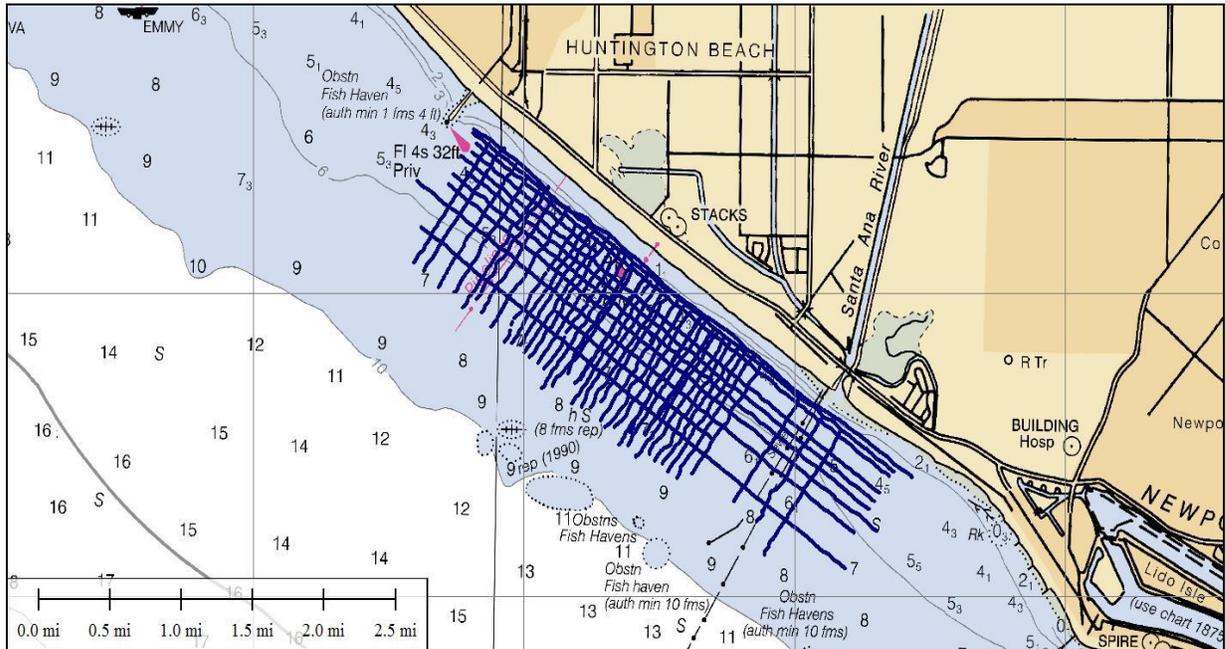


NEARSHORE SONAR SURVEYS AT HUNTINGTON BEACH, CALIFORNIA FIELD OPERATIONS REPORT

13 May 2014 – 15 May 2014



Survey Tracklines

Submitted to:

California State Lands Commission
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NEARSHORE SONAR SURVEYS AT HUNTINGTON BEACH, CALIFORNIA FIELD OPERATIONS REPORT

13 May 2014 – 15 May 2014

1.0 INTRODUCTION

EcoSystems Management Associates, Inc. (ECO-M), a subsidiary of Coastal Environments (CE), conducted a nearshore geophysical survey offshore of Huntington Beach from 13 May through 15 May 2014 for the Huntington Beach Desalination Project. The proposed desalination project site is located in Huntington Beach in Orange County, California (Figure 1-1). The project's purpose is to produce 50 million gallons per day (mgd) of desalinated water for human consumption. This would require a sustained-feed water supply of approximately 127 mgd.

For this project, bathymetric and sub-bottom profiling surveys were carried out. These surveys covered the area from the surf zone to about 6,000 feet offshore and imaged the sub-bottom geology to depths of at least 100–200 feet. The survey lines are shown in Figures 1-2 and 1-3. Figure 1-2 shows the bathymetry lines, while Figure 1-3 shows the sub-bottom lines. These surveys offshore of Huntington Beach were needed to identify the nearshore sub-bottom geology in order to characterize the offshore alluvial basin and its suitability for installing a subsurface intake system (infiltration gallery) for the proposed Huntington Beach Desalination Project.

1.1 PERMITTING: CALIFORNIA STATE LANDS COMMISSION

Prior to the geophysical survey work, ECO-M acquired the necessary permit from the California State Lands Commission (Permit #PRC 8536.9). As per the permit requirements, a Marine Wildlife Contingency Plan and an Oil Spill Response Plan were prepared. A marine wildlife observer was present during the surveys to ensure that the required safety zones were implemented and operations were stopped if marine wildlife entered the zone, as well as to monitor the safety of marine wildlife during activities that did not require safety zone monitoring (activities with frequencies > 200 kHz). A copy of the Marine Mammal Observer Report can be found in Appendix A. Additionally, all parties identified in Exhibit E of the permit were sent notifications of the geophysical survey activity, and NOAA's Long Beach office and whale-watching operations were called to determine recent whale sightings in the area. This information was then relayed to the captain and crew. Current whale sightings in the area were located approximately 5–10 miles offshore, well out of the range of these activities.

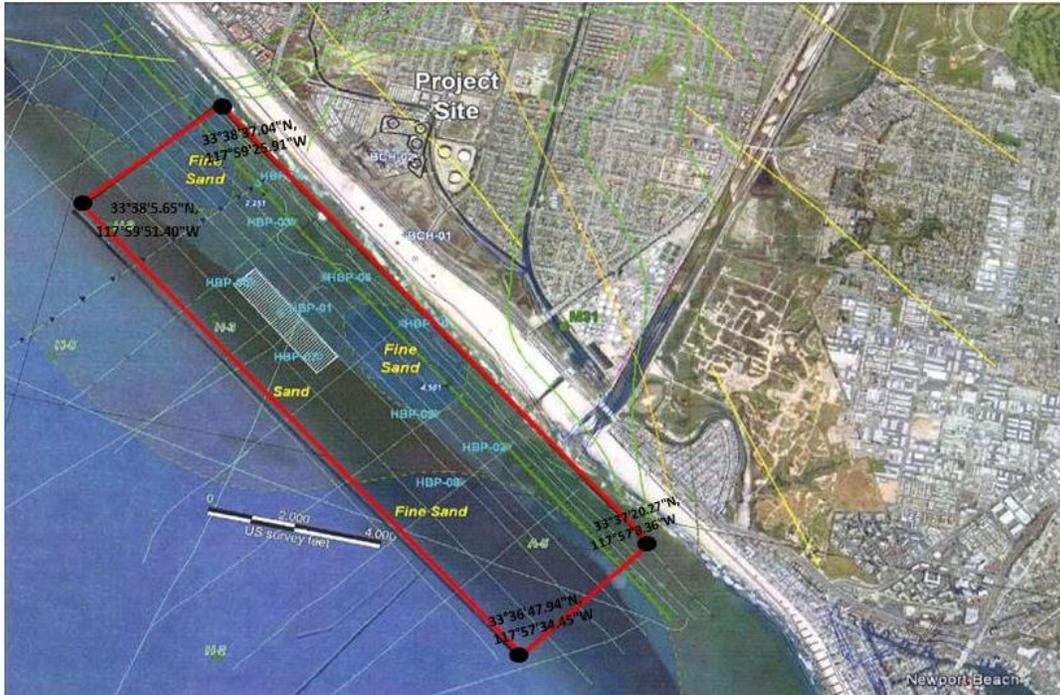


Figure 1-1. Survey area (red box) and the desalination project site in Huntington Beach.

