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F10a

9-19-1250 (City of Santa Barbara Desalination Facility)

June 19, 2020

EXHIBITS

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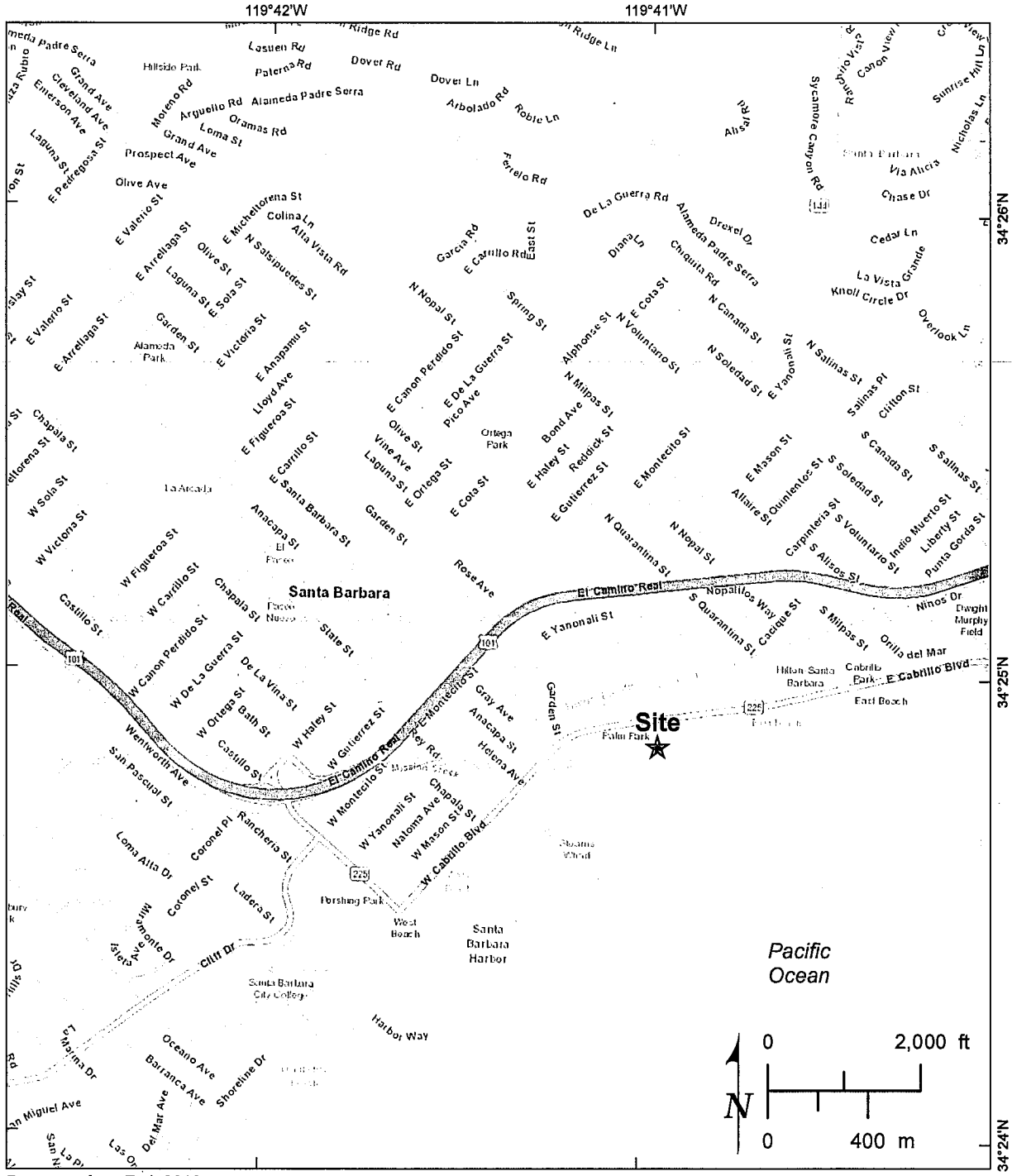

Base map from Esri, 2019.

Exhibit 1

PLATE 1

VICINITY MAP

04.61190004-PR-001 | Desalination Intake Modification Project

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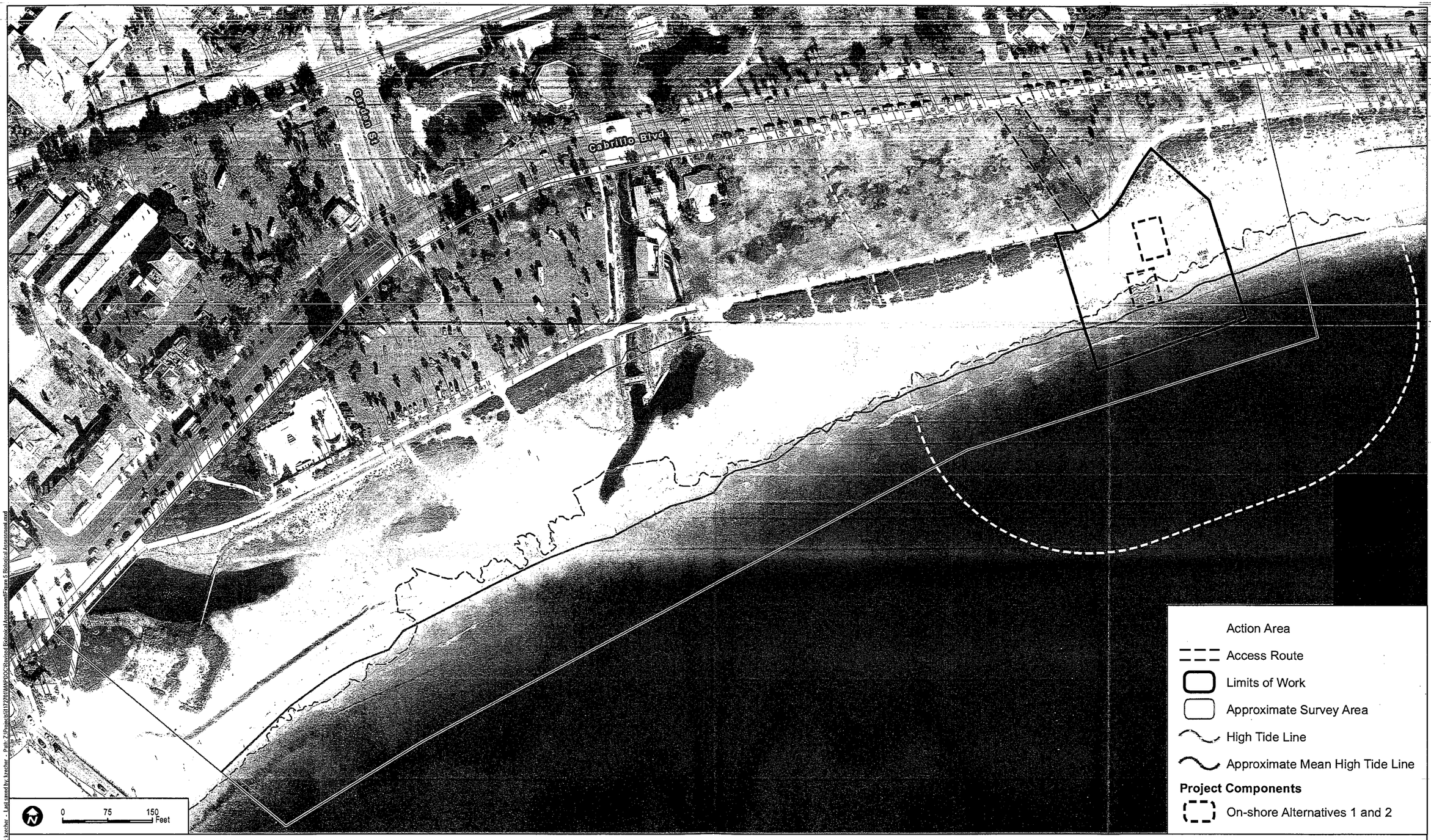
FUGRO



