 1947, the beach width has grown by more than 300 feet (see AFC Figure 4.15-7, which shows the growth in width from 1947 based on aerial photos; also see Figure 56-2 in response to Data Request 56). The width is approximated as the distance from the outfall headwall to the water line at the time of the photo. The estimate is approximate because the water level changes with the tides and season. However, all the photos, taken at different times over the decades, are consistent in showing the continual increase in beach width. During this period, SLR has been 0.004 foot per year (1.34 millimeters per year, as measured at the Santa Monica gage [NOAA, 2015b]). This amounts to about 3 inches since construction of the original power plant approximately 60 years ago. Although the historical rate of SLR is less than the predicted future rate, the fact that the beach has grown in width indicates a stable beach and sea level has not been a significant factor in the observed beach change. We also note that for the projected SLR scenario of 24 inches by 2050 to occur, the rate of SLR would need to increase by more than tenfold to 14.1 mm/yr.

- In the 1950s and 1960s, a paved road ran along the beach just above the outfall headwall. The road is currently buried about 3 to 4 feet beneath the sand (based on an exploratory excavation done in 2014) and is not maintained. As can be seen in the photos included with the Applicant's response to Data Request 64, the dunes have expanded farther towards the beach and ocean, and the old road is now partially covered by new dunes, indicating an increase in beach volume as well as width. The dunes' growth would appear to have been limited primarily by the outflow from the MGS outfall, rather than by erosion caused by extreme water levels or storms. This is indicated by the larger width in the dune field farther south from the outfall, where the outfall discharge impacts the beach less.

- With SLR, if the supply of sand from the north is not sufficient to keep up with SLR, the beach will contract. The existing slope of the beach averages approximately 3 percent, based on the 2013 LiDAR data. Assuming the high-scenario SLR of 24 inches by 2050 and that the beach slope remains the same, the beach would be expected to shrink by about 70 feet (24 inches/0.03/12 inches/foot). Over the expected 30-year life of the proposed project (2020 through 2050), the high-scenario SLR rate is considered to be extremely conservative, considering that recent historic rate of SLR is considerably less than the predicted future rate. Assuming the low or medium SLR scenarios, the estimated beach reduction would be on the order of about 20 or 45 feet, respectively. The *2013 Coastal Resilience Study* (specifically, Figure 16 in that report) shows that the sediment yield from the Santa Clara and Ventura Rivers should remain about the same as the historical yield until about 2050. The scenario presented in AFC Appendix N-2 was a “what if” scenario and not a prediction. The existing data indicate that loss of beach is unlikely to occur in the near future.

DATA REQUEST

53. Please provide all documents relied upon to support your answer to Data Request 52.

RESPONSE

The links for documents relied upon to support the Applicant's response to Data Request 52 are provided below:

ESA-PWA, 2013. *Coastal Resilience Ventura, Final Technical Report for Coastal Hazards Mapping*. Prepared for The Nature Conservancy. July 31. http://maps.coastalresilience.org/ventura/methods/CRV_Hazards_Mapping_Technical_Report.pdf

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.

NOAA (National Oceanic and Atmospheric Administration), 2015b. Tides and Currents. http://tidesandcurrents.noaa.gov/.

DATA REQUEST

54. Please provide any analysis conducted by NRG or its consultants of erosion of the coastal dunes that abut the Mandalay Bay site.

RESPONSE

As shown on AFC Figure 4.15-4 (same as AFC Appendix N-2, Figure 4), the distance between the toe of the dunes and the existing water level at MHHW is up to approximately 500 feet.

As presented in AFC Appendix N-2, the beach abutting MGS has widened by more than 300 feet since 1947, based on a comparison between the 2014 photograph and the 1947 photograph. The photographs were not necessarily taken at the same tidal phase or season. The average daily tidal horizontal variation is about 75 feet, so the increase in beach width was conservatively adjusted to be approximately 200 feet instead of 300 feet, as indicated on the photos. Therefore, the overall average rate of accretion from 1947 to 2014 is approximately 2.9 feet per year (i.e., accretion of 200 feet over 68 years), or approximately 0.9 meter per year.

The Applicant used the information presented in the *Coastal Resilience Report* (ESA-PWA, 2013) to estimate the amount of shoreline erosion expected over the life of the project. Table 7 in the *Coastal Resilience Report* provides projected erosion rates in meters per year at Mandalay Beach Road for low, medium, and high SLR scenarios. Using these rates, the estimated amount of erosion for Mandalay Beach due to SLR was estimated (see Table 54-1). Under worst-case conditions (i.e., high SLR), the beach could erode about 80 feet from its current location by year 2050. This is similar to the estimate of approximately 70 feet calculated from existing beach slope and the high SLR rate of 24 inches over 30 years as described in the response to DR 52. This assumes a decrease in the historic availability of sand. As discussed below, the availability of sand would be expected to counteract the erosion caused by SLR.

The *Coastal Resilience Report* also recommends including potential erosion by a 500-year storm wave event. This value was computed by ESA-PWA to be approximately 46 meters, or approximately 150 feet. The method used by the ESA-PWA analysis (Komar, 1999) is a geometric model that provides the "potential most-extreme erosion," and the authors of the method note that the actual erosion experienced could be considerably less. A major shortcoming of the method is that it assumes instantaneous erosion of the dune due to wave attack; whereas the extreme water level may last for only a short while, and for much of the tide cycle the water level will likely be below the toe of the dune, and no erosion will occur. In addition, for the dune erosion to continue, the eroded sediment needs to be transported cross-shore to deeper water. Sediment deposited lower down on the shore face due to erosion of the dune at the back of the beach may reduce the ability of future waves to erode the dune.

Based on the methodology presented in the *Coastal Resilience Report*, the coastal hazard zones are developed from three components: historic erosion, additional erosion due to SLR, and the potential erosion impact caused by a large storm wave event (e.g., 100-year or 500-year). Therefore, the total estimated worst-case erosion for Mandalay Beach in front of the project site would be:

- Historic erosion (2.9 feet accretion/year from 2015 to 2050) = -101 feet
- Erosion due to SLR (high SLR scenario) = 91 feet
- Total Erosion = -101 +91 = -10 feet (beach stays about the same, i.e., average accretion equals erosion due to SLR)

- Erosion impact from 500-year storm wave = 150 feet, however there is only a 7 percent chance of a 500-year event in the next 35 years.

Erosion would be expected to be offset by continuing accretion, which has historically been 2.9 feet per year. Furthermore, storm wave erosion would be a temporary, episodic event. Therefore, even given the high SLR case outlined above, the width would remain about the same.

The Komar et al. (1999) method mentioned above was devised for predicting dune erosion, which the authors applied to the coast of Oregon to provide a rational analysis for setback distances to prevent development in areas of the greatest coastal hazards. The method is a simple geometric model based on the extreme water level, elevation of the toe of the dune, and slope of the beach. Figure 54-1 provides a diagram describing the model.

The method developed by Komar et al. (1999) was applied in a probabilistic way using probability distributions for wave height and extreme water levels. The same distributions described under the Applicant's response to Data Request 47 were used in a similar analysis. To calculate wave run-up, the wave length is also needed. Wave length is calculated from wave period. The data from Seymour (1996) used to analyze wave heights were also used to develop a probability distribution for wave period. The equation for wave run-up from Ruggiero et al. (2001) was used to calculate wave run-up.

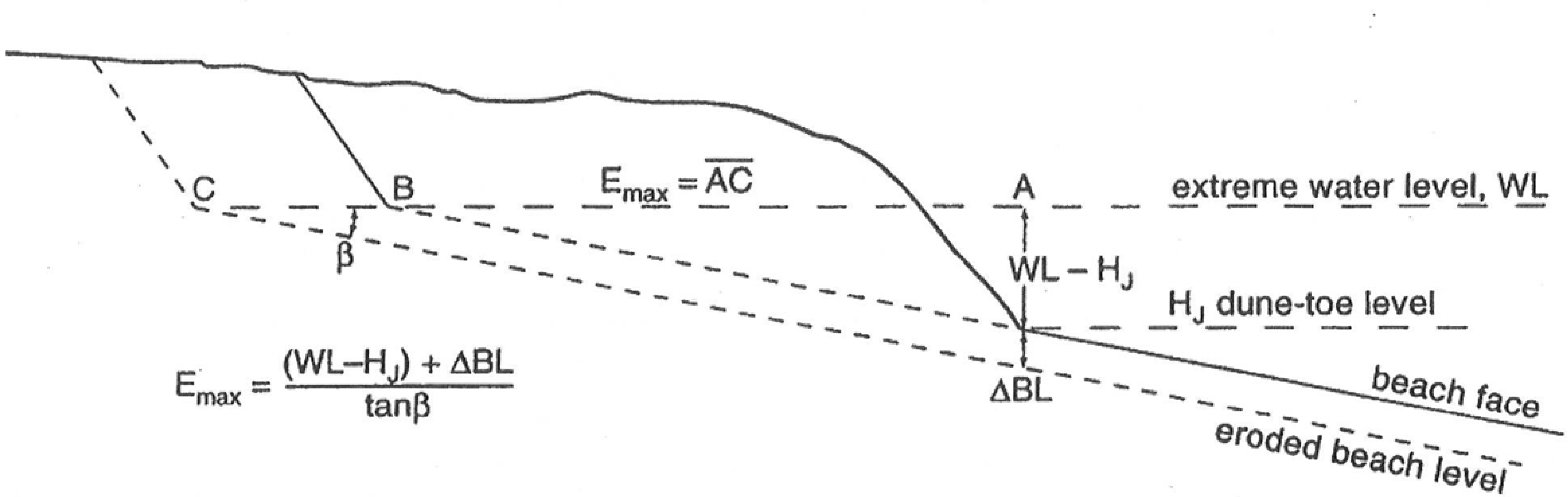
The location of the toe of the dune was estimated from the 2013 LiDAR data. Figure 54-2 shows detailed topography of the beach in front of the MGS site. There is a sharp scarp formed between elevations 12 and 15 feet. This scarp likely represents the extent of recent storm wave run up. A toe elevation of about 15 feet was therefore used for the analysis. The method is sensitive to the selection of dune toe elevation.