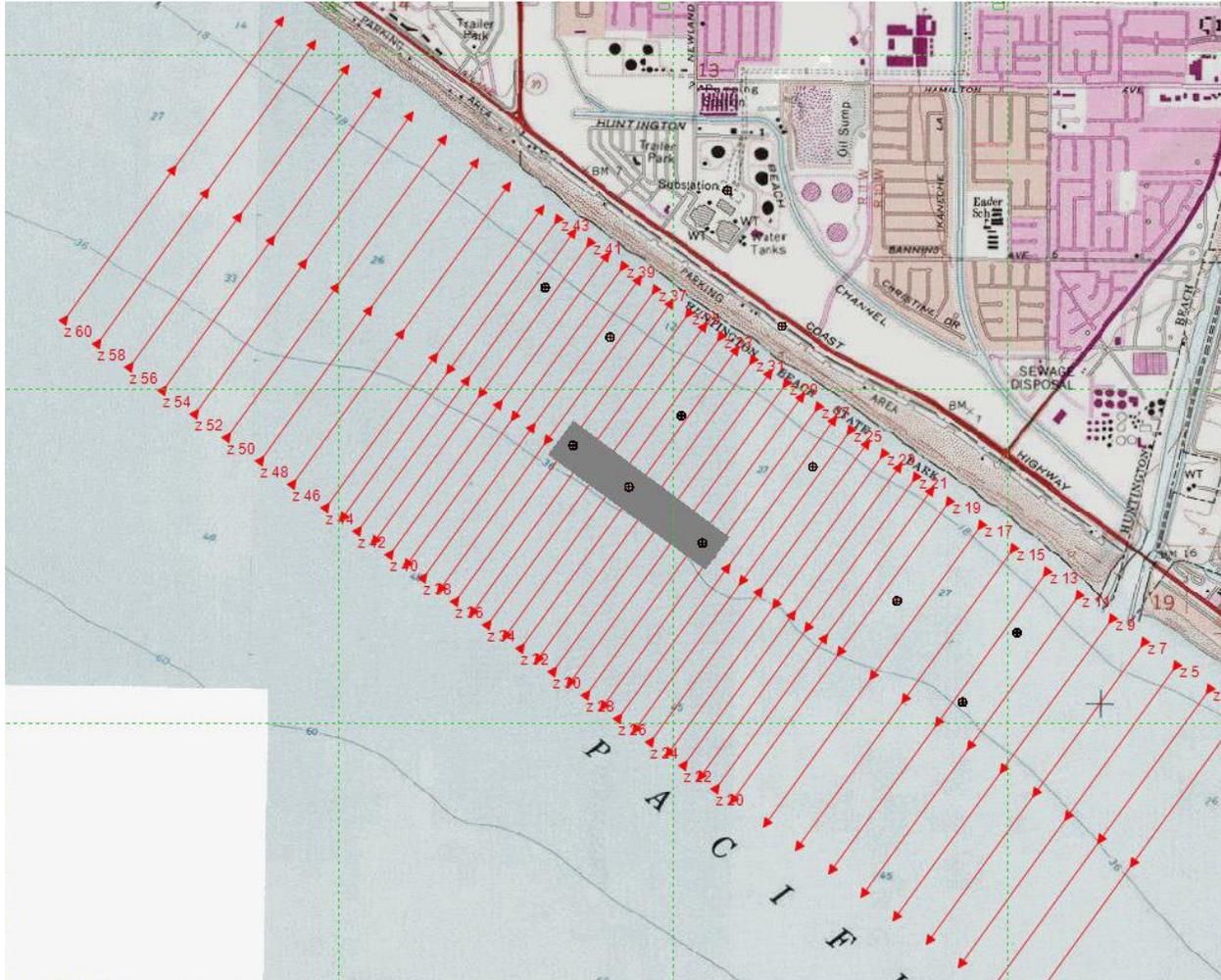


Figure 1-2. Bathymetric survey lines for the geophysical survey conducted at Huntington Beach on 13–15 May 2014.



Figure 1-3. Sub-bottom survey lines for the geophysical survey conducted at Huntington Beach on 13–15 May 2014.

1.2 PROJECT BACKGROUND AND NEED

These surveys were necessary to determine whether any geological hazards, faults, shallow gas, or soft sediments existed in the project area. The surveys examined the nearshore sub-bottom geology in order to characterize the offshore alluvial basin and its suitability for the installation of a subsurface intake system (infiltration gallery) for the proposed Huntington Beach Desalination Project. This intake system would draw saline water from the shallow sediments along the offshore area of the coastline. This approach would ameliorate the problem of saltwater wedge migration into local freshwater wells and eliminate future problems with marine life entrainment during the saline water pumping needed to supply the plant. There are questions regarding the types of alluvial deposits that exist in the offshore basin, their configurations and the associated geological structures, and whether these deposits would permit enough migration of water to the well head to properly supply water to the proposed desalination facility.

The Santa Ana River enters the Pacific Ocean about 1.5 miles south of the project site. The coastal fan/delta system of the Santa Ana River supplies most of the sediment that covers the coastal and nearshore area, whereas ancient channels of the Santa Ana River cut during sea level lowstands constrain the locations of the late Quaternary, coarse-grained fluvial deposits most suitable for groundwater flow. These paleochannels may exist across the area, since the river meandered across much of Orange County as the fan/delta system was building up along the Pleistocene coast.

Geological structures related to deformation along the Newport-Inglewood fault zone may exist in the survey area and create potential obstacles to horizontal fluid transport within the alluvial basin. Identification and mapping of these structures is necessary for input to the groundwater flow models used to evaluate subsurface intake designs. The Newport-Inglewood fault zone is located mostly to the northeast of the project site, although a buried "South Branch Fault" is projected to cross near the southern edge of the site. Judging by the complexity of faulting in this section of the Newport-Inglewood fault zone, where the offshore fault to the south steps northeast onshore in a releasing stepover (for a right-slip fault zone), it is possible that other buried faults cross the survey area. A releasing stepover is an extensional system that may enhance permeability and fluid flow. Many of the "gaps" along the fault zone to the north are sites where seawater intrusion affects the shallow groundwater aquifers. Other hazards that may exist in the offshore area include shallow gas pockets associated with natural seeps along the hydrocarbon-enriched fault zone, as manifested in the adjacent oil fields. These hazards must be avoided or mitigated during the construction of a subsurface intake system.

2.0 OFFSHORE GEOPHYSICAL SURVEY

2.1 GEOPHYSICAL SURVEY DESIGN

The survey included 22 sub-bottom survey lines and 44 bathymetric lines. Survey lines ran both inshore/offshore and shore-parallel (upcoast/downcoast). Shore-parallel survey lines were 18,000 feet long, and inshore/offshore survey lines were approximately 4,000 feet long.

Distances between survey lines varied, as shown in Figures 1-2 and 1-3. The coordinates of the start and end points for each trackline are presented in Table 2-1 for the bathymetric survey and Table 2-2 for the sub-bottom profile survey.

2.2 GEOPHYSICAL SURVEY EQUIPMENT

The following equipment was used for this survey:

- Echosounder (Syquest Bathy 500 MF),
- Sub-bottom profiler (Ross Laboratories transceiver with four 4T61 [3.5 kHz] Massa transducers), and
- DGPS navigation system.

Equipment specifications are in Table 2-3.

2.2.1 Echosounder

An echosounder measures the depth of the seafloor (bathymetry). When continuous measurements of seafloor depth are made along vessel tracks with accurate navigation positions, these depth measurements can be turned into bathymetric maps by connecting points of equal depth.

2.2.2 Sub-bottom Profiler

Sub-bottom profiling equipment allows for the detection and characterization of objects buried below the seafloor. The 3.5 kHz sub-bottom profiler was used for this project and provided excellent records.

2.2.3 Survey Vessel

The survey was conducted using a 27-ft Farrallon trailerable survey boat (Photo 2-1). This boat is powered by a Panther Marine 350 HP engine with dual counter-rotating props. The boat is equipped with DGPS, RADAR, echosounder, and related electronics with a lifting hoist for the deployment of sonar fish and other marine instrumentation.

2.2.4 Navigation System

Navigation and positioning were accomplished with a Differential Global Positioning System (DGPS). The DGPS is an all-weather, radio-based, satellite navigation system that enables users to accurately determine position, velocity, and precise time. The DGPS system consists of a Leica Professional GPS Model MX600, Hydro-Pro Navigation Software, and a differential correction signal receiver. The differential signals come from Coast Guard beacons established for GPS correction. The system provides an accuracy of +/-1 meter (3 feet).

Table 2-1. Coordinates for the bathymetry tracklines.

