NORTH SHIPYARD REMEDIAL ACTION PLAN IMPLEMENTATION REPORT
SAN DIEGO SHIPYARD SEDIMENT SITE – NORTH SHIPYARD

On behalf of

BAE Systems San Diego Ship Repair

San Diego Bay Environmental Restoration Fund – North

Prepared by

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TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

LIST OF ACRONYMS AND ABBREVIATIONS

µg/kg	microgram per kilogram
APE	American Pile Driving Equipment
BAE Systems	BAE Systems San Diego Ship Repair
BMP	best management practice
BODM	Basis of Design Memorandum
CAO	Cleanup and Abatement Order No. R9-2012-0024
CDP	Coastal Development Permit
City	City of San Diego
cm	centimeter
COC	contaminant of concern
CSCA	Clean Sand Containment Area
CSLC	California State Lands Commission
DC	Dredge Cell
DO	dissolved oxygen
EnviroMatrix	EnviroMatrix Analytical, Inc.
Granular Backfill	Select Compacted Granular Backfill
EIR	Environmental Impact Report
HPAH	high-molecular weight polycyclic aromatic hydrocarbon
IP	Individual Permit
IUDP	Industrial User Discharge Permit
IWGP	Industrial Waste Generator Permit
MLLW	mean lower low water
MM	Mitigation Measure
NASSCO	National Steel and Ship Building Company
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
North Trust	San Diego Bay Environmental Restoration Fund – North
NOT	Notice of Termination
NRCES	National Response Corporation Environmental Services
PCB	polychlorinated biphenyl
POSD	Pride of San Diego

PRMP	Post-Remedial Monitoring Plan
RAP	Remedial Action Plan
RES	R.E. Staite Engineering, Inc.
RMP	Remedial Monitoring Plan
SAP	Sampling and Analysis Plan
SDG&E	San Diego Gas & Electric
Site	North Shipyard portion of the San Diego Shipyard Sediment Site
SMA	Sediment Management Area
SMARTS	Storm Water Multiple Application and Report Tracking System
SMU	Sediment Management Unit
SWAC	Surface Weighted Average Concentration
SWPPP	Stormwater Pollution Prevention Plan
TSI	Testing Services and Inspection, Inc.
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
V:H	vertical to horizontal
Vulcan	Vulcan Materials Company
Water Board	Regional Water Quality Control Board
WDID	Waste Discharge Identification Number
WDR/WQC	Waste Discharge Requirements/Water Quality Certification

CERTIFICATION STATEMENT

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

R. Thomas Dorsey San Diego Bay Environmental Restoration Fund – North	Signature - de maximis, Inc. CFO	7/11/16 Date

DUTY TO USE REGISTERED PROFESSIONAL

This report was prepared under the direction of qualified professionals in accordance with the California Business and Professions Code Sections 6735, 7835, and 7835.1.

Michael Whelan, P.E. Project Engineer Anchor QEA, LLC	Signature	7/11/2016 Date

EXECUTIVE SUMMARY

This North Shipyard Remedial Action Plan (RAP) Implementation Report documents and verifies completion of the North Shipyard portion of the San Diego Shipyard Sediment Site (Site) cleanup project in San Diego, California, which was mandated by the Regional Water Quality Control Board (Water Board) under Cleanup and Abatement Order No. R9-2012-0024 (CAO; Water Board 2012a). Completion of permitted activities at the South Shipyard portion of the Site, also mandated for cleanup under the same CAO, was completed on March 25, 2014, as documented in a separate RAP Implementation Report (Anchor QEA 2014a). Starting 2 years after completion of the North Shipyard remediation (April 15, 2016), a post-remediation monitoring program will commence for the entire Site (North and South Shipyards) to determine ongoing compliance with sediment quality cleanup levels specified by Directive A.2.c of the CAO.

This report is being submitted as an appendix to the Final Cleanup and Abatement Completion Report, submitted on July 15, 2016, thus meeting the requirement that this report be submitted within 90 days of completion of remediation.

Based on pre-construction field investigations and through sediment collected and analyzed as part of post-dredge confirmatory sampling, removal of sediments exceeding chemical parameters stipulated in the CAO was accomplished to the degree economically and technologically feasible. Impacted sediments that could not be feasibly dredged (i.e., due to risk of undermining slopes or existing structures) were covered with sand or gravelly sand.

Dredged material was transported via barge to the Sediment Management Area (SMA), located at the northwestern corner of the shipyard. The dredged material was stabilized with Portland cement, as needed, to pass paint filter testing and was subsequently transported to the Otay Landfill in Chula Vista, California, for disposal. All decant water generated during dredging operations was collected, managed on site, and discharged to the City of San Diego sewer system.

Water quality monitoring was performed during debris removal, dredging, and sand cover placement activities.