1 inch = 150 feet

SOURCE: CIRGIS Imagery 2017, Dudek (2014) High Tide Line 11-14-2014

DUDEK

CHARLES MEYER DESALINATION FACILITY

FIGURE 5

Revised Biological Assessment

Biological Assessment

Date: 9/5/2018 - Created by: kzecher - Last saved by: kzecher - Path: Z:\Projects\01172018MP\MXD\Revised Biological Assessment\Figure 5 Biological Assessment.mxd

Exhibit 2

6.0 AVOIDANCE AND MINIMIZATION MEASURES

Based on this biological assessment, no potential adverse effects to western snowy plover habitat (breeding, non-breeding, or critical habitat) and/or impacts to individuals are anticipated; and no potential adverse effects to tidewater goby habitat, marine mammals, and/or individuals are anticipated. Although western snowy plovers are expected to breed in Santa Barbara County, such breeding activities would be less likely in locations near the Action Area. Nevertheless, implementation of the recommended avoidance measures would further ensure no impacts would occur to breeding western snowy plovers. The measures will also result in avoidance of impacts to nesting western snowy plover. All avoidance measures are to be developed and implemented in coordination with USFWS.

6.1 General Avoidance Measures

BIO-1 Workers Educational Training. Prior to the initiation of any repair and maintenance activities, all personnel associated with the proposed Project should attend a worker education training program (program) conducted by a qualified biologist. In general, it is recommended that the program discuss the western snowy plover and tidewater goby habitat preference(s), occupied habitat in the area, life histories, law and regulations, as well as potential impacts and protection measures, and Action Area limits. Protections and regulations federally-listed species should also be included in the program. It is recommended that a species and habitat fact sheet also be developed prior to the training program and distributed at the training program to all contractors, employers and other personnel involved with maintenance activities at the weir box. Specifically, the program should also include:

A. Measures to prevent indirect impacts during maintenance activities should be covered, including delivery, storage, and usage of materials and chemicals as they relate to the protection of adjacent aquatic habitat.

B. Training materials should include laws and regulations that protect federally-listed species and their habitats, the consequences of non-compliance with laws and regulations and a contact person (i.e. maintenance activity manager, biological monitor, and City's Project manager) in the event that protected biological resources are affected.

The City should notify the qualified biologist in advance of the kick-off meeting and any subsequent meetings that may take place if additional contractors are employed during additional maintenance activities at the weir box. A sign in sheet will be circulated for signatures to all personal that attend the workers educational training to confirm that program materials were received and that they understand information presented.

BIO-2 Establish temporary fencing. Temporary fencing will be installed around the perimeter of the weir box and dunes fitting on the beach to prevent inadvertent encroachment by crews and equipment to the surrounding beach area.

BIO-3 Weir box access. Access ~~from the public bike trail~~ to the weir box and dunes fittings location will occur along the least disturbing route feasible. This will include keeping all personnel and equipment directly adjacent to or within the iceplant bordering the northern portion of beach.

BIO-4 Personnel restrictions. Maintenance personnel will be prohibited from harming, harassing, or feeding wildlife and/or collecting special-status plant or wildlife species; bringing pets on the Action Area; littering on the Action Area; or exceeding normal daytime operational noise or nighttime lighting.

BIO-5 Night-time Lighting restrictions. Night-time lighting shall be the minimum necessary for personnel safety and execution of maintenance activities shall they expend past standard working hours. Lighting shall directed/shielded downward to minimize lighting along the beach.

6.2 Avoidance of Breeding Western Snowy Plover

BIO-6 Conduct pre-activity nesting bird surveys. If repair or maintenance work must occur during the western snowy plover nesting season (March through August), the applicant shall have pre-Action nesting surveys conducted by a qualified biologist to determine whether active nests of this species are present in the Action Area or within 300 feet of the Action Area (buffer to be established in coordination with the USFWS). If active nests are found, repair and maintenance activities within 300 feet of the nest shall be postponed or halted, at the discretion of the biologist in consultation with CDFW and USFWS, until the nest is vacated and juveniles have fledged, as determined by the biologist, and there is no evidence of a second attempt at nesting. In addition, the maintenance worker access route to the weir box or dunes fittings location will be re-routed to avoid disrupting nesting behaviors. This new access route will be established in coordination with the USFWS. A biological monitor shall be present during those periods when Actions will occur near active nest areas to ensure that no inadvertent impacts to these nests occur. Results of the surveys shall be provided to CDFW and USFWS.

BIO-7 Conduct biological activity monitoring during Actions. An authorized biological monitor must be present in the Action Area during all repair/maintenance activities. The monitor shall survey the activity site (i.e., weir box and transition fittings location) and surrounding area for compliance with all avoidance measures. Weekly biological monitoring reports shall be prepared and submitted to the appropriate permitting and responsible agencies

through the duration of the repair/maintenance activities. Monthly biological monitoring reports shall be prepared and submitted through the duration of maintenance activities to document compliance with avoidance measures.

6.3 Avoidance of Wintering Snowy Plover

BIO-8 Conduct pre-activity bird surveys. Biological surveys for sensitive bird species will be conducted by an authorized biologist prior to ~~weir box~~ repair and maintenance activities. If present, maintenance will be delayed until the sensitive bird species have vacated the work area.

6.4 Minimization of Effects to Snowy Plover Critical Habitat

BIO-9 Pre-activity evaluation. Prior to conducting repair and maintenance activities, a habitat assessment and evaluation will be assessed and approved by an approved biologist. This measure will ensure that avoidance measures have been provided to ensure the avoidance of western snowy plovers.

BIO-10 Beach sand maintenance or replacement. During the Actions, all efforts will be made to not disturb sand substrates more than is required for access to the weir box, dunes fittings location, and activities within the fenced work areas. During the Actions, beach sand paths uses to access the weir box and dunes fittings location will be maintained or piled and replaced after activities are completed. After the Actions are completed ~~at the weir box~~, the disturbed sand (both around the weir box, dunes fittings location, and paths used to access the work area) will be replaced. The replacement of sand will include raking and leveling the sand back to pre-activity condition or replacing any sand that was piled during work activities.

6.5 Avoidance of Nesting Birds under the Migratory Bird Treaty Act of 1918

BIO-11 Pre-Action Nesting Bird Survey. A pre-Action survey for nesting birds should be conducted by a qualified biologist to determine if active nests of special-status birds, or common bird species protected by the Migratory Bird Treaty Act and/or the California Fish and Game Code, are present within 300 feet of the maintenance/repair zone. The survey should be conducted within one week prior to initiation of Actions that would occur during the nesting/breeding season of native bird species potentially nesting on the site (typically March 1 through August 30).