Number	Starting Latitude	Starting Longitude	Ending Latitude	Ending Longitude
1	33.62484511	-117.9521469	33.61216685	-117.9627023
3	33.6257876	-117.9537642	33.6131092	-117.9643194
5	33.62673006	-117.9553815	33.61405153	-117.9659366
7	33.6276725	-117.9569989	33.61499383	-117.9675539
9	33.62861493	-117.9586163	33.61593612	-117.9691711
11	33.62955732	-117.9602337	33.61687839	-117.9707884
13	33.6304997	-117.9618512	33.61782063	-117.9724058
15	33.63144206	-117.9634687	33.61876286	-117.9740231
17	33.6323844	-117.9650862	33.61970506	-117.9756406
19	33.63332671	-117.9667038	33.62064724	-117.977258
20	33.62111832	-117.9780667	33.63379786	-117.9675126
21	33.634269	-117.9683214	33.6215894	-117.9788755
22	33.62206047	-117.9796842	33.63474014	-117.9691302
23	33.63521128	-117.969939	33.62253154	-117.980493
24	33.6230026	-117.9813018	33.63568241	-117.9707478
25	33.63615353	-117.9715567	33.62347365	-117.9821105
26	33.6239447	-117.9829193	33.63662465	-117.9723655
27	33.63709576	-117.9731744	33.62441575	-117.9837281
28	33.62488679	-117.9845369	33.63756687	-117.9739832
29	33.63803797	-117.9747921	33.62535782	-117.9853457
30	33.62582885	-117.9861546	33.63850906	-117.975601
31	33.63898015	-117.9764099	33.62629988	-117.9869634
32	33.6267709	-117.9877722	33.63945124	-117.9772188
33	33.63992232	-117.9780277	33.62724191	-117.9885811
34	33.62771292	-117.9893899	33.6403934	-117.9788366
35	33.64086447	-117.9796455	33.62818392	-117.9901988
36	33.62865492	-117.9910077	33.64133553	-117.9804545
37	33.64180659	-117.9812634	33.62912591	-117.9918166
38	33.6295969	-117.9926254	33.64227764	-117.9820724
39	33.64274869	-117.9828813	33.63006788	-117.9934343
40	33.63053886	-117.9942433	33.64321973	-117.9836903
41	33.64369077	-117.9844993	33.63100983	-117.9950522
42	33.63148079	-117.9958611	33.64416181	-117.9853083
43	33.64463283	-117.9861173	33.63195175	-117.99667
44	33.63242271	-117.997479	33.64510386	-117.9869263
45	33.64557487	-117.9877353	33.63289366	-117.9982879
46	33.6333646	-117.9990969	33.64604588	-117.9885443

Table 2-1. Coordinates for the bathymetry tracklines (continued).

Number	Starting Latitude	Starting Longitude	Ending Latitude	Ending Longitude
48	33.63430647	-118.0007148	33.64698789	-117.9901624
50	33.63524833	-118.0023328	33.64792988	-117.9917805
52	33.63619016	-118.0039508	33.64887184	-117.9933986
54	33.63713197	-118.0055689	33.64981378	-117.9950168
56	33.63807375	-118.007187	33.65075571	-117.996635
58	33.63901552	-118.0088051	33.65169761	-117.9982532
60	33.63995727	-118.0104233	33.65263949	-117.9998715

Table 2-2. Coordinates for sub-bottom survey tracklines.

Name	Starting Latitude	Starting Longitude	Ending Latitude	Ending Longitude
SB1	33.64081519	-118.0093699	33.65047485	-117.9991581
SB2	33.6468809	-117.9937262	33.63735976	-118.0034395
SB3	33.63287376	-117.996204	33.64237468	-117.98602
SB4	33.64016008	-117.9831551	33.63013137	-117.9917304
SB5	33.62923337	-117.9903337	33.63979048	-117.9814554
SB6	33.63743692	-117.9791521	33.62764872	-117.987419
SB7	33.62533891	-117.9838634	33.63608119	-117.9748317
SB8	33.63497551	-117.9732742	33.62436785	-117.9820579
SB9	33.62119245	-117.9766367	33.63128637	-117.967059
SB10	33.62867269	-117.962683	33.61806187	-117.9717493
SB11	33.61496248	-117.966487	33.62601974	-117.9573351
SB50	33.62394756	-117.952544	33.65185272	-118.0009901
SB51	33.65167249	-118.0011462	33.62322758	-117.9531153
SB52	33.62268922	-117.953424	33.65117702	-118.001562
SB53	33.65068005	-118.0020843	33.62232595	-117.9539489
SB54	33.62156146	-117.9545192	33.64995835	-118.0027617
SB55	33.64923589	-118.0034922	33.62088451	-117.9551977
SB56	33.62007696	-117.9556607	33.64860242	-118.0042246
SB57	33.64783771	-118.0047947	33.61939855	-117.9564455
SB58	33.6181854	-117.957273	33.64743197	-118.005159
SB59	33.64589653	-118.0067247	33.61710429	-117.9582095
SB60	33.61449267	-117.9603928	33.64359332	-118.0090732

Table 2-3. Equipment specifications for echosounder and sub-bottom profiler used on 13–15 May 2014 for the Huntington Beach survey.

Equipment	kHz	Source Level (dB re 1 μPa at 1 meter [m] [root mean square (rms)])	Pulse Rate and Length
Syquest Bathy 500 MF Echosounder	200	230	0.1 ms
Sub-bottom Profiler	3.5	214	330 μ sec



Photo 2-1. ECO-M’s survey vessel “Farallon,” which was used for data collection for the 13–15 May 2014 survey off Huntington Beach.

2.3 GEOPHYSICAL SURVEY EQUIPMENT

A total of 66 survey lines were acquired in a rectilinear grid measuring approximately 18,000 ft by 5,000 ft (2,066 acres). Twenty-two sub-bottom and 44 bathymetric survey lines were acquired in a shore-parallel (upcoast/downcoast) and inshore/offshore orientation. The sub-bottom profiler was towed off the starboard quarter of the vessel from the towing davit fairlead at a depth of 6-10 ft.

A differential Global Positioning Satellite (GPS) navigation system was used to record the shot points at precise one-second intervals during acquisition. A differential system uses ties to the Coast Guard-maintained permanent GPS base station in the area. Nominal GPS position accuracy is about 10 meters, and with differential technique, sub-meter position accuracy (< 3 ft) was achieved. The shot-point navigation (geographic coordinates) during acquisition was based on the World Geodetic System of 1984 (WGS84) and converted to the California State Plane Coordinate System, zone 6, North American Datum of 1983 (NAD83), in U.S. Survey Feet for mapping. Shot-point positions were determined by adding corrections for the layback or acoustic source distance behind the GPS antenna on the boat.

The survey parameters (i.e., area coordinates, line and cross-line spacings) were entered into the Chesapeake SonarWiz5 Navigation Software creating a “pre-plot.” With this pre-plot, it was possible to ensure that adequate survey line coverage had been obtained. The navigation system records the shot-point number, x/y position, date, time, and position information at each selected time interval. Position and time data are automatically stored on a computer hard drive, and digital back-up storage is used. In addition, a real-time Helmsman Correct Course Steering Display helped keep the vessel on the pre-plotted survey lines (Photo 2-2). Simultaneously with the collection of positioning data, an event mark was sent to the recorders, which was annotated with shot-point number, time, and date.

Data quality was established in the field during acquisition by monitoring the data being recorded by the digital data-acquisition system and by preliminary data processing aboard the boat. The software used for the digital recording of the data allows for the display of shot records and some quantitative measures of signal and noise levels. Real-time records from the data-acquisition system were also displayed to show data quality and to allow for preliminary geological interpretation.

2.3.1 Echosounder

A total of 44 tracklines were acquired for the bathymetric survey. Tracklines were run in an inshore/offshore orientation and a shore-parallel (upcoast/downcoast) orientation (Figure 1-2). Inshore/offshore tracklines were approximately 4,000 feet in length. Shore-parallel (upcoast/downcoast) tracklines were approximately 18,000 feet in length. Distances between tracklines varied from 200 feet to more than 1,000 feet. The echosounder is located underneath the vessel, at about 1 m or less below the surface. Data acquisition was with a Trimble Hydropro.



Photo 2-2. The helmsman steering display, seen in the photograph, shows pre-plotted survey lines.

2.3.2 Sub-bottom Profiling

A total of 22 tracklines were acquired for the sub-bottom profiler survey (Table 2-2). Sub-bottom tracklines were conducted in an inshore/offshore and shore-parallel (upcoast/downcoast) orientation (Figure 1-3). Inshore/offshore tracklines were approximately 4,000 feet in length. Shore-parallel (upcoast/downcoast) tracklines were approximately 18,000 feet in length. Distances between tracklines varied, ranging between 200 to over 1,000 ft. The sub-bottom profiler was towed off the starboard quarter on a cable length of 2 m (6.5 ft). Data acquisition was with the Chesapeake SonarWiz 5.