Figure 54-3 shows the probability distribution for potential most-extreme erosion using the Komar method. The curve is based on over 10,000 simulations for different combinations of wave height, wave length, and tidal elevation. The simulations were performed for existing conditions, and assuming 24 inches of high-scenario SLR. From the analysis, the 100-year maximum potential erosion is estimated to be approximately 170 feet without SLR, and 270 feet with the high-scenario SLR. The potential most-extreme erosion distance of 270 feet from the scarp would extend back to approximately the fence line of the MGS property, which is at the toe of the large dune that fronts MGS. The actual erosion, however, would be expected to be considerably less, as noted by Komar (1999). The analysis assumes instantaneous erosion and transport of sediment off the beach and into deep water, when actually no erosion occurs during much of the storm, and any erosion that did occur would likely leave deposits of sand on the beach, reducing further erosion. Further evidence of the large over estimate of the Komar method for dune erosion is the observation that the beach and dunes have expanded whereas the Komar method predicts that significant dune erosion should have occurred, because even during small events such as the 10-year and 25-year, the dunes would have eroded according to the method.

Table 54-1
Estimated Erosion Due to Sea-Level Rise

Date Range	Erosion Rate Low Sea-Level Rise (meters per year)	Estimated Erosion (feet per date range)	Erosion Rate Medium Sea-Level Rise (meters per year)	Estimated Erosion (feet per date range)	Erosion Rate High Sea-Level Rise (meters per year)	Estimated Erosion (feet per date range)
2015 to 2020	0.30	5	0.47	8	0.64	11
2020 to 2030	0.33	11	0.52	17	0.71	23
2030 to 2040	0.36	12	0.58	19	0.82	27
2040 to 2050	0.38	12	0.63	21	0.91	30
Total 2015 to 2050[1]		40		65		91

Source: ESA-PWA, 2013.
Note:
1. Proposed project life is 30 years: from 2020 to 2050. Erosion computed from 2015 to 2050.



Source: Komar, et al, 1999.

GEOMETRIC MODEL USED TO EVALUATE THE MAXIMUM POTENTIAL EROSION DURING AN EXTREME STORM

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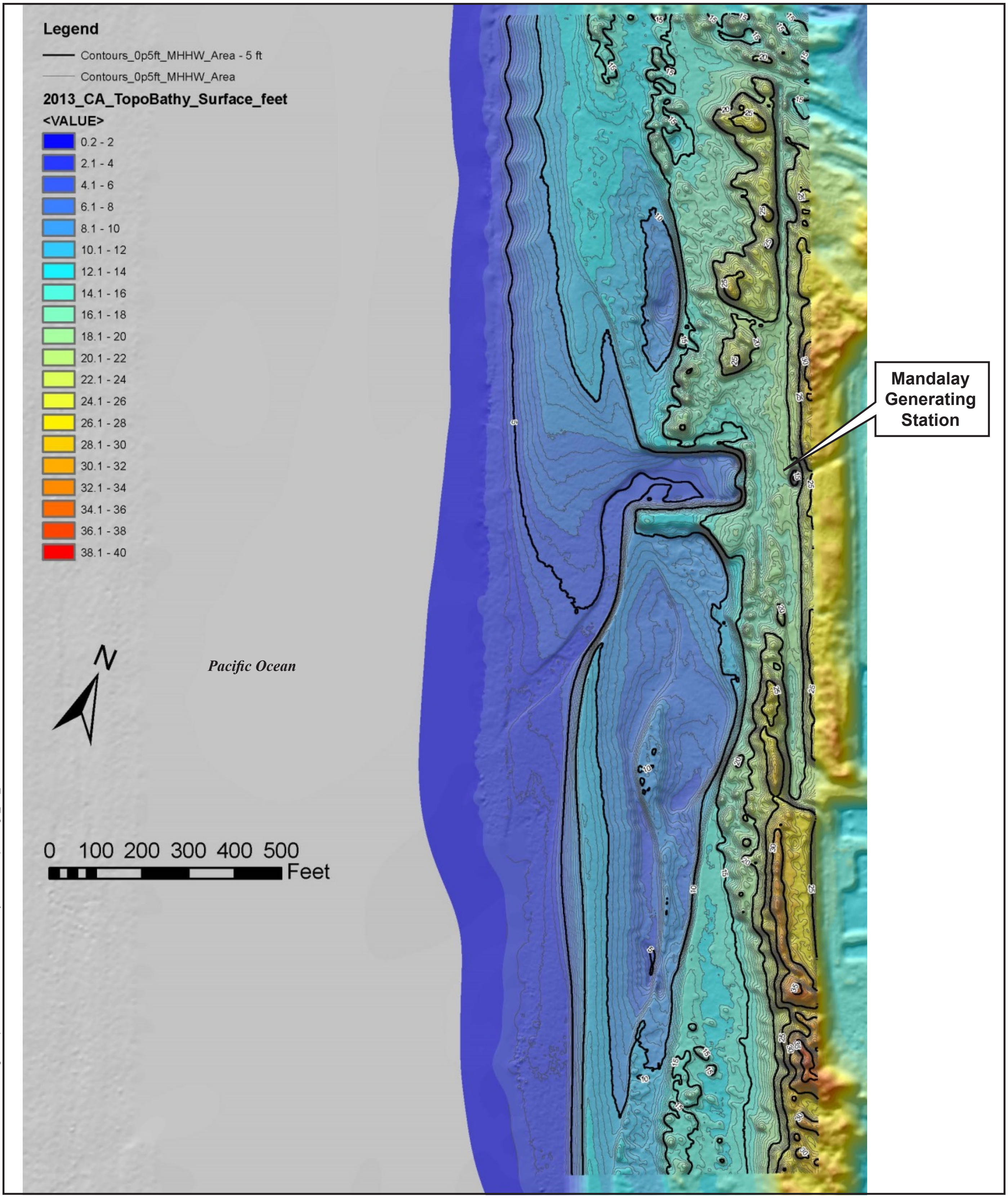
Oxnard, California

October 2015

FIGURE 54-1



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TOPOGRAPHIC MAP OF MANDALAY BEACH

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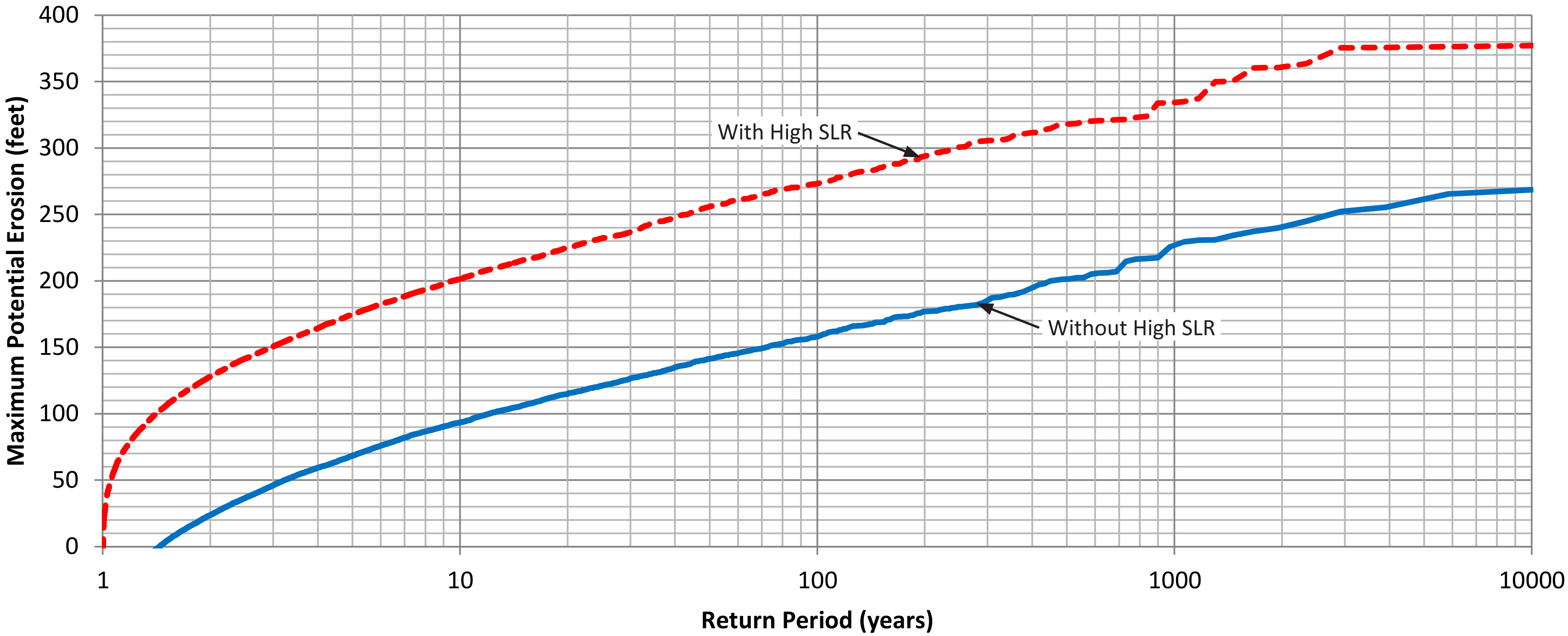
FIGURE 54-2



SLR = sea level rise
High SLR = 24 inches by 2050

PROBABILITY DISTRIBUTION FOR MAXIMUM POTENTIAL DUNE EROSION AT THE MANDALAY SITE BASED ON GEOMETRIC MODEL

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Oxnard, California

October 2015

FIGURE 54-3

DATA REQUEST

55. Please provide all documents relied upon to support your answer to Data Request 54.

RESPONSE

The links for documents relied upon to support the Applicant's response to Data Request 54 are provided below:

ESA-PWA, 2013. *Coastal Resilience Ventura, Final Technical Report for Coastal Hazards Mapping*. Prepared for The Nature Conservancy. July 31. http://maps.coastalresilience.org/ventura/methods/CRV_Hazards_Mapping_Technical_Report.pdf

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

Ruggiero, Peter, R. A. Holman, and R. A. Beach, 2001. Wave run-up on a high-energy dissipative beach. JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 109, C06025, doi:10.1029/2003JC002160, 2004. Available online at: http://geo.oregonstate.edu/files/geo/Ruggiero_etal_jgr_2004.pdf

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

DATA REQUESTS

56. Please provide any analysis conducted by NRG or its consultants of the effect that the dredging of Ventura Harbor has on the accretion and/or erosion of the beach that abuts the Mandalay Bay Generating Station.