BIO-12 Nesting Bird Buffers and Requirements. If active nests are found, a no activity buffer shall be established at a minimum of 100-foot (this distance may be greater depending on the bird species and activity, as determined by the biologist) around the nest site

where it overlaps with work areas. Activities within no-maintenance buffer shall be postponed or halted, at the discretion of the biologist, until the nest is vacated, juveniles have fledged, and there is no evidence of a second attempt at nesting. In addition, all active nests shall be mapped with a GPS unit and nest locations with 100-foot buffers overlain on aerial photographs to provide regular updated maps to inform the Project manager/engineer and maintenance crew of areas to avoid. The City-appointed biologist should also serve as a compliance monitor during the breeding season to ensure that there are no inadvertent impacts to nesting birds.

6.6 Minimization of Drilling Effects to Marine Mammals

BIO-13 Soft-Start/Ramp-Up Procedures. Any drilling activities or other noise that may affect marine mammal behavior shall follow a "soft-start or ramp-up" procedure in which the activity begins at a light/softer pressure and slowly works up to the full noise effect of the anticipated work. This procedure will create a noise profile that begins quietly to alert marine mammals of the work being conducted in the area and end with the fully anticipated noise effects. The intention is to allow marine mammals to first become aware of the noise and then remove themselves from the area with each incremental increase in noise level.

TECHNICAL MEMORANDUM

To:	**Carollo Engineers, Inc.**
From:	**Mads Jorgensen P.E.**
Date:	**April 13, 2020**
Subject:	**Rip-Rap Relocation and Removal Plan** **Charles E. Meyer Desalination Plant (Weir Box Erosion Protection)**
M&N Job No.:	**10499**

1 Rip-Rap Relocation and Removal

1.1 Plan Purpose and Need

This Technical Memorandum comprises the submittal for *Special Condition 2. Riprap Relocation and Removal*, stipulated in *Section III. Special Conditions* of the California Coastal Commission Staff Report of February 21, 2020 and Hearing on March 11, 2020, *CCC (2020)*.

The City of Santa Barbara will replace and relocate the beach weir box, a section of intake pipeline, fittings, and related components that are a part of the seawater intake system used by the Charles E. Meyer Desalination Facility. Rip-rap shoreline protection is needed to protect the relocated weir box and intake pipeline from erosion.

Protection of the relocated weir box and intake pipeline will involve relocation of existing rip-rap at the site. Existing rip rap will be rearranged to protect the existing outfall pipeline and relocated weir box. The rip rap was originally placed to protect the weir box and the outfall prior to the Coastal Act, before 1925. The construction contractor will be required to conduct exploratory excavation at the project site in order to locate, recover and stockpile the necessary quantity of rip-rap. Following placement of rip-rap to protect the weir box and intake pipeline, remaining stockpiled rip-rap shall be removed offsite. There is a need to inform the construction contractor and California Coastal Commission (lead regulatory agency) about known site conditions and guidelines for relocation and rip-rap removal.

The purpose of the rip-rap relocation and removal plan is therefore to provide:

1. Information about site conditions for exploratory location and excavation of rip-rap.
2. Guidelines with respect to stockpiling and placement of rip-rap; and
3. Requirements for removal of rip-rap.

1.2 Rip-Rap Survey

A topographical survey of the beach and mapping of the existing rip-rap was conducted on February 8, 2019, *MNS (2019)*.

Figure 1 shows a recent photo from the rip-rap survey and measurement of rip-rap dimensions. Figure 2 provides and aerial view of the rip-rap extent visible at the time of the recent survey. Figure 3 shows an elevation view of the rip-rap within the survey area. The survey focused on measurement and mapping of rip-rap visible on the beach at the time of the survey, i.e., the survey did not probe for buried rip-rap. Figure 4 provides a plan view of the extent of rip-rap coverage. The 2019 field survey covered the area of rip-rap from Station 0 to +100, which was the area of beach with visible rip-rap between the weir box and the waterline. Representative dimensions of rip-rap pieces were obtained during the survey in terms of the length, width, and height of individual stones.

Historical aerial imagery (Appendix A) was reviewed to confirm the extent of rip-rap and estimate dimensions of rip-rap buried under the sand. This analysis utilized aerial imagery from 1969 and 2016 where the beach level was low and a greater extent of the rip-rap was visible.

Figure 4 summarizes the available information. In the figure, the orange outline denotes the extent of rip-rap placed in connection with the original construction (i.e., before 1925) as traced in aerial photos dating from 1969, *UCSBL (2020)*.

The more recent aerial photo from 2016, which reflects a low beach following a significant El Niño event showed the original rip-rap section as eroded with scattered smaller-diameter pieces. The extent of material visible in the 2016 image is indicated by the green outline in Figure 4. The southern (lower) portion of this rip-rap extent confirms the extent of rip-rap determined from the beach survey (dark blue outline). The photo analysis leads to the conclusion that the larger pieces of rip-rap have remained stable, and that there is a broad gradation of rip-rap available at the site.

The aerial imagery was utilized to measure representative rip-rap dimensions over the area from Station -120 to 0. The findings are summarized in Appendix B.

The extent of rip-rap needed to protect the new weir box and pipeline section is indicated in Figure 4, amounting to 1,452 square feet. The corresponding volume of 3,805 cubic feet was estimated as neat line quantities based on the project design drawings. The estimated quantity of rip-rap available to the contractor for the rip-rap relocation is provided in Appendix B. The quantity of rip-rap to be hauled off-site is estimated as the difference between the rip-rap quantity needed for the new work versus the rip-rap quantity likely to be excavated and stockpiled by the contractor.

Table 1 provides a summary of the estimated quantities. Cells marked with " - " in the table indicate that no significant work is anticipated within the respective stations. The summary shows that rip-rap needed for the new construction can be found in the immediate vicinity of the pipeline alignment.

The in-situ quantity of rip-rap was estimated based on the measured planar areas, combined with assumptions about the cross-section of the existing rock pipeline protection as follows. Appendix C shows a typical cross-section for pipeline protection based on the industry guidelines from USACE (2011) and CIRIA (2007), adapted to the project site location. The method of construction that was utilized for the pipeline protection is envisioned as follows:

- A trench would have been cut into the beach for the pipeline.
- A prepared base consisting of a bedding layer provides a stable platform to support the pipeline.
- Core material, likely consisting of gravel or small rock is placed on each side of the pipeline to support it laterally and prevent sliding. A secondary function of the core material is to serve as a prepared base to support the underlayer for the armor stone.
- The underlayer is placed atop the pipeline and core material. The purpose of the underlayer is to provide a cushioning layer for the armor stone to rest on so the large stones won't bear directly against and impart point loads to the pipeline. A second function of the underlayer is to serve as a filter layer preventing washout of the core material through the voids in the rock mass.
- The upper layer consists of the large armor stone that is visible on the beach. Industry guidelines for design of rock protection, *USACE (2011)* and *CIRIA (2007)* require the armor rock to extend to the depth of anticipated scour. In this case this would be the low beach level as indicated in the figure in Appendix C.