2.4 DATA PROCESSING AND INTERPRETATION

2.4.1 Data Processing

Data processing for the sub-bottom profile data was performed using the ChesapeakeTM post-processing module of SonarWiz 5. Data processing for the bathymetric survey was done with Hydro Pro. For the bathymetric data, the data were referenced to the local datum of Mean Lower Low Water (MLLW) using data from the LA Harbor tide gauge (9410660).

2.4.2 Data Interpretation

Sub-bottom profile data were processed to identify the nearshore sub-bottom geology in order to characterize the offshore alluvial basin and its suitability for the installation of a subsurface intake system (infiltration gallery). Echosounder data were overlain onto sub-bottom profile data to determine the bathymetric contours of the surveyed areas.

2.5 MARINE MAMMAL OBSERVATION

The marine mammal observer's report is presented in Appendix A. In this report, we provide daily summaries of observed mammals during the surveys and weather logs through 15 May 2014. The marine mammal surveys were carried out by Mr. Steven Putnam. Mr. Putnam is a certified Marine Mammal Observer.

3.0 RESULTS

Figure 3-1 shows the bathymetry of the surveyed area off Huntington Beach. Figures 3-2 and 3-3 show the sub-bottom profiles for selected transects. The locations of these transects are shown in Figure 1-3.

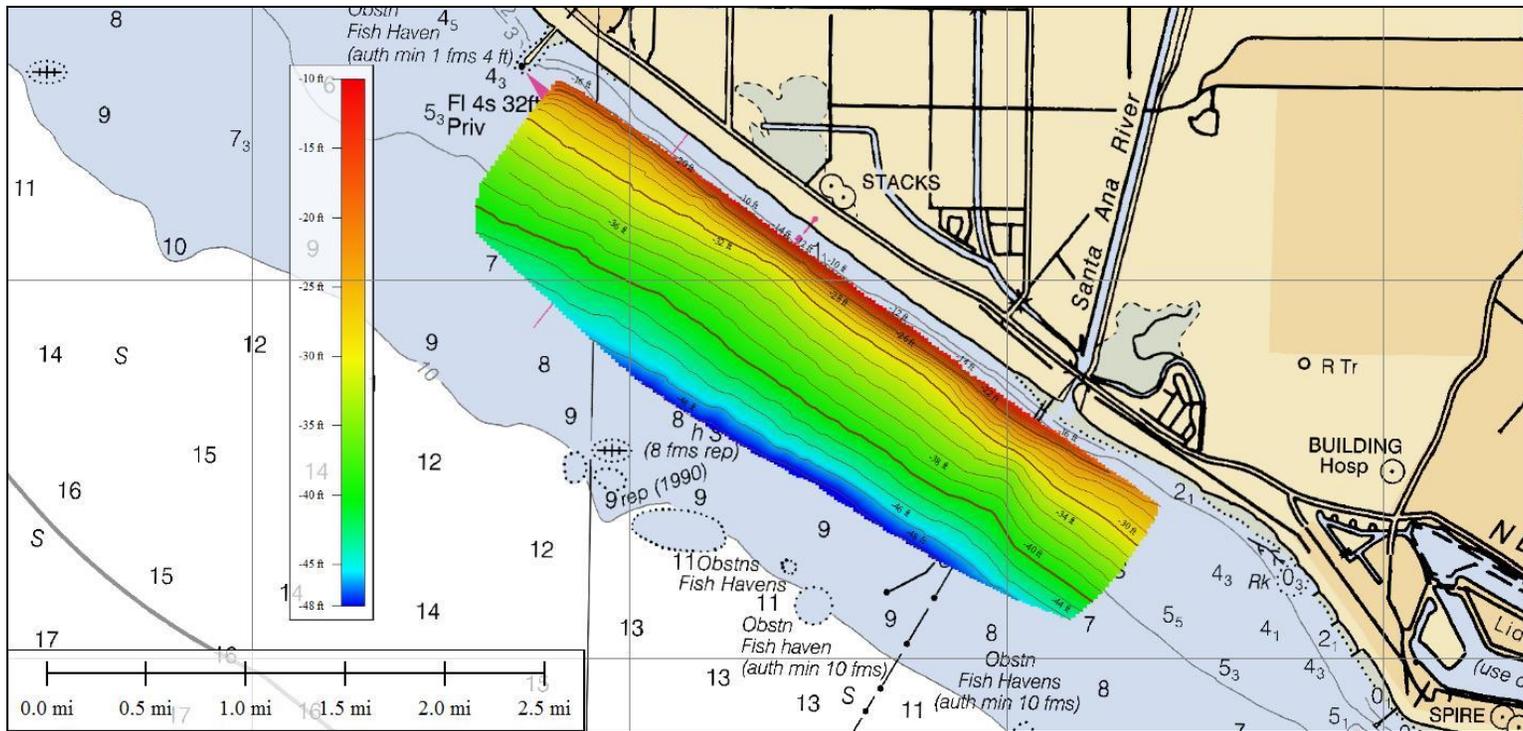


Figure 3-1. Bathymetry map of the surveyed area.

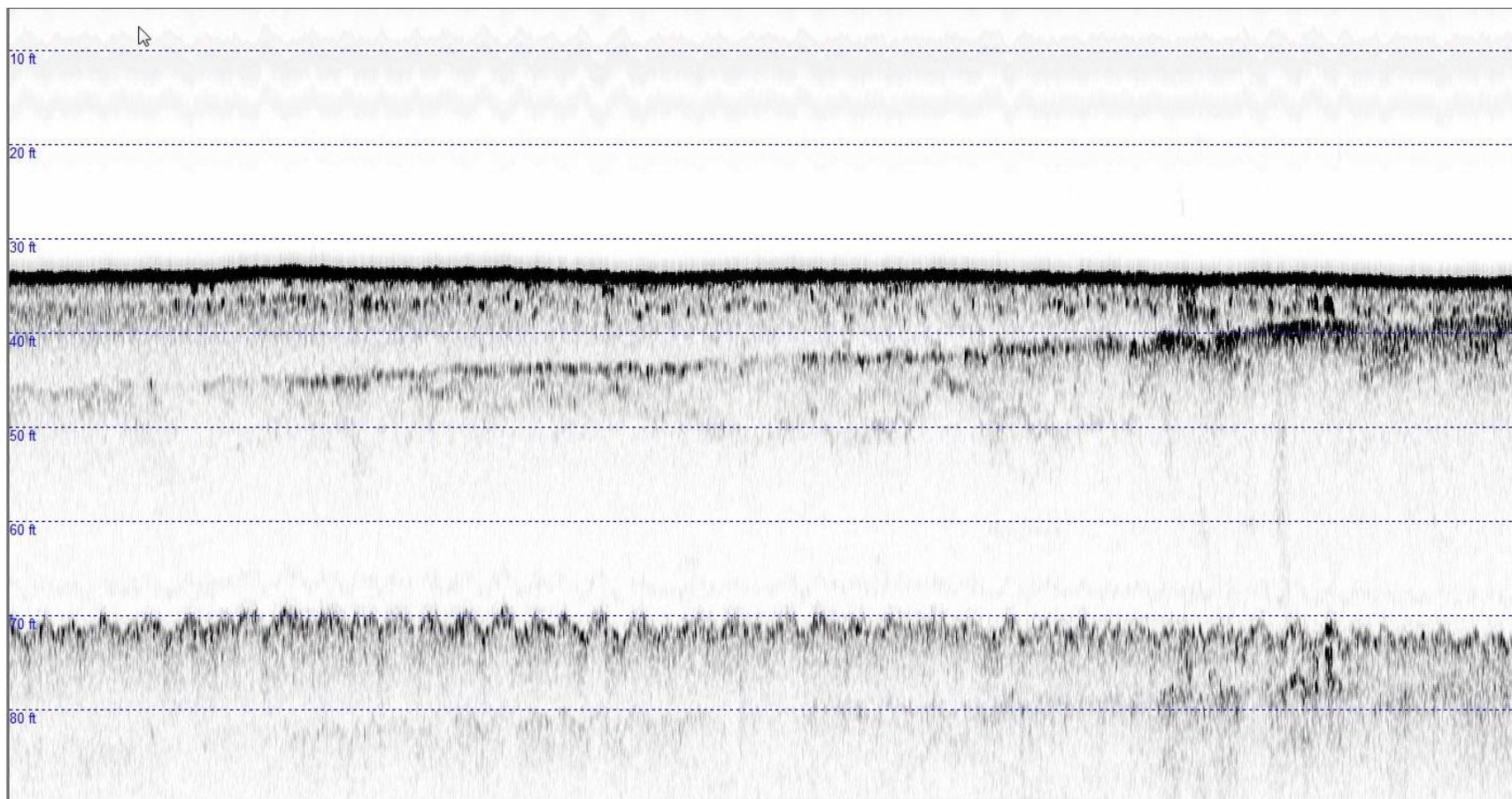


Figure 3-2. Sub-bottom profile for transect SB58 parallel to the shoreline. Location of profile SB58 is shown in Figure 1-3.