RESPONSE

Applicant's analysis of the effects that dredging of Ventura Harbor has on accretion and/or erosion of the Mandalay Beach included the following:

- Review of historical dredging from Ventura Harbor;
- Review of other potential sources of sediment;
- Review of changes in beach width; and
- Comparison between sediment volumes and beach width changes.

Ventura Harbor Dredging

The Ventura Harbor has a long history of problems with sediment accumulating in the navigation channels and interfering with navigation. The following history is from *Physical Model of Current-Induced Scour at Ventura Harbor*, by Steven Hughes and Bradd Schwichtenberg (undated). The work described in the document was performed at U.S. Army Engineering Research and Development Center Coastal and Hydraulics Laboratory.

Early History

Ventura Harbor was constructed by local interests in 1963, and the original design featured the arrowhead jetties, a middle groin, entrance channel, turning basin, and three berthing basins. Because of funding limitations, the arrowhead jetties were not constructed to full design length, which contributed to excessive channel shoaling, created dangerous wave conditions, and effectively closed the entrance an average of 66 days per year.

Improvements

In 1968, the USACE accepted responsibility for the entrance channel and navigation structures. The USACE constructed a 457-meter-long detached breakwater with a large sand trap in the breakwater lee to the north of the northern jetty to decrease wave heights so longshore moving sand would settle in the sand trap, thereby making navigation in the entrance channel safer. The sand trap was excavated to depths ranging between -8 meters to -12 meters MLLW to give a capacity of about 612,000 cubic meters (m^3). It was anticipated that dredging would eventually occur on a 2-year cycle. Construction of the detached breakwater and sand trap was completed in 1972.

The 1972 modifications were only partially effective. Rip currents and sand accumulation along the northern jetty allowed sand to bypass a portion of the sand trap and deposit in the entrance channel; and annual maintenance dredging was required to maintain an entrance channel project depth of -6 meters MLLW. Problematic shoaling in the entrance channel created dangerous navigation conditions; and between 1982 and 1990, there were 60 capsized or damaged vessels and 11 injuries at Ventura Harbor entrance. Hazardous conditions prevented vessels from navigating the entrance during a substantial portion of the year.

In 1989, the USACE developed modifications to the Ventura Harbor structures and entrance channel to help alleviate channel shoaling and associated dangerous wave conditions. The selected plan included construction of a 91-meter-long spur groin off the tip of the northern jetty angled toward the sand trap; construction of a new South Beach rubble-mound groin 300 meters south of the southern jetty; construction of a 91-meter extension to the southern end of the detached breakwater to provide improved wave protection for vessels and dredge equipment in the navigation channel; and deepening of portions of the navigation channel from a depth of -6 meters to a new depth of -12 meters MLLW to provide sand storage volume for advanced maintenance. The improvements were completed in 1994.

Maintenance Dredging

As the above historical discussion shows, preventing sand from bypassing the Ventura Harbor sand trap has been an ongoing problem. Regular dredging of the navigation channel is essential to keep the harbor open. Without dredging, the harbor may not continue to function, and sand would fill the channel and bypass the harbor completely.

Ventura Harbor is dredged almost every year, but in many years the sand trap on the northern side is not completely dredged, leaving inadequate storage for the next year's sediment transport from the northwest. On average, almost 600,000 yards are dredged each year. The dredged material is pumped to beaches on the southern side of the harbor. The Applicant reviewed historical dredged volumes from Ventura Harbor. These volumes are summarized in Table 56-1.

The Applicant contacted USACE regarding the dredging at Ventura Harbor (see Appendix 56-1). USACE plans to dredge the harbor in January-March of 2016. The amount that would be dredged would depend on the contractor bids they receive relative to USACE's appropriated funding for dredging Ventura Harbor in 2016. The harbor is scheduled for annual dredging, subject to the appropriation of funding. No deepening or other improvements to the harbor is planned by the USACE.

In those years where dredging is inadequate to remove all the sediment accumulated in the sediment trap, sediment appears to bypass the trap and accumulate in the navigation channel. It is highly likely that without regular dredging, the navigation channel could become unsafe and unnavigable, and could eventually lead to the closure of the harbor indicated by the need for annual dredging. In the event that dredging of Ventura Harbor were to cease, the sediment trap would quickly fill with sediment, and eventually bypass the harbor and continue down the coast to replenish the sand along Mandalay Beach. If dredging were to cease at Ventura Harbor, then sediment would either fill the harbor completely, or find a new equilibrium with prevailing tide/ wave conditions. In either case, a by-passing bar would be expected to form, and eventually the historic littoral drift would be restored. During this adjustment period, there could be some erosion on the down-drift side of the harbor. When the bypassing is restored, the erosion would stop and the beach would accrete and eventually reach its original width.

Other Sources of Sediment

Mandalay Beach is within the Santa Barbara Littoral Cell (Patsch and Griggs, 2007; BEACON, 2009). This geological unit extends from the Santa Maria River mouth to the Mugu Submarine Canyon. Mandalay Beach is in the southern portion of the Littoral Cell, between the Santa Clara River mouth and Channel Islands Harbor. Sediment supply includes sediment discharge from the Santa Clara River (approximately 1.2 million cubic yards per year), sand bypassing

Ventura Harbor (approximately 600,000 cubic yards per year), and windblown sand (approximately 10,000 cubic yards per year) (BEACON, 2009).

The Santa Clara River is the major source of sediment for Mandalay Beach, and is located between Ventura Harbor and the project site. On average, the Santa Clara River is a larger source of sediment—yielding up to twice as much as the dredging of Ventura Harbor. For example, in the wet winter of 2004-2005, the Santa Clara River discharged about 6 million cubic yards of sediment. In comparison, the amount of sediment dredged from Ventura Harbor in 2004 was approximately 600,000 cubic yards (Patsch and Griggs, 2007).

No estimates of sediment loads from the Santa Clara River are available past 2005. One moderately large flow occurred since 2005—in 2011—which may have contributed additional sediment to the beach (Ventura County Watershed Protection, 2015)

Changes in Beach Width

Changes in beach width were estimated from an examination of historic aerial photographs (see AFC Appendix N-2 and Appendix 64-1 included in these Responses to Oxnard Data Requests Set 2). For this analysis, the width of the beach was defined as the distance from the MGS outfall headwall to the water line shown in the historical aerial photographs. The Applicant recognizes that there would be some change in beach width over time due to tides and seasonal changes; however, this approach is considered reasonable to show overall trends in changes to beach width.

Figure 56-1 shows the change in beach width over time based on an analysis of aerial photographs. Figure 56-2 shows changes in beach width over time by overlaying the water lines from the photographs relative to each other. Note that there is little change in width in the early photos (indicated by a “clumping” of lines near the MGS outfall structure), then an increase in width of about 400 to 500 feet from the outfall which remains relatively constant for approximately the last 10 years.

Other studies acknowledge that the beach between the Santa Clara River and the Channel Islands Harbor has been accreting (Patsch and Griggs, 2007). Barnard et al., 2009, stated:

- The shoreline adjacent to the Santa Clara River prograded up to 129 meters as a result of the winter flood in 2004-2005. The term “prograde” with respect to a beach or coastline, means the advance toward the sea as a result of the accumulation of waterborne sediment.

- The shoreline south of the Santa Clara River mouth accreted an average of 34 meters from 1987 to 2007.

- From 2005 to 2008, the beach south of the Santa Clara River gained more than 200,000 m^3 of sediment.

Comparison between Sediment Volumes and Beach Width Changes

The dependency of the Mandalay Beach width on the dredging of Ventura Harbor and sediment discharged from the Santa Clara River was assessed by comparing the sediment volumes and the changes in beach width.

Figure 56-3A shows the volume of sediment dredged from Ventura Harbor compared to the width of the beach at the project site. Figure 56-3B also shows the volume of sediment discharged from the Santa Clara River compared to beach width.

The analysis does not show a direct relationship between the dredging from Ventura Harbor and the beach width. On the other hand, the Santa Clara River appears to be the main source of sediment that contributes to accretion of the beach.

Patsch and Griggs (2007) developed sand budgets for California's major littoral cells, including the Santa Barbara Cell where Mandalay Beach is located. They note in their discussion that the shoreline between the Santa Clara River and the Channel Islands Harbor moved seaward from the 1850s until the late 1950s, and then began to retreat. This occurred before the construction of Ventura Harbor. The accretion was due to deposition of sand from large floods on the Santa Clara River, which deposited more sand than the ability of waves to remove (Patsch and Griggs, 2007). They noted the beach retreated between 1969 and 1973, perhaps a delayed response to diminished littoral drift during the relatively dry years between 1938 and 1969 floods, aggravated by dam construction on the Ventura and Santa Clara rivers; however, this is not apparent from the data in Figure 56-2. In the 1990s, sand surpluses led to widespread coastal accretion, consistent with data shown in Figure 56-2.