Based on this guideline, the extent of the rock protection of the pipeline should be 50 feet wide (25 feet from the center of the pipeline on each side), which has been confirmed in the 2016 aerial photo (Appendix A).

Industry guidelines for placement of armor stone also require the layer to be minimum two stone diameters thick measured perpendicular to the slope. The two-layer thickness is necessary to prevent the underlying material from evacuating through the large voids in the armor layer. This guideline was utilized to assess the depth of rock at the project site as: $2 \times D_{n50}$, where D_{n50} is the nominal average diameter of the rock as measured in the survey. Because of the placement of large armor stone and smaller rock for the underlayer, there is likely to be a wide gradation of rock sizes available at the site.

Refer to Appendix B for the estimated volume of in-situ rip-rap. The quantity of in-situ rip-rap is estimated to be sufficient in volume compared to what is needed for protection around the new weir box and pipeline segment. Remaining stockpiled rip-rap will be hauled off the project site. Rip-rap removed off-site will become the property of the contractor. The haul off quantity is estimated to be about ½ to ¾ of a truck load, or 195 cubic feet.

Table 1: Summary of rip-rap quantities for excavation, stockpiling, relocation, and haul off.

Station	Rip-Rap In-Situ		Volume (cf)		
	Area (sf)	Volume (ft)	Excavation & Stockpiling	Needed for Construction	Haul Off Quantity
-120 to -100	501	1,154	-	-	-
-100 to -80	567	1,571	-	-	-
-80 to -60	1,069	2,615	1,800	1,734	66
-60 to -40	1,589	4,881	800	779	21
-40 to -20	1,406	4,558	700	642	58
-20 to 0	1,286	8,680	700	650	50
0 to +20	1,070	8,562	-	-	-
+20 to +40	927	5,562	-	-	-
+40 to +60	857	2,571	-	-	-
+60 to +80	862	6,892	-	-	-
+80 to +100	262	1,311	-	-	-
Total	**10,935**	**48,357**	**4,000**	**3,805**	**195**

Figure 1: Photo from rip-rap mapping conducted on 2-8-2019, *MNS (2019)*.

Figure 2: Aerial view of rip-rap survey area. Existing Beach Weir Box in center of image, *MNS (2019)*.

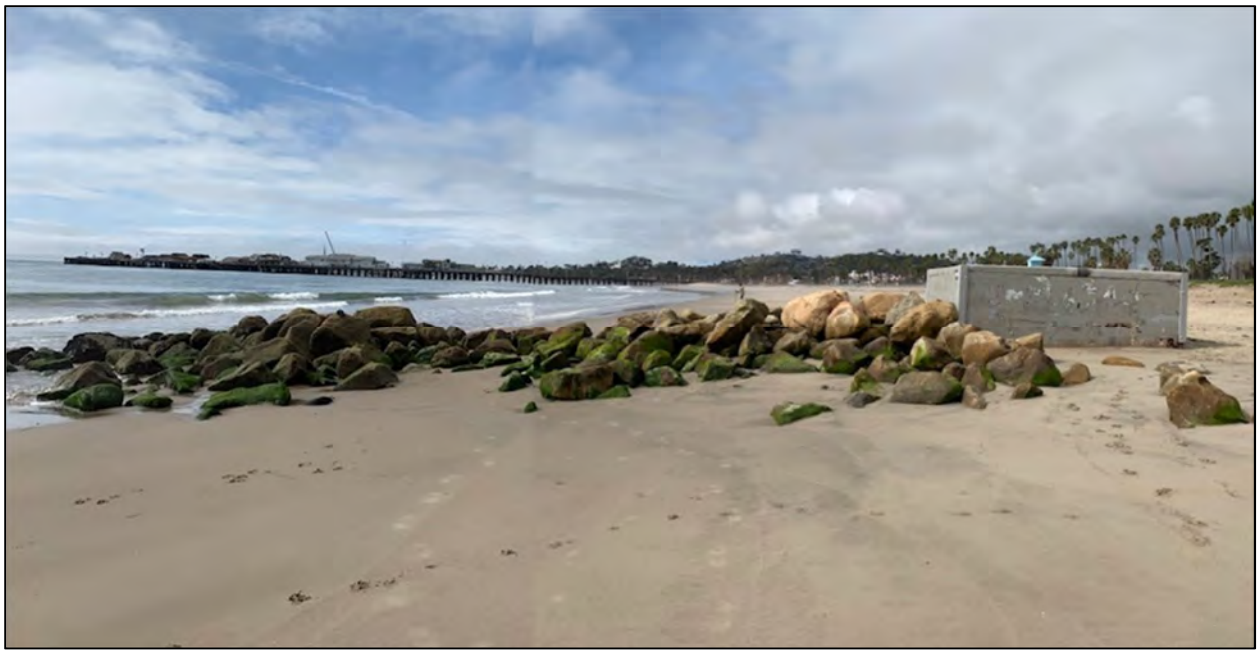


Figure 3: Profile view of rip-rap mapping area, *MNS (2019)*.