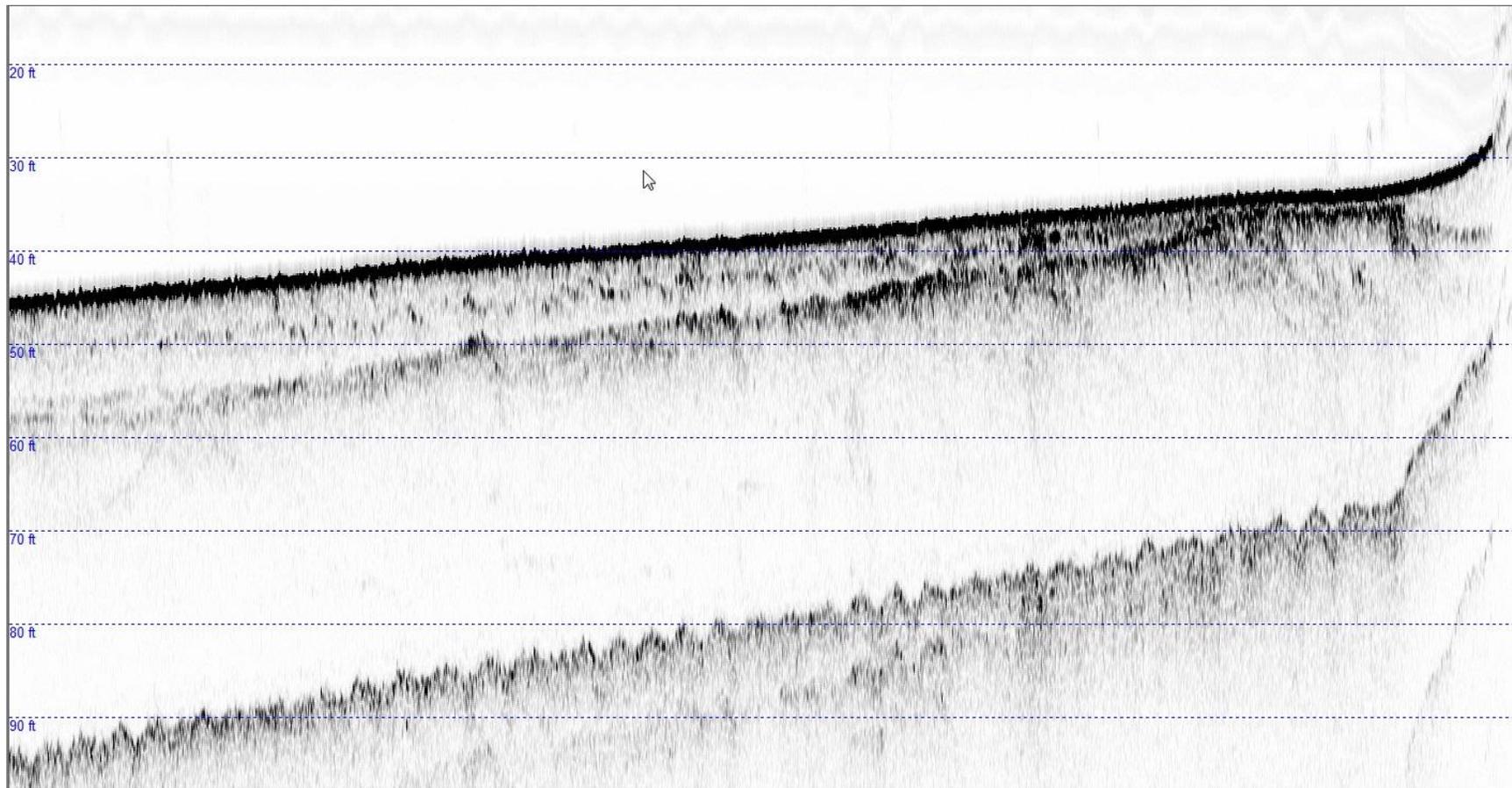


Figure 3-3. Sub-bottom profile for transect SB6 from 25 to 45 ft water depth. Location of profile SB6 is shown in Figure 1-3.

APPENDIX A
MARINE MAMMAL OBSERVER REPORT

Daily Log
ECO-M Survey
13 May 2014

Monitor: Steven Putnam, MMCG

Time	Species	Age class	Total	Behavior	Bearing	Range	Remarks
0800-0830							Initial circuit of area for marine mammals
0850							Sub-bottom profiler sonar started. No ramp-up since equipment only allowed switching on & off according to sonar tech Richard McGee
0901							Survey started
1109							Line complete. All stop
1110	T.t.	Adults	12-15	MI/ST	E	50 m	Still stopped. Equipment shut down as boat headed toward shore
1117	T.t.	Adults	12-15	ST	E	250 m	Resumed survey at farthest point from shore near SW corner of site
1142	Z.c.	Adult	1	RE	N	230 m	Animal resting on surface & not disturbed
1338							Crew alerted observer of grey whale. All equipment shut down (boat and sonar)
1338	E.r.	Adult	1	ST	N	150 m	Whale crossed bow as boat turned S to set up for next survey line. Equipment and boat remained off.
1344	E.r.	Adult	1	ST	W	450 m	Out of hazard zone; survey resumed
1455	Z.c.	Adult	1	ST	SSW	4 m	Equipment was already shut down because traveling to new survey line.
1502							Started new survey line
1801							Survey finished for day

T.t. *Tursiops truncatus*, common bottlenose dolphin ST Slow travel
Z.c. *Zalophus californianus*, California sea lion RE Resting
E.r. *Eschrichtius robustus*, gray whale
MI Milling

Weather Log

ECO-M Survey 13 May 2014

Time	% clouds (0-10)	Cloud type	Air Temp.	Visibility	Wind Direction	Wind Velocity	Swell Direction	Swell Height
0822	0	-	72° F	10 km clear	N	8-10 kts	E	0.33 m
1000	0	-	75° F	10 km clear	N	10 kts	SE	0.33 m
1054	0	-	75° F	7-10 km clear	N	12-13 kts	SE	0.33 m
1315	0	-	80° F	6-8 km clear	NE	6-8 kts	SE	0.75 m
1450	0	-	85+° F	6-8 km clear	NE	6-8 kts	S	0.5 m
1520	0	-	80° F	8-10 km clear	W	8-10 kts	S	0.75-1 m
1700	0	-	75° F	8-10 km clear	W	10-12 kts	W	0.75 m
1801	0	-	71° F	8-10 km clear	W	6-8 kts	W	1.0 m

Explanations:

1. Time of tide(s) is in local times.
2. Percentage of cloud cover is on scale of 0 to 10, with 0 representing no clouds or fog and 10 representing complete cloud cover or dense fog.
3. Examples of cloud types: low cumulus, fog, marine layer, cirrus.
4. Visibility is in kilometers and represents the distance at which objects can be *clearly* seen.
5. Wind direction is the direction the wind is coming from, not going toward.
6. Wind velocity is in knots.
7. Swell direction is the direction the swell is coming from, not going toward.
8. Swell height is in meters or fractions of meters. Swell heights are onsite breaker heights, not offshore swell heights.