Conceptually the width of beach at Mandalay should be at least partially controlled by the amount of sediment dredged from the Ventura Harbor. However, a comparison of the width of the beach estimated from aerial photographs does not show a direct relationship between the dredging and the beach width. This may be due to the large amount of sediment contributed by the Santa Clara River; which delivers about 55 percent of the sediment load to the Santa Barbara Littoral Cell.

Table 56-1
Volume of Material Dredged from Ventura Harbor and Sediment Discharged from the Santa Clara River

Year	Volume Dredged from Ventura Harbor[1, 2] (cubic yards)	Sediment Discharged from Santa Clara River[3] (cubic yards)
1964	191,000	8,877
1965	180,000	24,166
1966	143,000	2,600,577
1967	239,000	953,824
1968	257,000	29,098
1969	188,3000	24,436,445
1970	325,000	326,490
1971	111,3000	747,672
1972	17,000	165,218
1973	1,193,820	2,499,966

Table 56-1
Volume of Material Dredged from Ventura Harbor and Sediment Discharged from the Santa Clara River
(Continued)

Year	Volume Dredged from Ventura Harbor[1, 2] (cubic yards)	Sediment Discharged from Santa Clara River[3] (cubic yards)
1974	420,000	454,226
1975	160,000	416,250
1976	152,000	98,637
1977	911,000	16,768
1978	496,000	14,458,772
1979	1,021,500	997,718
1980	320,000	5,391,524
1981	812,900	112,940
1982	1,186,000	130,201
1983	142,7000	11,214,093
1984	133,2900	118,858
1985	0	14,302
1986	910,000	1,565,870
1987	363,100	493
1988	800,000	128,229
1989	230,314	493
1990	217,913	2,959
1991	377,183	869,489
1992	524,702	3,652,545
1993	486,478	11,798,520
1994	470,000	NA
1995	271,357	NA
1996	833,000	NA
1997	449,128	NA
1998	741,975	NA
1999	639,173	NA
2000	818,477	NA
2001	624,931	NA

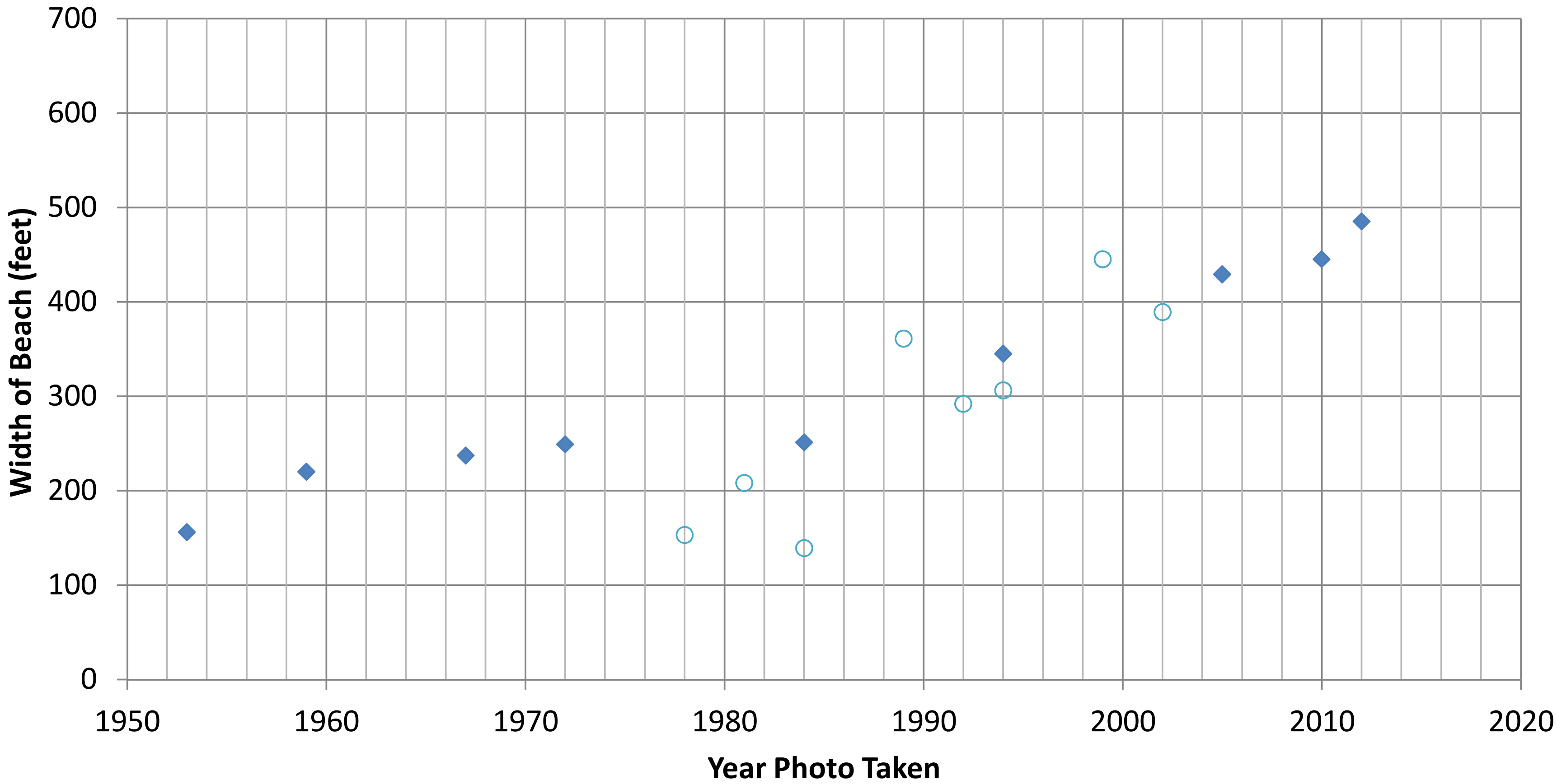
Table 56-1
Volume of Material Dredged from Ventura Harbor and Sediment Discharged from the Santa Clara River
(Continued)

Year	Volume Dredged from Ventura Harbor[1, 2] (cubic yards)	Sediment Discharged from Santa Clara River[3] (cubic yards)
2002	669,749	NA
2003	669,566	NA
2004	578,357	NA
2005	NA	6,000,000[4]
2006	NA	NA
2007	NA	NA
2008	355,000	NA
2009	379,000	NA
2010	386,000	NA
2011	316,000	NA
2012	227,000 (USACE) 273,000 (local sponsor)	NA
2013	240,000	NA
2014	440,000	NA
2015	780,000	NA

NA = not available

Notes:

1. Ventura Harbor dredging volumes for 1964 – 2004 from Patsch and Griggs, 2007.
2. Ventura Harbor dredging volumes for 2008-2015 from personal communication with USACE (see Appendix 56-1).
3. Santa Clara River sediment discharge volumes based on metric tonnes from Warrick, 2002 converted to cubic yards per year. Sediment discharge records are available starting in 1928, however to be consistent with data available for Ventura Harbor dredging, only data for the Santa Clara River starting in 1964 are included in this table. Other than episodic reporting, sediment discharge data collection ceased after 1993.
4. Source: Patsch and Griggs, 2007.



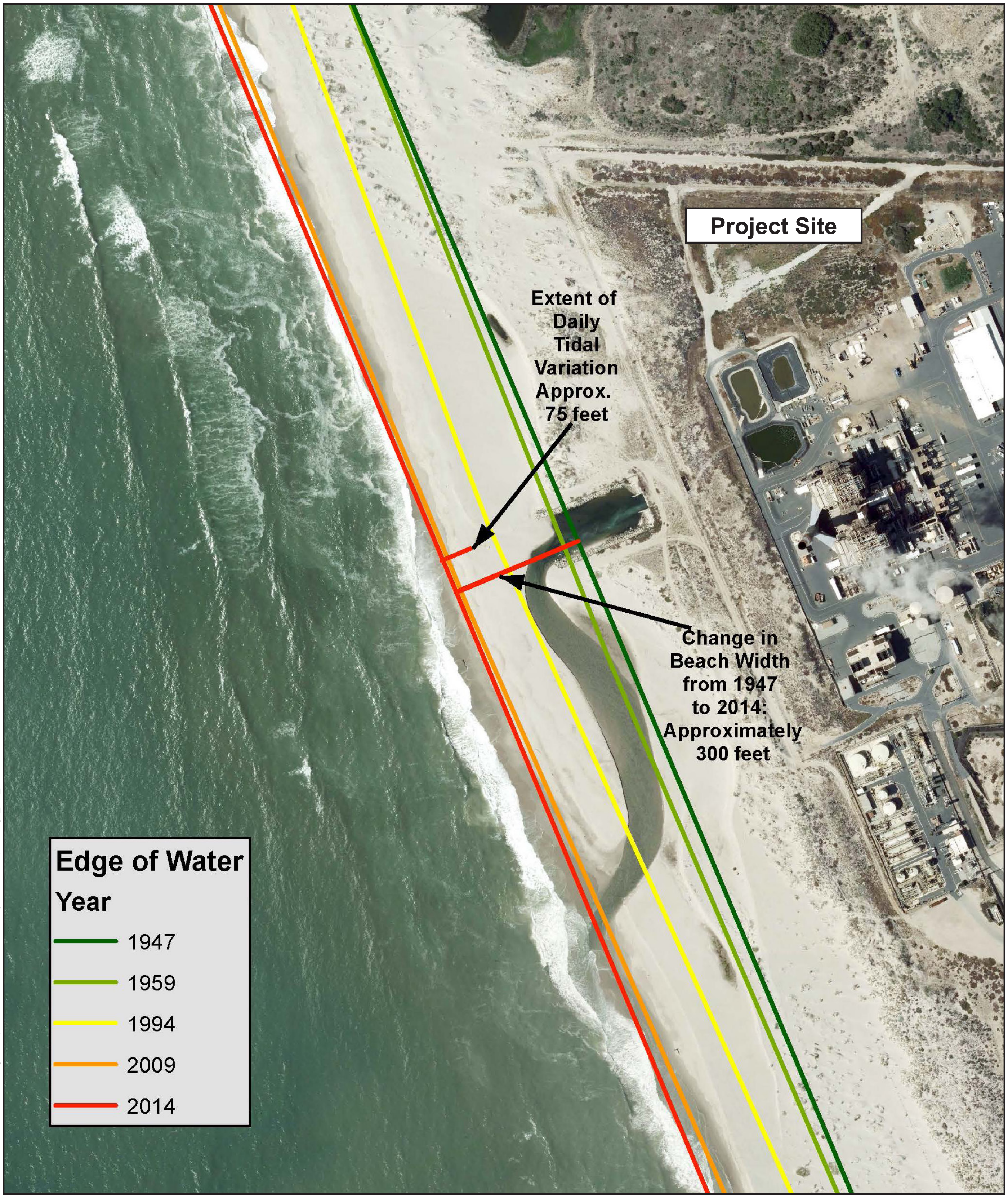
Note: Photos provided in AFC Appendix N-2 and Appendix DR-64 in this Request to Oxnard Data Request Set 2.