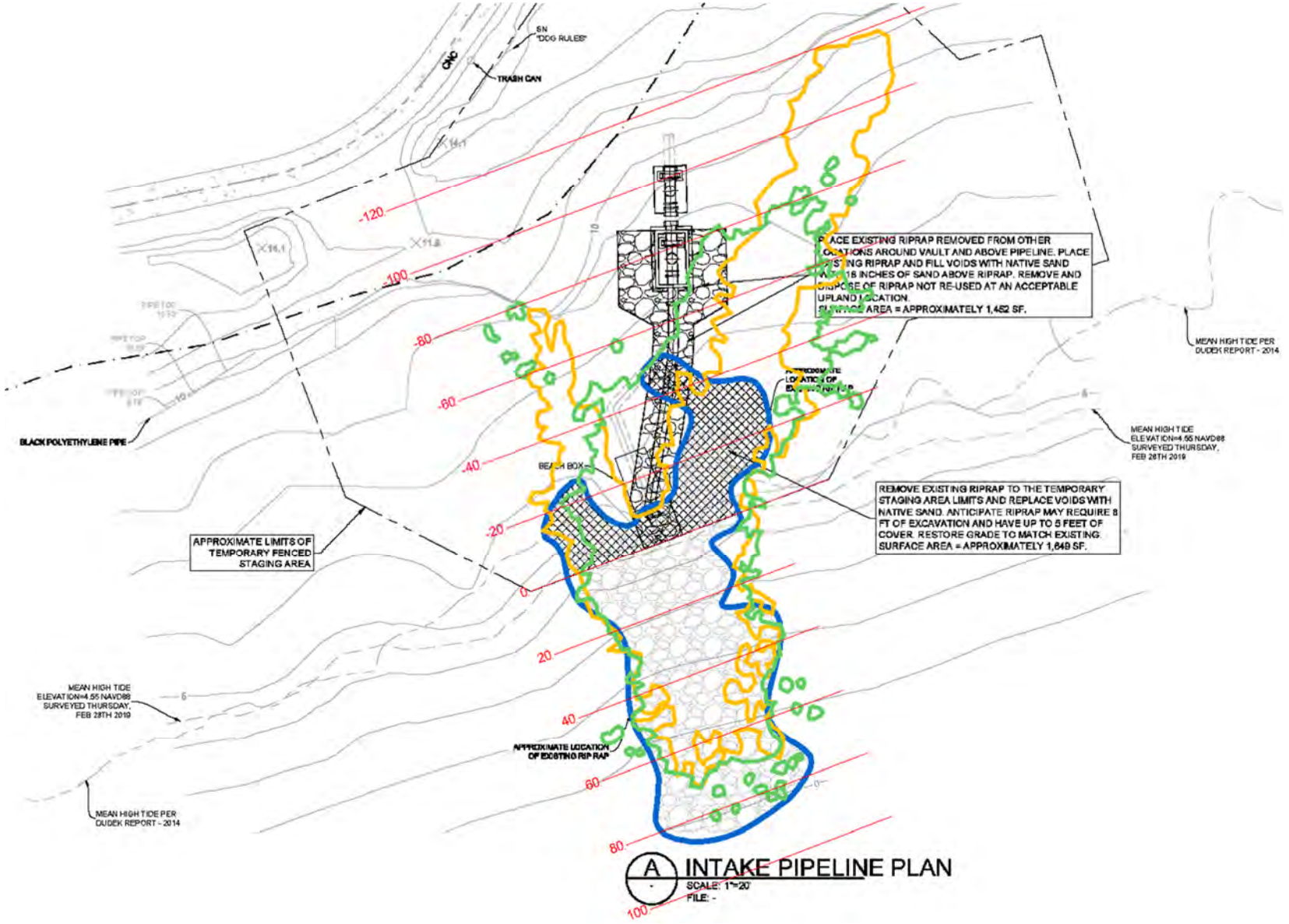


Figure 4: Rip-Rap extent surveyed (dark blue), 2016 El Niño (green), original construction (orange).

1.3 Geotechnical Considerations

Fugro acquired subsurface geotechnical information at the site based on in-situ Cone Penetration Test (CPT) soundings in June 2019. Figure 5 shows the locations of the CPTs. The CPT locations were selected to be proximal to the proposed structures and to avoid areas of existing rip-rap. CPT-1 and CPT-2 were advanced to refusal at depths of 85 to 90 feet below the ground surface. CPT-3 was advanced to a depth of 42 feet below the ground surface.

The CPTs were utilized to characterize the soil and groundwater conditions at the site. The soil profile at the site consists of about 20 feet of medium-dense to dense poorly graded sand underlain by about 60 feet of fine-grained estuarine deposits comprised of soft to medium stiff clayey silt, silty and lean clay. The CPT data suggests that stiffer/denser older alluvial or older marine deposits are present below the estuarine deposits. Rip-rap is present in the near surface and is embedded in the upper portion of the beach sand deposits. The groundwater level will fluctuate approximately around mean sea level and vary with tide levels.

Fugro subsequently conducted a geohazard evaluation for the project (September 2019), which included:

- Characterization of geologic hazards such as seismic setting and ground rupture potential, strong ground shaking, tsunami, sea level rise, and liquefaction potential;
- Geotechnical-related seismic design parameters for use with the 2016 California Building Code;
- Geotechnical analyses consisting of bearing capacity, settlement, and lateral resistance to sliding (friction and passive resistance) for the new weir box and new dunes fitting, assuming the structures will be supported on a mat or slab foundation; and
- Geotechnical analyses consisting of axial and lateral pile capacity and pile foundation settlement for the new weir box, if the structure will be supported on a driven pile foundation.

Based on this evaluation, Fugro provided geotechnical design input in the form of:

- Geotechnical seismic design parameters for use with the 2016 California Building Code;
- Geotechnical design recommendations consisting of ultimate and allowable bearing capacity, sliding friction and passive resistance, and settlement for the weir box if the structure is supported on a mat or pad foundation;
- Geotechnical design recommendations consisting of ultimate and allowable pile axial compression and uplift capacity, lateral pile capacity (pile deflection, bending moment and shear forces developed from LPILE), and pile foundation settlement for a typical precast concrete pile, H-pile, and timber pile if the weir box is supported on a driven pile foundation. Additionally, information regarding the distribution of lateral resistance between piles and the passive resistance of the weir box structure;
- Design recommendations for the dunes fitting foundation consisting of bearing capacity, settlement, and lateral resistance to sliding;
- Recommended design parameters for the use in the design of temporary shoring; and

- General input for earthwork, including site preparation, excavation, the need for dewatering, and compacted fill.

Base data from MNS Engineers, 2019. Imagery from Santa Barbara County, 2012.

Figure 5: Locations of Cone Penetration Tests, Fugro (2019).

1.3.1 Findings

The geotechnical investigation found that:

- The ground rupture hazard at the site is low with respect to faults in proximity to the site (Mission Ridge-Arroyo Parida- Moore Ranch fault zone, Mesa fault, and the Rincon Creek fault).
- Soils at the site are sufficiently dense to avoid generating high pore pressures and triggering of liquefaction.

Soils at the site classify as OSHA Type C soils (granular material). Figure 6 summarizes OSHA safety requirements for simple slope excavation. The maximum permissible depth of excavation is 20 feet below the ground level. The rip-rap is embedded in the upper portion of the beach sand deposits near the surface. Excavation for relocation of the rip-rap will therefore meet this requirement. The permissible slide slope for excavation is 1.5H:1V, (34°) which corresponds to the natural angle of repose of granular material such as beach sand.

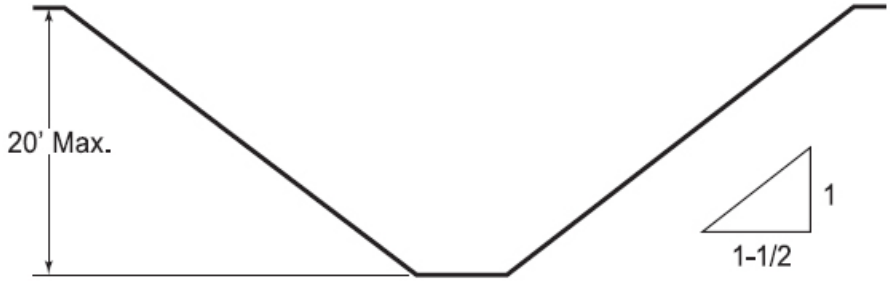


Figure 6: OSHA Type C Soil simple slope excavation.

Rip-rap is also a granular material. Figure 7 shows angles of repose of rip-rap as a function of stone size and angularity. The rip-rap at the site can be considered to be moderately angular to slightly rounded (Figure 1). The angle of repose of the rip-rap is therefore 39.5 degrees or higher for stone sizes with diameters larger than 4 inches (100 mm). Rip-rap excavated at 1.5H:1V is therefore within the OSHA guidelines summarized in Figure 6.