Daily Log
ECO-M Survey
14 May 2014

Monitor: Steven Putnam, MMCG

Time	Species	Age class	Total	Behavior	Bearing	Range	Remarks
0700-0744							Initial circuit of area for marine mammals
0744							Survey started with sub-bottom profiler sonar
0819							All Stop.
0819	T.t.	Adult	1	ST	E	50 m	Survey had already stopped as animal approached hazard zone (233 m). Equipment shut down.
0825							Animal left area; survey resumed
1025							All stop.
1025	Z.c.	Adult	1	FE	S	50 m	Animal feeding on surface. Equipment shut down. Boat moved E
1034	.						Survey resumed
1158							Computer error; equipment stopped
1215							Sub-bottom survey completed

Weather Log

ECO-M Survey 14 May 2014

Time	% clouds (0-10)	Cloud type	Air Temp.	Visibility	Wind Direction	Wind Velocity	Swell Direction	Swell Height
0720	0	-	75° F	10+ km clear	NE	2-3 kts.	S	flat
0900	0	-	78° F	10 km clear	E	5-8 kts.	S	1.0 m
1019	0	-	78° F	10 km clear	N	5-8 kts.	NNE	0.33 m
1100	0	-	80° F	10 km clear	N	8-10 kts.	N	0.33 m
1200	0	-	78° F	10 km clear	W	4-5 kts.	SW	Nearly flat
1300	0	-	78° F	10 km clear	W	6-8 kts	SW	0.5 m chop
1400	0	-	78° F	10 km clear	W	8-10 kts	SSW	0.5 m
1530	0	-	75° F	10 km clear	W	10-12 kts	SSW	1.0 m
1600	0		75° F	10 km clear	W	12-14 kts	SSW	1.25 m – too much chop to continue

Daily Log
ECO-M Survey
15 May 2014

Monitor: Steven Putnam, MMCG

Time	Species	Age class	Total	Behavior	Bearing	Range	Remarks
0730-0800							Initial circuit of area for marine mammals
0759	Z.c.	Adult	1	ST	W	150 m	Advised captain of sea lion. Equipment shut down.
0800							Survey started with high-frequency echosounder
0806	Z.c.	Adult	1	FE	N	75 m	Technical problem with echosounder. Stopped. Sea lion noted heading toward boat. Equipment shut down at time.
0808	Z.c.	Adult	1	FE	SE	40 m	Sea lion moved closer to boat; moved E to new line. Equipment still shut down.
0814							Area clear; echosounder resumed
0830	Z.c.	Adult	1	ST	W	400 m	Same sea lion seen at 0808
0854	Z.c.	Adults	2	RE	SE	150 m	Mammals out of safety zone (95 m) ; vessel headed W
0900							Echousounder started
0903							Equipment pulled because of technical problem
0907							Equipment resumed
1008	T.t.	Adults	~20	MI	SE	450 m	Equipment stopped
1010	T.t.	Adults	2	MI	E	120 m	To starboard. Mammals out of hazard zone (95 m)
1011	T.t.	Adult	1	MI	E	150 m	
1054	T.t.	Adults	~50	FT	SSE	600-800 m	All-stop called because of fast approach
1101	T.t.	Adults	~50	FT	SSE	500 m	All clear; restarted sonar

1400							Continuing echosounder
1504							Shut down to change out computer
1524							Restarted echosounder; false read
1546							Computer down; chop suspected problem
1608							Restarted echosounder
1857							Survey completed

Weather Log

ECO-M Survey 15 May 2014

Time	% clouds (0-10)	Cloud type	Air Temp.	Visibility	Wind Direction	Wind Velocity	Swell Direction	Swell Height
0730	0	-	75° F	8 km clear	-	0 kts	-	flat
0900	0	Pollution haze SE to W (110°-280°)	80° F	8 km clear	E	2 kts	SE	1.5 m
0925	0	-	85° F	8 km clear	-	0 kts	S	1.0 m
1023	0	-	85° F	8 km clear	ESE	1 kts	S	1.0 m
1207	0	-	85° F	8 km clear	SSW	2 kts	S	1.2 m
1300	0	-	85° F	8 km clear	W	3 kts	SSW	1.0 m
1400	0	-	85° F	8 km clear	W	3 kts	W	0.75 m
1500	0	-	80° F	8 km clear	W	7 kts	W	0.75 m
1600	0	-	78° F	8 km clear		7-10 kts	W	0.5 m
1700	0	-	78° F	8-10 km clear	W	5-7 kts	W	0.5 m
1800	0	-	70+° F	8-10 km clear	W	7-10 kts	W	0.5 m

EXHIBIT H

Mitigation Monitoring Program

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
<i>Air Quality and Greenhouse Gas (GHG) Emissions (MND Section 3.3.3)</i>						
MM AIR-1: Engine Tuning, Engine Certification, and Fuels. The following measures will be required to be implemented by all Permittees under the Offshore Geophysical Permit Program (OGPP), as applicable depending on the county offshore which a survey is being conducted. Pursuant to section 93118.5 of CARB's Airborne Toxic Control Measures, the Tier 2 engine requirement applies only to diesel-fueled vessels.	All Counties: Maintain all construction equipment in proper tune according to manufacturers' specifications; fuel all off-road and portable diesel-powered equipment with California Air Resources Board (CARB)-certified motor vehicle diesel fuel limiting sulfur content to 15 parts per million or less (CARB Diesel).	Daily emissions of criteria pollutants during survey activities are minimized.	Determine engine certification of vessel engines. Review engine emissions data to assess compliance, determine if changes in tuning or fuel are required.	OGPP permit holder and contract vessel operator; California State Lands Commission (CSLC) review of Final Monitoring Report.	Prior to, during, and after survey activities. Submit Final Monitoring Report after completion of survey activities.	N/A – exempt – gasoline vessel
	Los Angeles and Orange Counties: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner; the survey shall be operated such that daily NO _x emissions do not exceed 100 pounds based on engine certification emission factors. This can be accomplished with Tier 2 engines if daily fuel use is 585 gallons or less, and with Tier 3 engines if daily fuel use is 935 gallons or less.	Verify that Tier 2 or cleaner engines are being used. Calculate daily NO _x emissions to verify compliance with limitations.	N/A – exempt – gasoline vessel			
	San Luis Obispo County: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner, accomplished with Tier 2 engines if daily fuel use is 585 gallons or less; all diesel equipment shall not idle for more than 5 minutes; engine use needed to maintain position in the water is not considered idling; diesel idling within 300 meters (1,000 feet) of sensitive receptors is not permitted; use alternatively fueled construction equipment on site where feasible, such as compressed natural gas, liquefied natural gas, propane or biodiesel.	Verify that Tier 2 or cleaner engines are being used. Inform vessel operator(s) of idling limitation. Investigate availability of alternative fuels.	N/A – exempt – gasoline vessel			
	Santa Barbara County: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner, accomplished with Tier 2 engines if daily fuel use is 790 gallons or less.	Verify that Tier 2 or cleaner engines are being used. Investigate availability of alternative fuels.	N/A – exempt – gasoline vessel			
	Ventura County: Use alternatively fueled construction equipment on site where feasible, such as compressed natural gas, liquefied natural gas, propane or biodiesel.	Investigate availability of alternative fuels.	N/A – exempt – gasoline vessel			