WIDTH OF BEACH OVER TIME

NRG
Puente Power Project
Oxnard, California

October 2015

FIGURE 56-1



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MANDALAY BEACH 1947 – 2014

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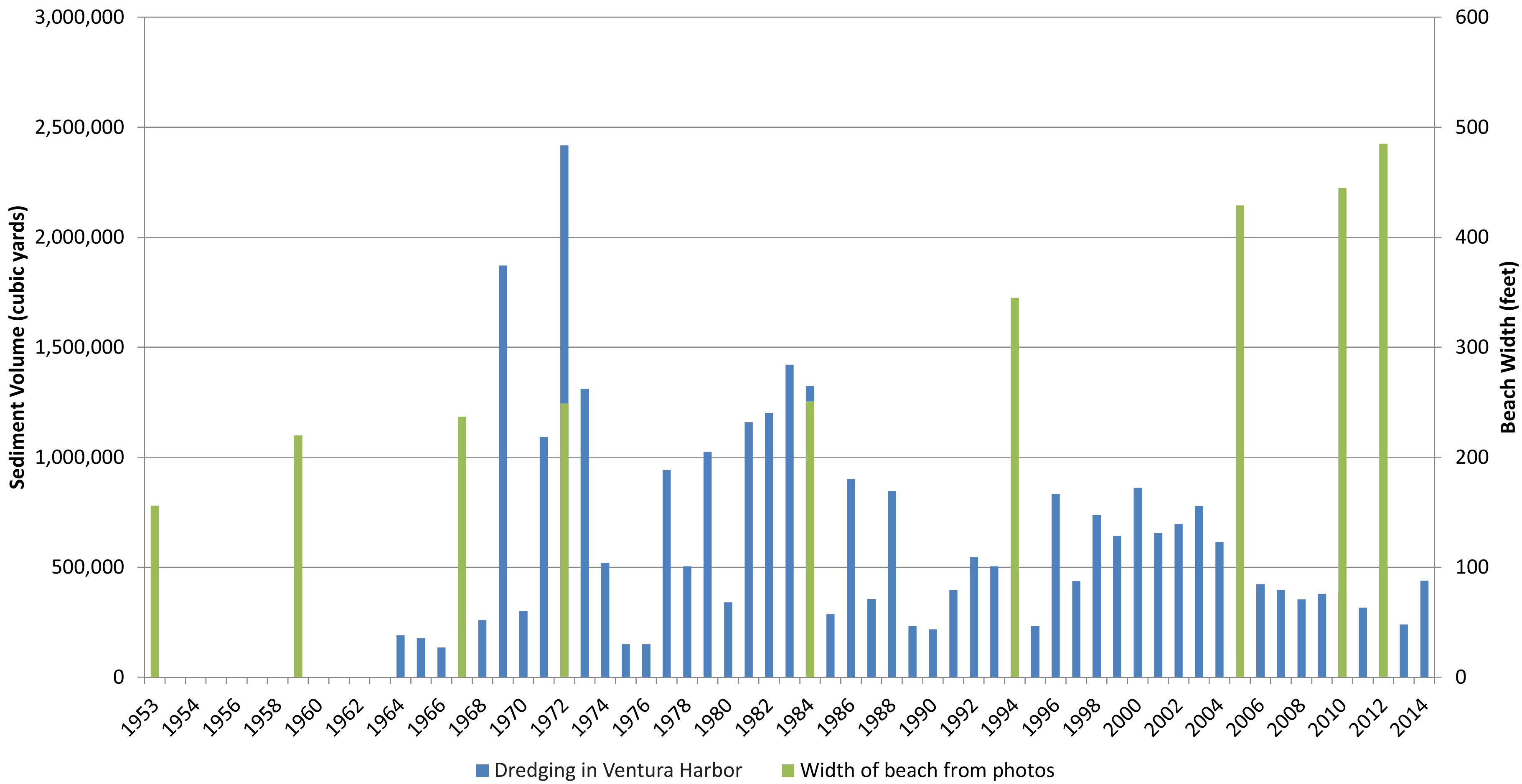
October 2015

FIGURE 56-2



Note: Photos provided in AFC Appendix N-2 and Appendix DR-64 in this Request to Oxnard Data Request Set 2.

BEACH WIDTH COMPARED TO VOLUME OF SEDIMENT DREDGED FROM VENTURA HARBOR

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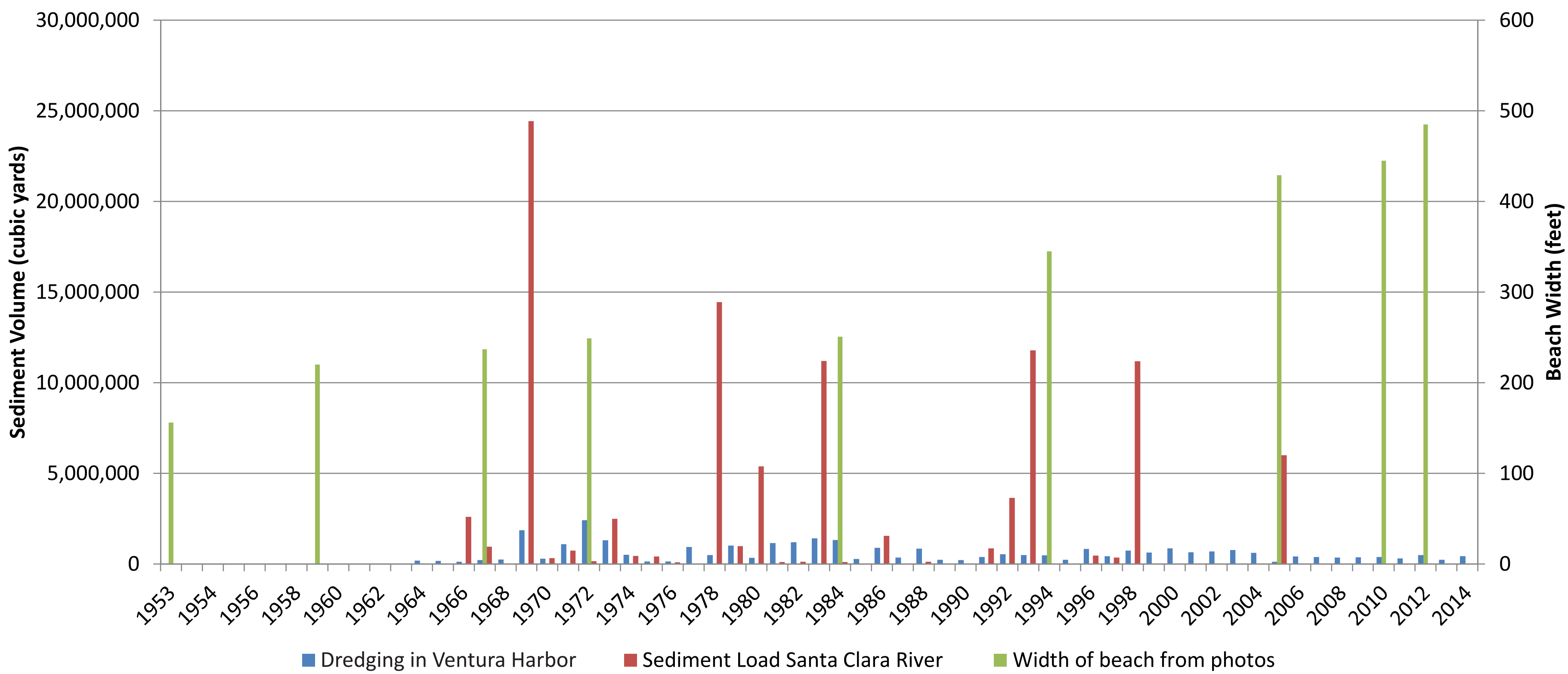
FIGURE 56-3A

10/06/15 hk \\1578sr-w2kf03\gis\Graphics\NRG Puente Power Project\DataRequest\Figs_DR_Oct15.indd



Note: Photos provided in AFC Appendix N-2 and Appendix DR-64 in this Request to Oxnard Data Request Set 2.

BEACH WIDTH COMPARED TO VENTURA HARBOR AND SANTA CLARA RIVER SEDIMENT SOURCES

NRG
Puente Power Project
Oxnard, California

October 2015

FIGURE 56-3B

DATA REQUEST

57. Please provide all documents relied upon to support your answer to Data Request 56.

RESPONSE

The links for documents relied upon to support Applicant's response to Data Request 56 are provided below:

Barnard, P.L., D.L. Revell, D. Hoover, J. Warrick, J. Brocatus, A.E. Draut, P. Dartnell, E. Elias, N. Mustain, P.E. Hart, and H.F. Ryan, 2009. Coastal processes study of Santa Barbara and Ventura Counties, California: U.S. Geological Survey Open-File Report 2009-1029, 904 pp. Available online at: http://pubs.usgs.gov/of/2009/1029/.