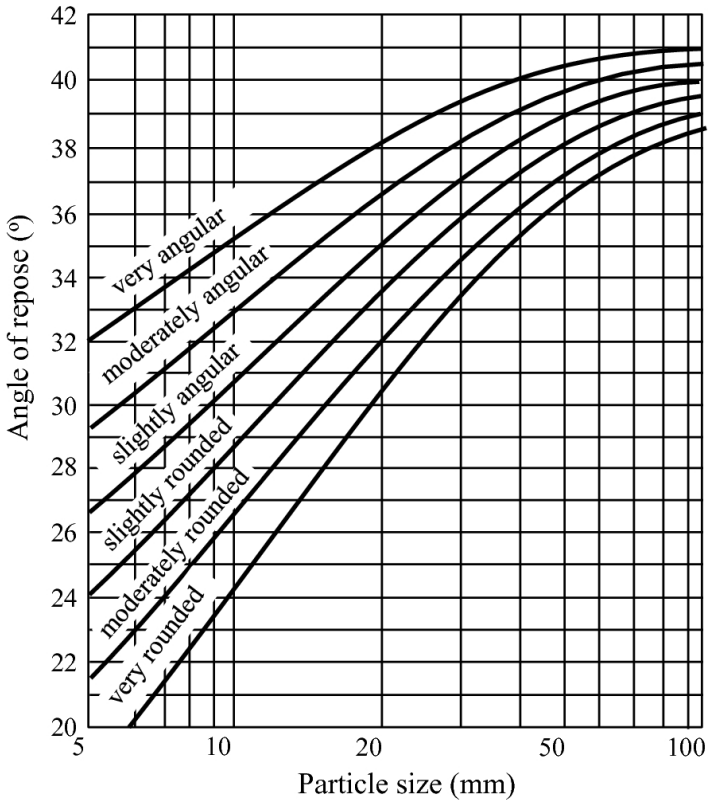


Figure 7: Angles of repose of rip-rap.

1.3.2 Guidelines for Excavation, Rip-Rap Relocation and Removal

The contractor's exploration and relocation of rip-rap will be subject to the following guidelines.

Excavation for Recovery of Rip-Rap

- Locate and mark pipeline alignment(s) prior to excavation.
- Exploratory location of rip-rap may be aided by water jetting.
- Remove and relocate rip-rap from the top down. Do not undercut existing rip-rap.
- Do not excavate rip-rap or beach material to a slope steeper than 1.5H:1V.
- Place extracted rip-rap in a stockpile.
- Keep excavated material and other materials at least 2 feet from trench edges.
- Operate machinery on a stable and level base. Do not drive atop rip-rap.
- Keep heavy equipment away from trench edges.
- Identify any equipment or activities that could affect the stability of excavated areas.
- Inspect excavated areas following a rainstorm or other water intrusion.
- Inspect excavated areas after any occurrence that could have changed conditions in the trench.

Excavation in Proximity to Existing Structures

- Do not excavate within 6 feet of the pipeline alignment. Mark 6-ft clearance prior to excavation.
- Do not undercut the pipeline.

Placement of Rip-Rap (140 cy)

- Replace rip-rap along new pipeline section.
- Rip-rap is not permitted to be dropped from a height greater than 1 foot.
- Rip-rap may not be dropped atop the pipeline.
- Rip-rap shall be placed in such a manner as to avoid segregation of various sizes of rock, and distributed so that there will be no segregation of either the larger or smaller sizes of stone. Individual rocks shall be placed in tight contact with one another in such a way to produce the least amount of void spaces.
- The entire mass of placed rip-rap shall be well distributed within the limits specified.

Site Cleanup

- Implement all BMPs as required by Coastal Development Permit (CDP).
- Backfill voids created by rip-rap excavation with sand to match the existing beach profile.
- Dispose of any rip-rap remaining in stockpile off-site.

2 References

CCC (2020). *Staff Recommendation for Replacing and relocating part of the seawater intake system of the City of Santa Barbara's Charles E. Meyer Desalination Facility.* California Coastal Commission Staff Recommendation W14a. Application No.: 9-19-1250. Date Filed: December 2, 2019. Staff Report: February 21, 2020. Hearing Date: March 11, 2020. State of California – Natural Resources Agency, California Coastal Commission, 45 Fremont, Suite 2000, San Francisco, CA 94105- 2219.

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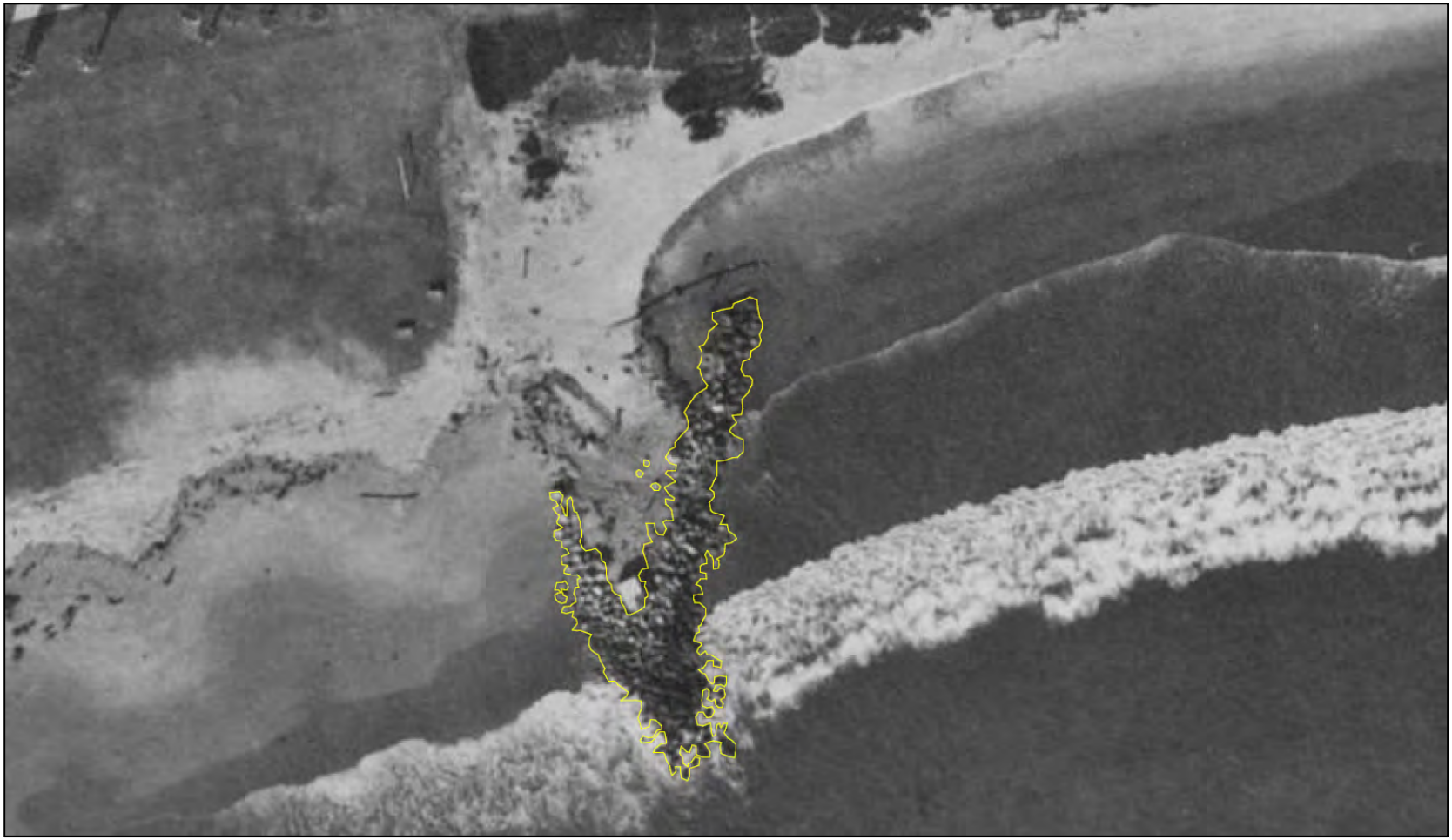
UCSBL (2020). Digital Aerial Photography Collections. UC Santa Barbara Library, Map & Imagery Laboratory (MIL). http://mil.library.ucsb.edu/mapindexes/

USACE (2011). *Coastal Engineering Manual.* Engineer Manual EM 1110-2-1100, Change 3. US Army Corps of Engineers, 28 Sep. 2011.