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MM BIO-1: Marine Mammal and Sea Turtle Presence – Current Information.	All State waters; prior to commencement of survey operations, the geophysical operator shall: (1) contact the National Oceanic and Atmospheric Administration Long Beach office staff and local whale-watching operations and shall acquire information on the current composition and relative abundance of marine wildlife offshore, and (2) convey sightings data to the vessel operator and crew, survey party chief, and onboard Marine Wildlife Monitors (MWMs) prior to departure. This information will aid the MWMs by providing data on the approximate number and types of organisms that may be in the area.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Document contact with appropriate sources. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder; Inquiry to NOAA and local whale watching operators.	Prior to survey.	NE 5/12/14
MM BIO-2: Marine Wildlife Monitors (MWMs).	Except as provided in section 7(h) of the General Permit, a minimum of two (2) qualified MWMs who are experienced in marine wildlife observations shall be onboard the survey vessel throughout both transit and data collection activities. The specific monitoring, observation, and data collection responsibilities shall be identified in the Marine Wildlife Contingency Plan required as part of all Offshore Geophysical Permit Program permits. Qualifications of proposed MWMs shall be submitted to the National Oceanic and Atmospheric Administration (NOAA) and CSLC at least twenty-one (21) days in advance of the survey for their approval by the agencies. Survey operations shall not commence until the CSLC approves the MWMs.	Competent and professional monitoring or marine mammals and sea turtles; compliance with established monitoring policies.	Document contact with and approval by appropriate agencies. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	HE 5/13/14- 5/15/14 Approval by NOAA on 5/12/14
MM BIO-3: Safety Zone Monitoring.	Onboard Marine Wildlife Monitors (MWMs) responsible for observations during vessel transit shall be responsible for monitoring during the survey equipment operations. All visual monitoring shall occur from the highest practical vantage point aboard the survey vessel; binoculars shall be used to observe the surrounding area, as appropriate. The MWMs will survey an area (i.e., safety or exclusion zone) based on the equipment used, centered on the sound source (i.e., vessel, towfish), throughout time that the survey equipment is operating. Safety zone radial distances, by equipment type, include:	No adverse effects to marine mammals or sea turtles due to survey activities are observed; compliance with established safety zones.	Compliance with permit requirements (observers); compliance with established safety zones. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	SP (MWO) 5/13/14- 5/15/14

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	<table border="1" data-bbox="401 239 852 421"> <thead> <tr> <th data-bbox="407 247 683 287">Equipment Type</th> <th data-bbox="689 247 846 287">Safety Zone (radius, m)</th> </tr> </thead> <tbody> <tr> <td data-bbox="407 291 683 317">Single Beam Echosounder</td> <td data-bbox="689 291 846 317">50</td> </tr> <tr> <td data-bbox="407 321 683 347">Multibeam Echosounder</td> <td data-bbox="689 321 846 347">500</td> </tr> <tr> <td data-bbox="407 351 683 376">Side-Scan Sonar</td> <td data-bbox="689 351 846 376">600</td> </tr> <tr> <td data-bbox="407 381 683 406">Subbottom Profiler</td> <td data-bbox="689 381 846 406">100</td> </tr> <tr> <td data-bbox="407 411 683 436">Boomer System</td> <td data-bbox="689 411 846 436">100</td> </tr> </tbody> </table> <p data-bbox="349 444 904 1049">If the geophysical survey equipment is operated at or above a frequency of 200 kilohertz (kHz), safety zone monitoring and enforcement is not required; however, if geophysical survey equipment operated at a frequency at or above 200 kHz is used simultaneously with geophysical survey equipment less than 200 kHz, then the safety zone for the equipment less than 200 kHz must be monitored. The onboard MWMs shall have authority to stop operations if a mammal or turtle is observed within the specified safety zone and may be negatively affected by survey activities. The MWMs shall also have authority to recommend continuation (or cessation) of operations during periods of limited visibility (i.e., fog, rain) based on the observed abundance of marine wildlife. Periodic reevaluation of weather conditions and reassessment of the continuation/cessation recommendation shall be completed by the onboard MWMs. During operations, if an animal's actions are observed to be irregular, the monitor shall have authority to recommend that equipment be shut down until the animal moves further away from the sound source. If irregular behavior is observed, the equipment shall be shut-off and will be restarted and ramped-up to full power, as applicable, or will not be started until the animal(s) is/are outside of the safety zone or have not been observed for 15 minutes.</p> <p data-bbox="349 1072 904 1235">For nearshore survey operations utilizing vessels that lack the personnel capacity to hold two (2) MWMs aboard during survey operations, at least twenty-one (21) days prior to the commencement of survey activities, the Permittee may petition the CSLC to conduct survey operations with one (1) MWM aboard. The CSLC will consider such authorization on a case-by-case basis and</p>	Equipment Type	Safety Zone (radius, m)	Single Beam Echosounder	50	Multibeam Echosounder	500	Side-Scan Sonar	600	Subbottom Profiler	100	Boomer System	100					<p data-bbox="1561 568 1676 658">SP (MWO) 5/13/14- 5/15/14</p>
Equipment Type	Safety Zone (radius, m)																	
Single Beam Echosounder	50																	
Multibeam Echosounder	500																	
Side-Scan Sonar	600																	
Subbottom Profiler	100																	
Boomer System	100																	

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	factors the CSLC will consider will include the timing, type, and location of the survey, the size of the vessel, and the availability of alternate vessels for conducting the proposed survey. CSLC authorizations under this subsection will be limited to individual surveys and under any such authorization; the Permittee shall update the MWCP to reflect how survey operations will occur under the authorization.					SP (MWO) 5/13/14- 5/15/14
MM BIO-4: Limits on Nighttime OGPP Surveys.	All State waters; nighttime survey operations are prohibited under the OGPP, except as provided below. The CSLC will consider the use of single beam echosounders and passive equipment types at night on a case-by-case basis, taking into consideration the equipment specifications, location, timing, and duration of survey activity.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Presurvey request for nighttime operations, including equipment specifications and proposed use schedule. Document equipment use. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Approval required before survey is initiated. Monitoring Report following completion of survey.	N/A – no nighttime surveys conducted
MM BIO-5: Soft Start.	All State waters; the survey operator shall use a “soft start” technique at the beginning of survey activities each day (or following a shut down) to allow any marine mammal that may be in the immediate area to leave before the sound sources reach full energy. Surveys shall not commence at nighttime or when the safety zone cannot be effectively monitored. Operators shall initiate each piece of equipment at the lowest practical sound level, increasing output in such a manner as to increase in steps not exceeding approximately 6 decibels (dB) per 5-minute period. During ramp-up, the Marine Wildlife Monitors (MWMs) shall monitor the safety zone. If marine mammals are sighted within or about to enter the safety zone, a power-down or shut down shall be implemented as though the equipment was operating at full power. Initiation of ramp-up procedures from shut down requires that the MWMs be able to visually observe the full safety zone.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Compliance with permit requirements (observers); compliance with safe start procedures. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Immediately prior to survey.	SP (MWO) 5/13/14- 5/15/14

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Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
<p>MM BIO-6: Practical Limitations on Equipment Use and Adherence to Equipment Manufacturer's Routine Maintenance Schedule.</p>	<p>All State waters; geophysical operators shall follow, to the maximum extent possible, the guidelines of Zykov (2013) as they pertain to the use of subbottom profilers and side-scan sonar, including:</p> <ul style="list-style-type: none"> • Using the highest frequency band possible for the subbottom profiler; • Using the shortest possible pulse length; and • Lowering the pulse rate (pings per second) as much as feasible. <p>Geophysical operators shall consider the potential applicability of these measures to other equipment types (e.g., boomer). Permit holders will conduct routine inspection and maintenance of acoustic-generating equipment to ensure that low energy geophysical equipment used during permitted survey activities remains in proper working order and within manufacturer's equipment specifications. Verification of the date and occurrence of such equipment inspection and maintenance shall be provided in the required presurvey notification to CSLC.</p>	<p>No adverse effects to marine mammals or sea turtles due to survey activities are observed.</p>	<p>Document initial and during survey equipment settings.</p> <p>Submit Final Monitoring Report after completion of survey activities.</p>	<p>OGPP permit holder.</p>	<p>Immediately prior to and during survey.</p>	<p>HE 5/13/14 – 5/15/14</p>
<p>MM BIO-7: Avoidance of Pinniped Haul-Out Sites.</p>	<p>The Marine Wildlife Contingency Plan (MWCP) developed and implemented for each survey shall include identification of haul-out sites within or immediately adjacent to the proposed survey area. For surveys within 300 meters (m) of a haul-out site, the MWCP shall further require that:</p> <ul style="list-style-type: none"> • The survey vessel shall not approach within 91 m of a haul-out site, consistent with National Marine Fisheries Service (NMFS) guidelines; • Survey activity close to haul-out sites shall be conducted in an expedited manner to minimize the potential for disturbance of pinnipeds on land; and • Marine Wildlife Monitors shall monitor pinniped activity onshore as the vessel approaches, observing and reporting on the number of pinnipeds potentially disturbed (e.g., via head lifting, flushing into the water). The purpose of such reporting is to provide CSLC and California Department of Fish and Wildlife (CDFW) with information regarding potential disturbance associated with OGPP surveys. 	<p>No adverse effects to pinnipeds at haul outs are observed.</p>	<p>Document pinniped reactions to vessel presence and equipment use.</p> <p>Submit Final Monitoring Report after completion of survey activities.</p>	<p>OGPP permit holder.</p>	<p>Monitoring Report following completion of survey.</p>	<p>NE 3/17/14 – no pinniped haul-out sites in area</p>