Beach Erosion Authority for Clean Oceans and Nourishment (BEACON), 2009. Coastal Regional Sediment Management Plan, Central coast from Pt. Conception to Pt. Mugu. January. Available online at: http://www.beacon.ca.gov/assets/reports/CRSMP.pdf.

Hughes, Steven and Bradd Schwichtenberg (undated). *Physical Model of Current-Induced Scour at Ventura Harbor*. Available online at: http://cirp.usace.army.mil/Downloads/PDF/web-break99.pdf.

Patsch, Kiki and Gary Griggs, 2007. Development of Sand Budgets for California's Major Littoral Cells. January. Available online at: http://www.researchgate.net/publication/240635473_LITTORAL_CELLS_AND_SAND_BUDGETS_ALONG_THE_COAST_OF_CALIFORNIA_Proposal_to_the_California_Coastal_Sediment_Management_Working_Group_And_California_Department_of_Boating_and_Waterways.

USGS (U.S. Geological Survey), 1993. OFFICE OF SURFACE WATER TECHNICAL MEMORANDUM NO. 93.21. SUBJECT: Policy and technical guidance for conversion of sediment concentration from parts per million (ppm) to milligrams per liter (mg/L). Available online at: http://water.usgs.gov/admin/memo/SW/sw93.21.html.

Warrick, Jonathan Adam, 2002. Short-term (1997-2000) and Long-term (1928-2000) Observations of Sediment of Discharge to Santa Barbara Channel, California, March. Available online at: http://www.researchgate.net/publication/34263829_Short-term_%281997-2000%29_and_long-term_%281928-2000%29_observations_of_river_water_and_sediment_discharge_to_the_Santa_Barbara_Channel_California_.

Willis, Cope M., and Gary B. Griggs, 2003. Reductions in Fluvial Sediment Discharge by Coastal Dams in California and Implications for Beach Sustainability, March. Available online at: http://www.researchgate.net/publication/228963249_Reductions_in_Fluvial_Sediment_Discharge_by_Coastal_Dams_in_California_and_Implications_for_Beach_Sustainability.

In addition, the following is provided in Appendix 56-1.

USACE (U.S. Army Corps of Engineers), 2015. Personal Communication regarding Ventura Dredging Volumes.

DATA REQUEST

58. Please identify all measures that NRG considered as possible mitigation for impacts from sea level rise and coastal storms. Please state whether such measures are feasible from a legal, technical, and/or economic perspective and state the basis upon which you make this conclusion.

RESPONSE

Results of Applicant's analysis presented in the AFC and in these Responses to Oxnard Data Requests Set 2 indicate that over the expected 30-year project life, no mitigation would be required. While Applicant does not anticipate that mitigation would be required, it does note that MGS personnel conduct periodic inspections of the perimeter of the facility, including the outfall area and beach dunes. Significant observations or changes to these features would be recorded and, if improvements to address significant changes to these features are needed, the Applicant will consider improvements that would maintain the integrity of beach dunes within and/or adjacent to the MGS/P3 site. Applicant also notes that MGS personnel have observed increasing accumulation of sand that covers the Beach Road that aligns the western perimeter of the facility near the toe of the beach dunes. These observations are consistent with the aerial photographic review's conclusion that the adjoining beach is accreting.

BACKGROUND: TSUNAMI INUNDATION

The AFC's analysis for a tsunami is based on the 2009 Oxnard tsunami map, confirmed with LIDAR data. This analysis indicates a water level elevation of 10 to 15 feet. AFC Appendix N-2, p. 5. With 2 feet of sea level rise, this leaves 3 feet of freeboard on the lowest part of the 25- to 30-foot-high berms/levees. This is a very small safety margin, given the omissions from the analysis. The AFC's cumulative sea level rise analysis was based on an historic 2009 tsunami map that does not include recently reported information on the Ventura Fault and other Southern California offshore fault systems and worst case sea level rise estimates. Thus, it underestimates potential tsunami impacts. Further, the AFC's tsunami analysis fails to consider cumulative effects from other sources of flooding.

Awareness of the hazards of tsunami inundation has grown since the 2011 Japan earthquake and tsunami. This event led scientists to investigate similar fault systems in Southern California that could unleash tsunamis along the California coast. Recent geological work has indicated that the Ventura fault could cause a major earthquake that could create a tsunami that would begin "in the Santa Barbara Channel area, and would affect the coastline…down through the Santa Monica area and further south." Other work has reported active fault zones off the Southern California coast.[3] These fault systems were not considered in developing the "Tsunami Inundation Map for Emergency Planning, Oxnard Quadrangle," that the AFC relied on. AFC, Appendix N-2, Attachment 2, Inset Table 1. As a result of these studies, the California Geological Survey is studying whether it needs to revise tsunami hazard maps.[4] The resulting inundation would be "severe right along the coast."[5]

The Preliminary Geotechnical Evaluation (AFC, Appendix A, pdf 259/260) states the project site is adjacent to a mapped tsunami run-up hazard area and notes that while dunes elevated up to about 25 feet above MSL offer some protection, "due to the site location in an area mapped as susceptible to tsunami run-up hazards, the potential for tsunami run-up hazards at the site and possible mitigation techniques should be evaluated during the detailed design phase of the project." The Sea Level Rise Analysis in Appendix N-2, on the other hand, dismisses tsunami inundation as an issue because the elevation of a tsunami with sea level rise is less than the height of the berm. AFC, Appendix N-2, p. 6. This conclusion fails to consider the impact of storm surges, coastal erosion and sea level risk on the structural integrity of the dunes and berms.

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3 Mark R. Legg et al., High-Resolution Mapping of Two Large-Scale Transpressional Fault Zones in the California Continental Borderland: Santa Cruz-Catalina Ridge and Ferrelo Faults, Journal of Geophysical Research: Earth Surface, May 30, 2015; Sci-News.com, Researchers Map Active Fault Zones off Southern California, June 1, 2015, See: http://www.sci-news.com/othersciences/geophysics/science-fault-zones-southerncalifornia- 02862.html

4 Rong-Gong Lin II, Earthquake Fault Heightens California Tsunami Threat, Experts Say, Los Angeles Times, June 6, 2015, See: http://www.latimes.com/local/california/la-meventura- fault-20150420-story.html#page= 1

5 Rong-Gong Lin II, Earthquake Fault Heightens California Tsunami Threat, Experts Say, Los Angeles Times, June 6, 2015, See: http://www.latimes.com/local/california/la-meventura- fault-20150420-story.html#page= 1

DATA REQUEST

59. Please prepare a tsunami runup hazard analysis that includes the most recent information on the Ventura Fault and Southern California fault system and propose mitigation for any impacts. Your analysis should include an updated tsunami hazard map that includes all recently discovered faults.

RESPONSE

As described in the Applicant's Requests for Additional Time to Respond to City of Oxnard's Data Requests Set 2 (Nos. 48 through 67), docketed on September 17, 2015, the Applicant is requesting additional time to address this Data Request.

DATA REQUEST

60. Please revise the cumulative sea level rise analysis in Appendix N-2 to include recent information on the Ventura Fault and Southern California fault systems.[6]

RESPONSE

As described in the Applicant's Requests for Additional Time to Respond to City of Oxnard's Data Requests Set 2 (Nos. 48 through 67), docketed on September 17, 2015, the Applicant is requesting additional time to address this Data Request.

6 J. Hubbard, J.H. Shaw and others, Structure and Seismic Hazard of the Ventura Avenue Anticline and Ventura Fault, California: Prospect for Large, Multisegment Ruptures in coastline....south." 1 "Quadrangle," 2 the Western Transverse Ranges, Bulletin of the Seismological Society of America, May 2014.

DATA REQUEST

61. Please resolve the apparent inconsistency between the Sea Level Rise Analysis and the Geotechnical Report with respect to tsunami inundation.

RESPONSE

There is no inconsistency between the Sea Level Rise Analysis presented in Appendix N-2 of the AFC and the Preliminary Geotechnical Evaluation presented in Appendix A-9 of the AFC. Both reports referenced the Tsunami Inundation Map for Emergency Planning developed by California Emergency Management Agency (CalEMA, 2009). The map was included as Figure 5 in the Preliminary Geotechnical Evaluation; and as Attachment 2 in AFC Appendix N-2.

The map shows that the project area is not in the Tsunami inundation zone. The inundation area on the map represents inundation from combining inundation results for an ensemble of source events affecting the Ventura County coastline, including the Goleta Landslide–generated tsunami. The source events used to develop the map are listed on the map (see Attachment 2 in AFC Appendix N-2)

CalEMA states that the purpose of the map is as follows:

> *This tsunami inundation map was prepared to assist cities and counties in identifying their tsunami hazard. It is intended for local jurisdictional, coastal evacuation planning uses only. This map, and the information presented herein, is not a legal document and does not meet disclosure requirements for real estate transactions nor for any other regulatory purpose.*
>
> *The inundation map has been compiled with best currently available scientific information. The inundation line represents the maximum considered tsunami runup from a number of extreme, yet realistic, tsunami sources. Tsunamis are rare events; due to a lack of known occurrences in the historical record, this map includes no information about the probability of any tsunami affecting any area within a specific period of time.*

The *Preliminary Geotechnical Evaluation* was prepared by Ninyo & Moore in November 2013. The main purpose of the Preliminary Geotechnical Evaluation report was to provide the results of the cone penetrometer testing program that was conducted to characterize the subsurface conditions in the northern portion of the MGS property. Details of the proposed Puente Power Project (P3) project had not yet been developed at this time. Ninyo & Moore did not perform any detailed tsunami hazard evaluations, other than reference the CalEMA map. The report merely acknowledged that tsunami run-up would need to be evaluated and addressed during detailed engineering design, as stated on page 12: "However, due to the site location in an area mapped as susceptible to tsunami run-up hazards, the potential for tsunami run-up hazard at the site and possible mitigation techniques should be evaluated during the detailed design phase of the project."