Appendix A

Historical Aerial Photos

Aerial Photo, February 2016.



Aerial Photo, 12-24-1969.

Appendix B

Rip-Rap Dimensions and Estimated Quantities for Excavation and Stockpiling, Construction, and Haul Off

Station	Rip-Rap Dimensions – Above/Below Ground				Volume (cf)			
	Length (ft)	Width (ft)	Height (ft)	Area (sf)	In-Situ	Excavation & Stockpiling	Needed for Construction	Haul Off Quantity
-120 to -100	3.7	2.7	2.3	501	1,154	0	0	0
	2.5	2.2	1.8					
	2.6	2.5	2.1					
	2.8	2.6	2.2					
	3.7	2.0	1.7					
	1.9	1.8	1.5					
	2.5	1.9	1.6					
	3.2	2.1	1.8					
-100 to -80	2.4	1.8	1.5	567	1,571	0	0	0
	2.2	1.6	1.3					
	4.1	2.3	1.9					
	2.6	2.0	1.7					
	3.1	2.9	2.5					
	3.9	3.3	2.8					
	2.2	1.2	1.0					
	3.9	2.5	2.1					
-80 to -60	2.4	1.8	1.5	1,069	2,615	1,800	1,734	66
	3.4	1.5	1.3					
	4.5	2.8	2.4					
	2.9	2.9	2.4					
	3.7	1.6	1.3					
	2.6	1.6	1.4					
	3.2	1.5	1.3					
	1.9	1.2	1.0					

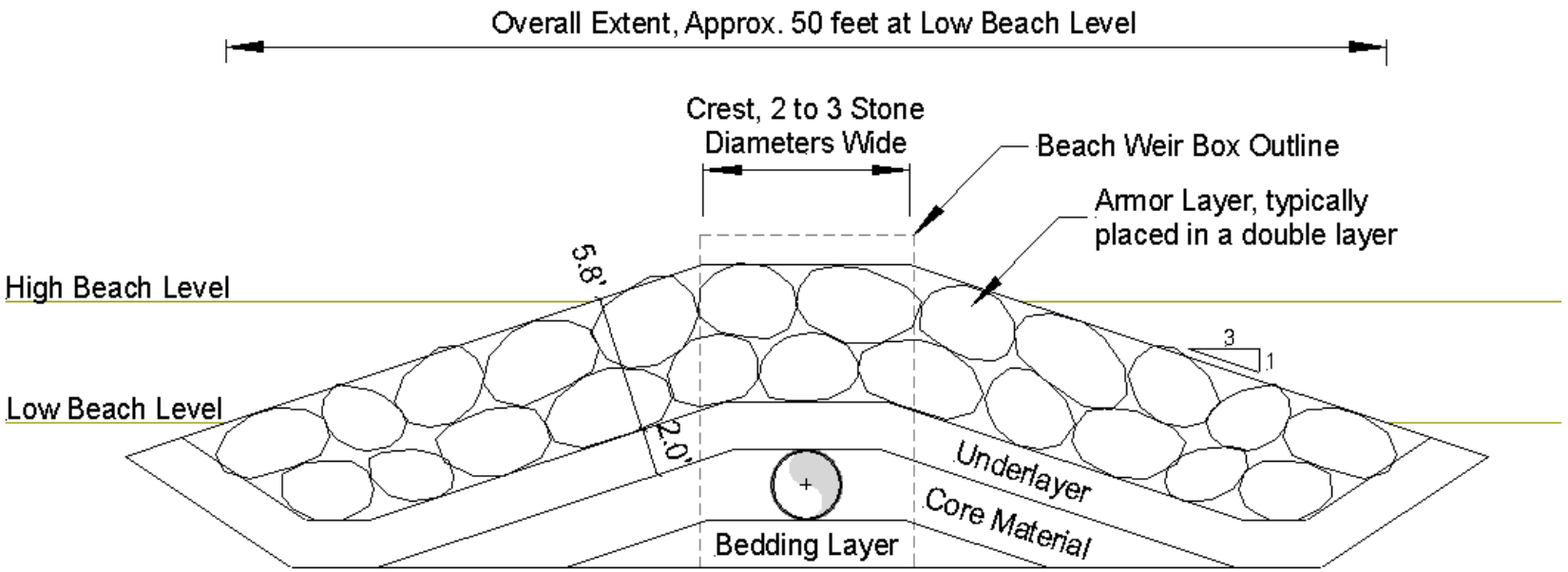
Station	Rip-Rap Dimensions – Above/Below Ground				Volume (cf)			
	Length (ft)	Width (ft)	Height (ft)	Area (sf)	In-Situ	Excavation & Stockpiling	Needed for Construction	Haul Off Quantity
-60 to -40	2.8	2.5	2.1	1,589	4,881	800	779	21
	2.3	2.1	1.7					
	3.9	3.4	2.8					
	4.0	2.6	2.2					
	3.8	3.6	3.1					
	4.0	2.5	2.1					
	1.9	1.6	1.4					
	1.9	1.7	1.4					
-40 to -20	4.2	3.8	3.2	1,406	4,558	700	642	58
	5.0	2.8	2.3					
	2.5	1.8	1.5					
	4.0	3.0	2.5					
	2.6	2.0	1.7					
	3.8	1.9	1.6					
	2.6	2.2	1.9					
	2.8	1.9	1.6					
-20 to 0	5.5	4.0	3.4	1,286	8,680	700	650	50
	5.4	3.0	2.5					
	2.9	2.2	1.8					
	4.5	2.7	2.3					
	4.3	2.5	2.1					
	3.9	3.1	2.6					
	2.4	1.9	1.6					
	2.8	1.8	1.5					
	1.4	1.2	1.0					

Station	Rip-Rap Dimensions – Above/Below Ground				Volume (cf)			
	Length (ft)	Width (ft)	Height (ft)	Area (sf)	In-Situ	Excavation & Stockpiling	Needed for Construction	Haul Off Quantity
0 to +20	4.0	4.0	3.0	1,070	8,562	0	0	0
	5.0	6.0	3.0					
	3.0	3.0	2.5					
	5.0	4.0	4.0					
	3.5	4.0	3.0					
	2.5	3.0	2.0					
	2.0	1.5	1.5					
+20 to +40	3.0	2.5	2.0	927	5,562	0	0	0
	4.0	4.0	3.0					
	3.0	3.0	2.5					
	3.5	4.0	3.0					
	1.5	1.5	1.5					
	4.0	3.0	3.0					
	2.0	3.0	2.0					
	3.0	4.0	2.5					
	2.5	3.0	1.5					
	2.0	3.0	2.5					
	2.0	3.5	1.5					
+40 to +60	3.0	1.5	2.0	857	2,571	0	0	0
	3.0	2.0	2.0					
	3.0	3.0	2.0					
	3.0	3.0	3.0					
	3.0	1.5	2.0					
	4.0	3.0	3.0					
	3.0	2.5	1.5					
	3.0	5.0	2.5					