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-8: Reporting Requirements – Collision.	<p>All State waters; if a collision with marine mammal or reptile occurs, the vessel operator shall document the conditions under which the accident occurred, including the following:</p> <ul style="list-style-type: none"> • Vessel location (latitude, longitude) when the collision occurred; • Date and time of collision; • Speed and heading of the vessel at the time of collision; • Observation conditions (e.g., wind speed and direction, swell height, visibility in miles or kilometers, and presence of rain or fog) at the time of collision; • Species of marine wildlife contacted (if known); • Whether an observer was monitoring marine wildlife at the time of collision; and, • Name of vessel, vessel owner/operator, and captain officer in charge of the vessel at time of collision. <p>After a collision, the vessel shall stop, if safe to do so; however, the vessel is not obligated to stand by and may proceed after confirming that it will not further damage the animal by doing so. The vessel will then immediately communicate by radio or telephone all details to the vessel's base of operations, and shall immediately report the incident. Consistent with Marine Mammal Protection Act requirements, the vessel's base of operations or, if an onboard telephone is available, the vessel captain him/herself, will then immediately call the National Oceanic and Atmospheric Administration (NOAA) Stranding Coordinator to report the collision and follow any subsequent instructions. From the report, the Stranding Coordinator will coordinate subsequent action, including enlisting the aid of marine mammal rescue organizations, if appropriate. From the vessel's base of operations, a telephone call will be placed to the Stranding Coordinator, NOAA National Marine Fisheries Service (NMFS), Southwest Region, Long Beach, to obtain instructions. Although NOAA has primary responsibility for marine mammals in both State and Federal waters, the California Department of Fish and Wildlife (CDFW) will also be advised that an incident has occurred in State waters affecting a protected species.</p>	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Monitoring Report following completion of survey.	N/A – no collisions. Mandated in Marine Wildlife Contingency Plan dated March 2014

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Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-9: Limitations on Survey Operations in Select Marine Protected Areas (MPAs).	All MPAs; prior to commencing survey activities, geophysical operators shall coordinate with the CLSC, California Department of Fish and Wildlife (CDFW), and any other appropriate permitting agency regarding proposed operations within MPAs. The scope and purpose of each survey proposed within a MPA shall be defined by the permit holder, and the applicability of the survey to the allowable MPA activities shall be delineated by the permit holder. If deemed necessary by CDFW, geophysical operators will pursue a scientific collecting permit, or other appropriate authorization, to secure approval to work within a MPA, and shall provide a copy of such authorization to the CSLC as part of the required presurvey notification to CSLC. CSLC, CDFW, and/or other permitting agencies may impose further restrictions on survey activities as conditions of approval.	No adverse effects to MPA resources due to survey activities are observed.	Monitor reactions of wildlife to survey operations; report on shutdown conditions and survey restart. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder; survey permitted by CDFW.	Prior to survey.	N/A No MPAs in project area
MM HAZ-1: Oil Spill Contingency Plan (OSCP) Required Information.	Permittees shall develop and submit to CSLC staff for review and approval an OSCP that addresses accidental releases of petroleum and/or non-petroleum products during survey operations. Permittees' OSCP's shall include the following information for each vessel to be involved with the survey: <ul style="list-style-type: none"> • Specific steps to be taken in the event of a spill, including notification names, phone numbers, and locations of: (1) nearby emergency medical facilities, and (2) wildlife rescue/response organizations (e.g., Oiled Wildlife Care Network); • Description of crew training and equipment testing procedures; and • Description, quantities, and location of spill response equipment onboard the vessel. 	Reduction in the potential for an accidental spill. Proper and timely response and notification of responsible parties in the event of a spill.	Documentation of proper spill training. Notification of responsible parties in the event of a spill.	OGPP permit holder and contract vessel operator.	Prior to survey.	HE 3/17/14
MM HAZ-2: Vessel fueling restrictions.	Vessel fueling shall only occur at an approved docking facility. No cross vessel fueling shall be allowed.	Reduction in the potential for an accidental spill.	Documentation of fueling activities.	Contract vessel operator.	Following survey.	N/A – boat is trailered and fuels on land
MM HAZ-3: OSCP equipment and supplies.	Onboard spill response equipment and supplies shall be sufficient to contain and recover the worst-case scenario spill of petroleum products as outlined in the OSCP.	Proper and timely response in the event of a spill.	Notification to CSLC of onboard spill response equipment/supplies inventory, verify	Contract vessel operator.	Prior to survey.	HE 3/17/14 – supplies confirmed

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			ability to respond to worst-case spill.			
MM HAZ-1: Oil Spill Contingency Plan (OSCP) Required Information.	Outlined under Hazards and Hazardous Materials (above)					HE 3/17/14
MM HAZ-2: Vessel fueling restrictions.	Outlined under Hazards and Hazardous Materials (above)					N/A – boat is trailered and fuels on land
MM HAZ-3: OSCP equipment and supplies.	Outlined under Hazards and Hazardous Materials (above)					HE 3/17/14
MM BIO-9: Limitations on Survey Operations in Select MPAs.	Outlined under Biological Resources (above)					N/A no MPAs
MM REC-1: U.S. Coast Guard (USCG), Harbormaster, and Dive Shop Operator Notification.	All California waters where recreational diving may occur; as a survey permit condition, the CSLC shall require Permittees to provide the USCG with survey details, including information on vessel types, survey locations, times, contact information, and other details of activities that may pose a hazard to divers so that USCG can include the information in the Local Notice to Mariners, advising vessels to avoid potential hazards near survey areas. Furthermore, at least twenty-one (21) days in advance of in-water activities, Permittees shall: (1) post such notices in the harbormasters' offices of regional harbors; and (2) notify operators of dive shops in coastal locations adjacent to the proposed offshore survey operations.	No adverse effects to recreational divers from survey operations.	Notify the USCG, local harbormasters, and local dive shops of planned survey activity. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	NE – 3/17/14

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MM FISH-1: U.S. Coast Guard (USCG) and Harbormaster Notification.	All California waters; as a survey permit condition, the CSLC shall require Permittees to provide the USCG with survey details, including information on vessel types, survey locations, times, contact information, and other details of activities that may pose a hazard to mariners and fishers so that USCG can include the information in the Local Notice to Mariners, advising vessels to avoid potential hazards near survey areas. Furthermore, at least twenty-one (21) days in advance of in-water activities, Permittees shall post such notices in the harbormasters' offices of regional harbors.	No adverse effects to commercial fishing gear in place.	Notify the USCG and local harbormasters of planned survey activity. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	NE – 3/17/14
MM FISH-2: Minimize Interaction with Fishing Gear.	To minimize interaction with fishing gear that may be present within a survey area: (1) the geophysical vessel (or designated vessel) shall traverse the proposed survey corridor prior to commencing survey operations to note and record the presence, type, and location of deployed fishing gear (i.e., buoys); (2) no survey lines within 30 m (100 feet) of observed fishing gear shall be conducted. The survey crew shall not remove or relocate any fishing gear; removal or relocation shall only be accomplished by the owner of the gear upon notification by the survey operator of the potential conflict.	No adverse effects to commercial fishing gear in place.	Visually observe the survey area for commercial fishing gear. Notify the gear owner and request relocation of gear outside survey area. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Immediately prior to survey (prior to each survey day).	MJ (captain) 5/12/14
MM FISH-1: USCG and Harbormaster Notification.	Outlined under Commercial and Recreational Fisheries (above)					NE – 3/17/14

Acronyms/Abbreviations: CARB = California Air Resources Board; CDFW = California Department of Fish and Wildlife; CSLC = California State Lands Commission; dB = decibels; kHz = kilohertz; MPA = Marine Protected Area; MWCP = Marine Wildlife Contingency Plan; MWM = Marine Wildlife Monitor; m= meter(s); NOAA = National Oceanic and Atmospheric Administration; NO_x = Nitrogen Oxide; OGPP = Offshore Geophysical Permit Program; OSCP = Oil Spill Contingency Plan; USCG = U.S. Coast Guard