As part of the analysis in support of the 2015 AFC, the Applicant took a closer look at the contours shown on the CalEMA Tsunami Inundation Map, available LiDAR data (NOAA, 2015a), and the elevation of the beach dunes. The elevation of the tsunami inundation area shown on the CalEMA map appears to be at approximately elevation 10 to 15 feet. The elevation of the beach dunes, according to the March 2011 topographic survey (see AFC

Figure 2.4-2) ranges from approximately 20 to 35 feet. Therefore, as mapped by CalEMA, the Puente site is not in the tsunami inundation zone.

The Applicant, however, is revisiting potential tsunami effects in response to Data Requests 59, 61, and 62.

DATA REQUEST

62. Please evaluate the ability of the existing berm to contain the force of a tsunami that raises water elevation to the top of the berm along the entire length of the berm.

RESPONSE

As described in the Applicant's Requests for Additional Time to Respond to City of Oxnard's Data Requests Set 2 (Nos. 48 through 67), docketed on September 17, 2015, the Applicant is requesting additional time to address this Data Request.

DATA REQUEST

63. The Preliminary Geotechnical Evaluation, AFC, Appendix A-9, concludes: "The existing dunes are up to approximately 25 feet above MSL and should continue to provide protection to the site during the predicted sea level rise of 55 inches by 2100. As sea level rises, however, periodic storm surge and wave activity will impact the dunes. Future maintenance/re-building of the dunes (and berms) that border the site would provide continued protection for the project site, and reduce the impacts of projected sea level rise." AFC, Appendix A-9, p. 16. Please include these measures as mitigation for significant sea level rise impacts in the AFC or provide technical justification for excluding them. How frequent will these measures be required and what form of dedicated funding is in place to maintain these dunes?

RESPONSE

As shown on AFC Figure 2.4-1, the beach dunes range in elevation from approximately 20 to 35 feet. This is based on the detailed topographic survey of the MGS property provided by Southern California Edison. Applicant notes that Ninyo & Moore did not have this information when they prepared the Preliminary Geotechnical Report.

As presented in the Applicant's responses to Data Requests 47 and 54, adverse impacts from SLR and coastal storms are not anticipated over the expected 30-year project life, and no mitigation would be required. However, the Applicant recognizes the uncertainties inherent in predicting future conditions. SLR will be monitored and compared against current predicted values. As warranted, adaptation strategies consistent with the CCC's *Sea-Level Rise Policy Guidance* (CCC, 2015) would be implemented. These strategies could include identifying steps to modify the facility as needed to prevent risks to the project or to coastal resources, or establishing dune management actions to maintain and restore the natural dunes.

DATA REQUEST

64. Please provide any photographs or other documentation of any coastal or river flooding or coastal erosion that has occurred at the Mandalay Bay Generating station since 1966.

RESPONSE

The Applicant included several aerial photographs in Appendix N-2 that show the beach and dunes in front of MGS. Photos were included for the following years: 1947, 1953, 1959, 1967, 1977, 1984, 1994, 2005, 2009, 2010, and 2012.

Additional photographs can be found on the California Coastal Records Project's website (http://www.californiacoastline.org). Photograph sets from the 1970s through 2013 are included. To find photographs of MGS, search for "Mandalay."

The Applicant obtained and reviewed available photos taken by Pacific Western Aerial Survey for the following dates: May 16, 1978; June 15, 1981; January 11, 1984; December 10, 1986; March 23, 1989; September 1, 1992; November 1, 1994; October 7, 1999 and May 19, 2003. Copies of these photographs are included in Appendix 64-1.

DATA REQUEST

65. Please provide any photographs or other documentation showing the Santa Clara Estuary within 0.5 mile of the Mandalay Bay Generating station since 1966.

RESPONSE

See Response to Data Request 64.

Please note that the Santa Clara River is approximately 2 miles north of the project site.

DATA REQUEST

66. Please provide maintenance records and volume estimates of sand management that has occurred on the Mandalay Bay Generating station since 1966.

RESPONSE

A summary of data compiled from the available MGS Operator Logs and Maintenance Invoices is provided in Appendix 66-1. The operator logs go back to 2002, as do the maintenance records of the outfall area sand management. The summary includes dates and estimated volumes of sand moved from the outfall to maintain a straight path to the ocean to prevent ponding to the north and south. Also, approximately every 5 years, windblown sand is removed from the fence line.

The first maintenance activity to straighten the outfall occurred in 2003. Prior to that time, dozers were used for damming off the outfall channel for purposes of dewatering the circulating water system.

DATA REQUEST

67. Please provide plans and locations of any tidegates or water control infrastructure that may affect the hydraulic connectivity between the site, the Pacific Ocean, and the Edison Canal.

RESPONSE

There are no tidegates between MGS and the Pacific Ocean, because there has never been a need due to the distance between the outfall structure and the ocean.

There is no tidegate or control infrastructure on the Edison Canal. There is a debris barrier that stretches across the canal banks south of Wooley Road; the Applicant understands that the purpose of this barrier is to prevent people and boaters from leaving the Channel Islands Harbor and going up the canal. The inlet for the MGS consists of trash racks and pumps. In addition, there is a recirculation line that connects the outfall pipe with the intake.

With the shutdown of MGS Units 1 and 2 in 2020, the intake of ocean water from Edison Canal for once-through-cooling purposes will cease and therefore will essentially eliminate the hydraulic connectivity between the canal and the ocean outfall at Mandalay. Small intake and discharge flows in support of MGS Unit 3 (for bearing cooling purposes) would continue, but would be limited to the operation of MGS Unit 3 (up to 200 hours per year). Connectivity is limited by mechanical valves and pumps.

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APPENDICES

APPENDIX 56-1
VENTURA HARBOR DREDGING

Personal Communication/Contact Report

Name: Kelly Bayer, AECOM

Date: May 11, 2015

Person contacted:

Jeffrey C. Cole
US Army Corps of Engineers
Project Manager -
Navigation Section
213.452.3401

Subject: Dredging of Ventura Harbor

Summary:

Contacted Jeff Cole regarding the extent of dredging of Ventura Harbor since 2008. He provided the following dredge quantities. All volumes were dredged by the USACE in the January-March timeframe of each year. In addition, as noted below, additional volume was dredged by the local sponsor (the Ventura Port District) in 2012; Jeff noted that the local sponsor contribution was atypical.

2008: 355,000 CY

2009: 379,000 CY

2010: 386,000 CY

2011: 316,000 CY

2012: 227,000 CY (USACE); 273,000 CY (local sponsor)

2013: 240,000 CY

2014: 440,000 CY

2015: 780,000 CY

Jeff stated that future dredging is subject to federal funding, and he was hesitant to predict at what frequency the harbor would be dredged in the future.

Personal Communication/Contact Report

Name: Kelly Bayer, AECOM

Date: September 30, 2015

Person contacted:
Jeffrey C. Cole
US Army Corps of Engineers
Project Manager -
Navigation Section
213.452.3401

Subject: Dredging of Ventura Harbor

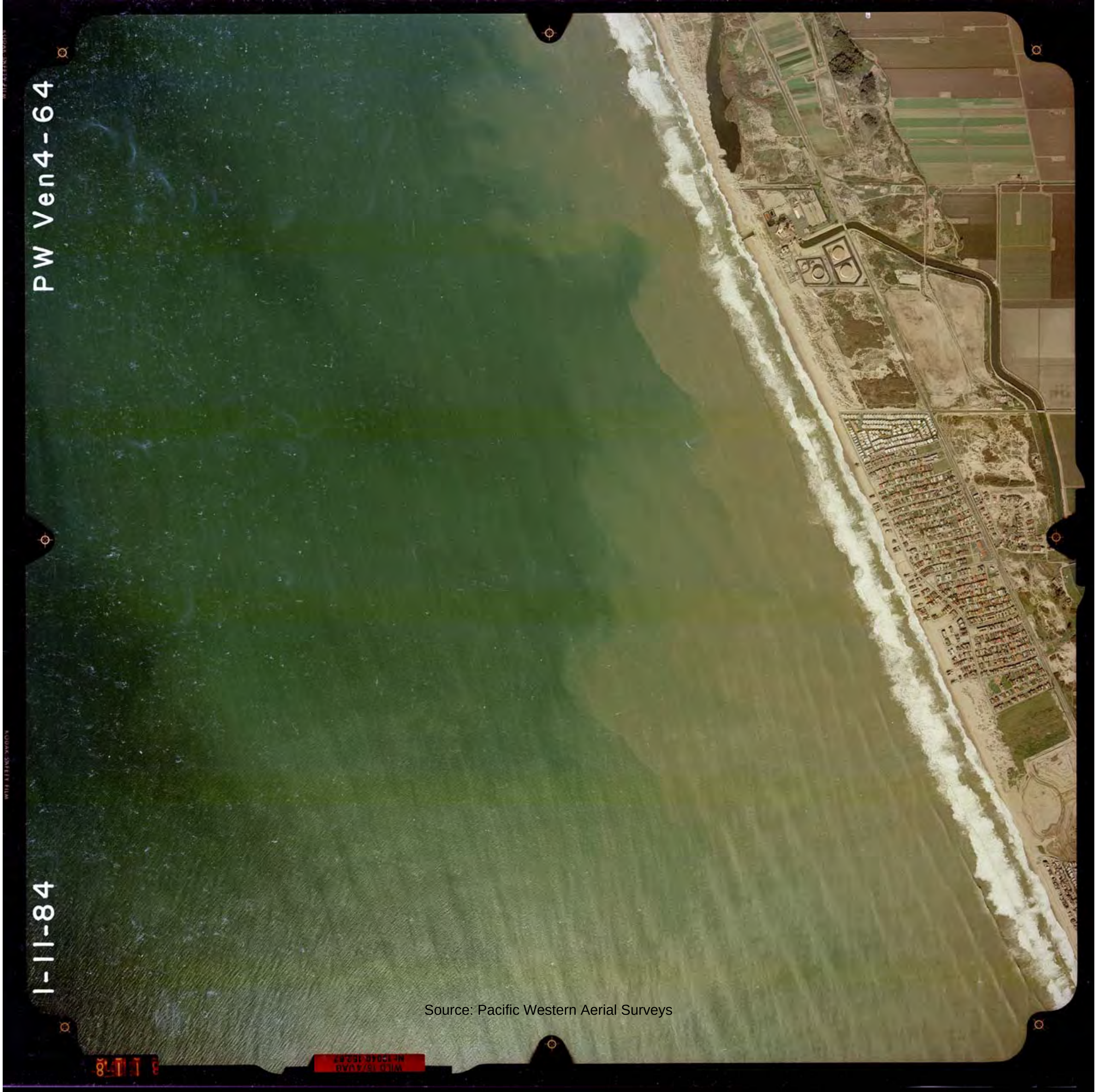
Summary:

Contacted Jeffrey Cole at the USACE, who I originally spoke to back in May, regarding the dredging at Ventura Harbor. He left me a detailed voicemail this morning indicating that the harbor will be dredged in January-March of 2016. He said the amount that would be dredged would depend on the contractor bids they receive (they can only dredge as much as they have funding for). He said the harbor is scheduled for annual dredging, subject to the appropriation of funding. He said no deepening or other improvements to the harbor are planned by the USACE.