Station	Rip-Rap Dimensions – Above/Below Ground				Volume (cf)			
	Length (ft)	Width (ft)	Height (ft)	Area (sf)	In-Situ	Excavation & Stockpiling	Needed for Construction	Haul Off Quantity
+60 to +80	5.0	4.0	3.0	862	6,892	0	0	0
	5.0	3.0	2.0					
	1.5	1.0	1.0					
	5.0	3.0	3.0					
	3.5	2.0	2.0					
	1.5	1.5	1.5					
	4.0	4.0	3.0					
	5.0	2.5	2.5					
	2.0	2.0	4.0					
	5.0	2.0	2.0					
+80 to +100	3.0	3.5	2.5	262	1,311	0	0	0
	1.5	1.5	1.5					
	4.0	3.5	2.5					
	3.0	3.5	2.0					
	3.5	3.0	2.0					
	5.0	2.0	2.5					
	3.0	3.0	2.0					
	4.0	3.0	2.5					
	2.0	2.0	1.0					
	5.0	4.0	2.5					
Total				**10,935**	**48,357**	**4,000**	**3,805**	**195**

Appendix C

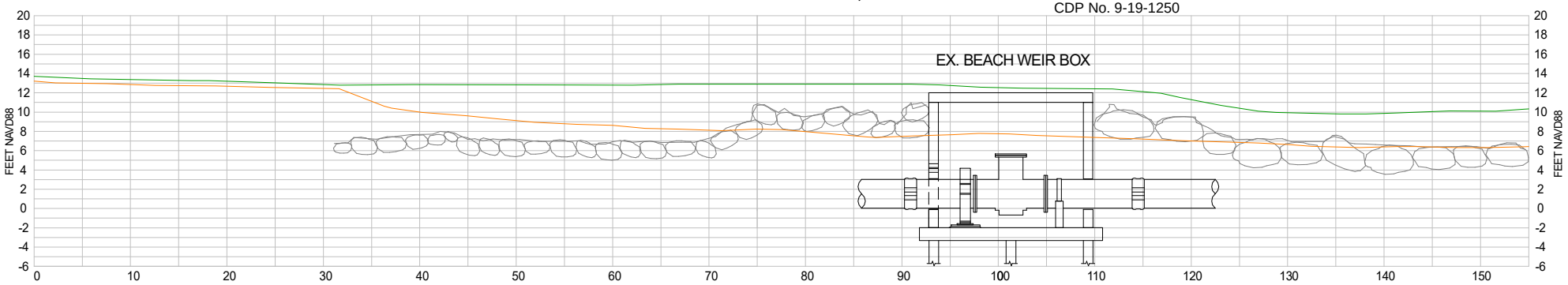
Pipeline Protection
Typical Cross-Section



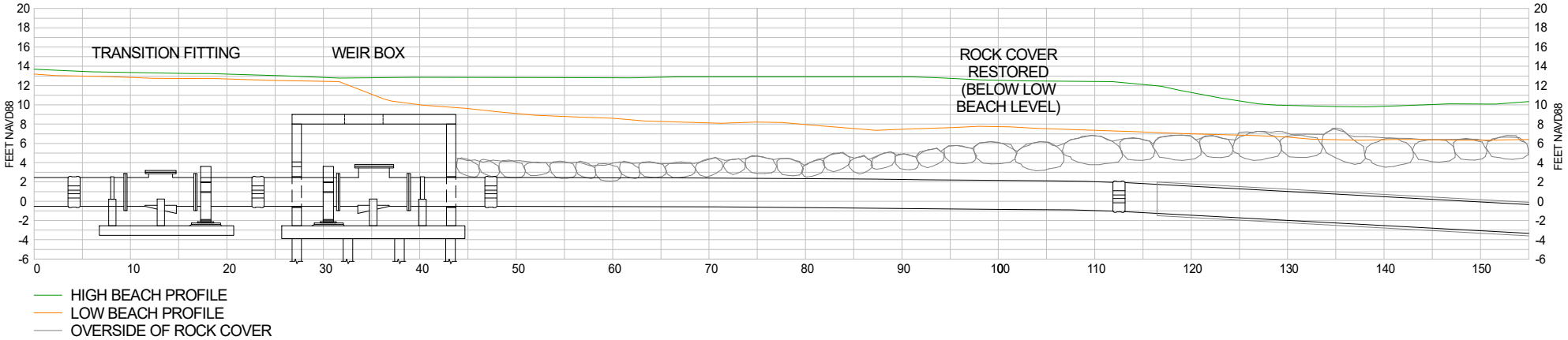
Pipeline Protection – Typical Cross-Section

EXHIBIT 5
CDP No. 9-19-1250

EXISTING CONDITIONS, NO SLR.



POST CONSTRUCTION, NO SLR.



YEAR 2050, 2.5 FEET OF SLR. EXTREME RISK AVERSION SCENARIO, OPC (2018).

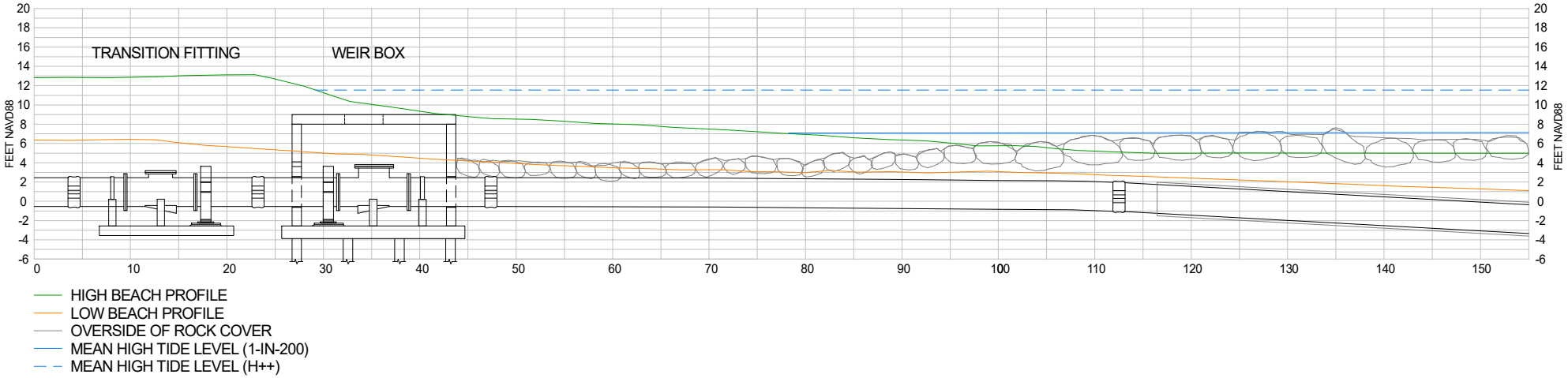


EXHIBIT 5
CDP No. 9-19-1250

YEAR 2040, 1.6 FEET OF SLR. EXTREME RISK AVERSION SCENARIO, OPC (2018).