APPENDIX 64-1
PHOTOGRAPHS

Source: Pacific Western Aerial Surveys

Source: Pacific Western Aerial Surveys



Source: Pacific Western Aerial Surveys

Source: Pacific Western Aerial Surveys

Source: Pacific Western Aerial Surveys

Source: Pacific Western Aerial Surveys

Source: Pacific Western Aerial Surveys

Source: Pacific Western Aerial Surveys

Source: Pacific Western Aerial Surveys

APPENDIX 66-1
SAND MANAGEMENT SUMMARY

Response to Data Request - City of Oxnard

No. 66 -- Please provide maintenance records and volume estimates of sand management that has occurred on the Mandalay Bay Generating station since 1966.

Start	**Complete**	**Primary Contractor**	**Equipment Utilized in Maintenance of Outfall**	**Total Hours Sand Management**	**Estimated Volume Sand Moved (Cubic Yards)**
01/29/2003	01/29/2003	CD Lyon	Bulldozer and Excavator	20.00*	1250
03/02/2004	03/09/2004	CD Lyon	Bulldozer and Excavator	20.00*	1250
04/20/2004	04/20/2004	CD Lyon	Bulldozer and Excavator	30.00*	1875
12/13/2004	12/22/2004	CD Lyon	Bulldozer & Excavator	90.00*	5625
02/22/2005	02/22/2005	CD Lyon	Bulldozer & Excavator	30.00*	1875
01/13/2007	1/14/2007	CD Lyon	Bulldozer & Excavator	15.75	984
07/27/2007	7/29/2007	CD Lyon	Bulldozer & Excavator	30.00*	1875
08/29/2007	9/8/2007	CD Lyon	Bulldozer & Excavator	20.00*	1250
01/18/2008	01/18/2008	CD Lyon	Caterpillar 325 Excavator	30.00*	1875
05/31/2008	6/2/2008	CD Lyon	Bulldozer & Excavator	15.00	938
02/28/2009	02/28/2009	CD Lyon	Caterpillar D6 Dozer & 325 Excavator	12.00	750
05/30/2009	05/31/2009	CD Lyon	Caterpillar D6 Dozer & 325 Excavator	15.00	938
12/8/2009	12/11/2009	CD Lyon	Caterpillar 325 Excavator, D5 & D6 Dozers	20.00	1250
12/14/2009	12/19/2009	CD Lyon	Caterpillar 325 Excavator & D6 Dozers	66.50	4156
02/3/2010	2/4/2010	CD Lyon	Caterpillar D6 Dozer, Excavator, and Backhoe	24.00	1500
05/24/2010	5/25/2010	CD Lyon	Caterpillar D6 Dozer & Excavator	18.00	1125
02/28/2011	3/3/2011	CD Lyon	Caterpillar D6 Dozer & 325 Excavator	26.00	1625

* Estimate of hours is based on invoice totals

Response to Data Request - City of Oxnard

No. 66 -- Please provide maintenance records and volume estimates of sand management that has occurred on the Mandalay Bay Generating station since 1966.

Start	Complete	Primary Contractor	Equipment Utilized in Maintenance of Outfall	Total Hours Sand Management	Estimated Volume Sand Moved (Cubic Yards)
04/4/2011	04/4/2011	CD Lyon	Caterpillar 325 Excavator	4.00	250
06/28/2011	7/1/2011	CD Lyon	Caterpillar D6H Dozer & 325 Excavator	16.00	1000
07/10/2011	07/10/2011	CD Lyon	Caterpillar D5 Dozer & 325 Excavator	20.00	1250
02/9/2012	2/9/2012	CD Lyon	Caterpillar D6H & 320 Excavator	9.00	563
04/12/2012	4/13/2012	CD Lyon	Caterpillar D6H Dozer & 325 Excavator	35.00	2188
05/24/2012	5/25/2012	CD Lyon	Caterpillar D6H Dozer & 325 Excavator	18.00	1125
06/6/2012	06/6/2012	CD Lyon	Caterpillar D6-H Dozer	4.00	250
06/11/2012	06/11/2012	CD Lyon	Caterpillar D6-H Dozer	5.00	313
06/21/2012	06/21/2012	CD Lyon	Caterpillar D6-H Dozer	7.00	438
06/25/2012	06/25/2012	CD Lyon	Caterpillar 320 Excavator	5.00	313
07/8/2012	07/8/2012	CD Lyon	Caterpillar D6H Dozer	6.00	375
07/17/2012	7/21/2012	CD Lyon	Caterpillar 320 Excavator (work occurring 7/17 & 7/21, respectively)	14.00	875
08/19/2012	08/19/2012	CD Lyon	Caterpillar 320 Excavator	6.00	375
12/11/2012	12/11/2012	CD Lyon	Dresser-TD20 Bulldozer	5.00	313
12/13/2012	12/13/2012	CD Lyon	Dresser-TD20 Bulldozer	5.00	313
01/10/2013	1/11/2013	CD Lyon	Caterpillar D5 Dozer & 325 Excavator	20.00	1250
02/11/2013	2/12/2013	CD Lyon	Caterpillarr D6H Dozer	10.00	625

* Estimate of hours is based on invoice totals

Response to Data Request - City of Oxnard

No. 66 -- Please provide maintenance records and volume estimates of sand management that has occurred on the Mandalay Bay Generating station since 1966.

Start	Complete	Primary Contractor	Equipment Utilized in Maintenance of Outfall	Total Hours Sand Management	Estimated Volume Sand Moved (Cubic Yards)
03/13/2013	3/14/2013	CD Lyon	Caterpillar D6-H Dozer and 325 Excavator	18.00	1125
04/27/2013	04/27/2013	CD Lyon	Cat D6-H Dozer and 325 Excavator	12.00	750
05/18/2013	05/18/2013	CD Lyon	Caterpillar D6H Dozer & 325 Excavator	12.00	750
06/13/2013	6/14/2013	CD Lyon	Caterpillar D6H Dozer & 325 Excavator	26.00	1625
07/12/2013	07/12/2013	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	14.00	875
07/26/2013	07/26/2013	CD Lyon	Caterpillar D6H Dozer & 325 Excavator	10.00	625
08/7/2013	08/7/2013	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	10.00	625
08/21/2013	8/22/2013	CD Lyon	Caterpillar D6H Dozer & 325 Excavator	22.00	1375
09/17/2013	09/17/2013	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	12.00	750
01/27/2014	01/27/2014	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	12.00	750
03/4/2014	03/4/2014	CD Lyon	Caterpillar D6H Dozer	6.00	375
03/19/2014	03/19/2014	CD Lyon	Caterpillar D6H Dozer	6.00	375
04/12/2014	04/12/2014	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	13.00	813
04/30/2014	04/30/2014	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	13.00	813
05/28/2014	05/28/2014	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	11.00	688
6/23/2014	6/23/2014	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	11.00	688
07/19/2014	07/19/2014	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	13.00	813

* Estimate of hours is based on invoice totals

Response to Data Request - City of Oxnard

No. 66 -- Please provide maintenance records and volume estimates of sand management that has occurred on the Mandalay Bay Generating station since 1966.

Start	Complete	Primary Contractor	Equipment Utilized in Maintenance of Outfall	Total Hours Sand Management	Estimated Volume Sand Moved (Cubic Yards)
07/22/2014	7/23/2014	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	17.00	1063
09/8/2014	09/8/2014	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	4.00	250
12/19/2014	12/19/2014	CD Lyon	Caterpillar D5 Dozer & 320 Excavator	13.00	813
01/4/2015	01/4/2015	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	14.00	875
02/16/2015	02/16/2015	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	11.00	688
03/27/2015	03/27/2015	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	13.00	813
05/13/2015	05/13/2015	CD Lyon	Caterpillar D6H Dozer & 320 Excavator	11.00	688
07/10/2015	07/10/2015	CD Lyon	Caterpillar D5 Dozer & 325 Excavator	3.00	188

* Estimate of hours is based on invoice totals

Response to Data Request - City of Oxnard

No. 66 -- Information pertaining to clearing of sand from perimeter fence line to maintain proper fence height.

Start	Complete	Primary Contractor	Equipment Utilized in Maintenance of Outfall	Total Hours Sand Management	Estimated Volume Sand Moved (Cubic Yards)
11/23/2004	11/23/2004	CD Lyon	Excavator	8.00	500
05/31/2009	05/31/2009	CD Lyon	Caterpillar D6 Dozer	5.00	313
02/09/2012	02/09/2012	CD Lyon	Caterpillar 320 Excavator	2.00	125