Sediment was removed from eight distinct dredge areas at the Site. In total, 114,085 cubic yards of sediment were dredged from the North Shipyard portion of the Site, as determined through pre-construction and post-dredge bathymetric surveys. The original volume presented in the Basis of Design Memorandum (BODM; Anchor QEA 2013) was increased due to the presence of contaminated sediments (analytical concentrations measured above the CAO cleanup objectives) at the design depth, resulting in the need for additional dredging. A total of 5,821 tons of sand cover material and 17,117 tons of gravelly sand cover material was placed under and adjacent to piers.

To provide shoreline protection and stabilization, a submerged sheetpile wall was installed offshore of the SMA along the U.S. Bulkhead Line to facilitate sediment removal in this area. The SMA shoreline was cleared and replaced with a new concrete retaining wall at the top of the slope and shoreline revetment that extends to the installed submerged sheetpile wall. The remaining portions of the SMA have since been restored to conditions similar to those existing prior to the commencement of dredging operations.

Shoreline protection and revetment on the southern nearshore corner of the North Shipyard was also implemented. This work did not include installation of any submerged sheetpile wall or other structures.

This report documents the completion of remedial activities at the North Shipyard portion of the Site. Dredging, sand cover placement, debris removal, and all SMA shoreline improvements have been concluded at the North Shipyard, and eelgrass restoration is ongoing. The current mitigation approach discussed with the National Marine Fisheries Service (NMFS), U.S. Army Corps of Engineers (USACE), Water Board, and Port of San Diego consists of combining mitigation requirements with other mitigation required for North Shipyard improvements. The combined mitigation would be conducted within the cooling water intake channel of the now decommissioned South Bay Power Plant. The mitigation site would use dredged material from the North Shipyard improvement project and has already received a Clean Water Act Section 401 Water Quality Certification (Water Board), completed an Essential Fish Habitat and Endangered Species Act Section 7 consultation, received a Coastal Development Permit (Port of San Diego), and an approval for use on the Port of San Diego-administered Tidelands. Suitability has been verified by the

USACE and U.S. Environmental Protection Agency (USEPA). Construction of this mitigation site is scheduled to commence in summer 2016, with eelgrass restoration planting being performed in spring 2017.

Long-term monitoring will commence 2 years after notification of completion is received from the Water Board and will take place 2 (2018) and 5 (2021) years after completion of remediation.

1 INTRODUCTION

This Remedial Action Plan (RAP) Implementation Report documents and verifies the completion of remedial activities at the North Shipyard portion of the San Diego Shipyard Sediment Site (Site) cleanup project in San Diego, California, which was mandated by the Cleanup and Abatement Order No. R9-2012-0024 (CAO; Water Board 2012a). This report documents North Shipyard compliance with Directives A.2.a and A.2.b of the CAO, while compliance with Directive A.2.c will be determined pending post-remedial monitoring to commence 2 years following completion of remediation, defined as April 15, 2016, the final day of Contractor demobilization from the Site.

This RAP Implementation Report, along with the previously completed RAP Implementation Report for the South Shipyard (Anchor QEA 2014a) is being submitted as an appendix to the Final Cleanup and Abatement Completion Report. The Final Cleanup and Abatement Completion Report was submitted on July 15, 2016, thus meeting the requirement that this report be submitted within 90 days of completion of remediation.

1.1 Purpose and Organization of this Report

This report documents the construction activities that occurred during remediation of the North Shipyard portion of the Site and provides a demonstration that the dredging and under-pier remedial activities stipulated in the CAO have been completed, subject to post-remedial monitoring as required by Directive A.2.c of the CAO (Water Board 2012a).

Specifically, this report summarizes the following aspects of the project:

- Section 2 – Site Description and Regulatory Background
- Section 3 – Remedial Design
- Section 4 – Summary of Remedial Action
- Section 5 – Environmental Protection, Monitoring, and Reporting
- Section 6 – Summary and Completion Statement
- Section 7 – References

This report also includes supporting data and information in a series of appendices, as follows:

- Appendix A – As-built Drawings
- Appendix B – Post-dredge Confirmatory Sampling Core Logs
- Appendix C – Post-dredge Confirmatory Sampling Analytical Results
- Appendix D – Analytical Data Quality Control Review
- Appendix E – Sand Cover Gradation and Analytical Information
- Appendix F – Summary of Manual Water Quality Results
- Appendix G – Discharge Monitoring Laboratory Results
- Appendix H – Summary of Biological Monitoring Results
- Appendix I – CAO-mandated Electronic Reporting Submittals

1.2 Summary of Final Cleanup and Abatement Completion Report Required by the CAO

As stated above, this report is submitted to document the North Shipyard's current compliance with Directive C of the CAO (Water Board 2012a), which states:

> ***Final Cleanup and Abatement Completion Report****. The Discharges shall submit a final Cleanup and Abatement Completion Report verifying completion of the RAP activities for the Shipyard Sediment Site within 90 days of completion of remediation. The report shall provide a demonstration, based on sound technical analysis, that sediment quality cleanup levels in Directive A.2 have been achieved.*

Final demonstration of cleanup compliance with post-remedial Surface Weighted Average Concentrations (SWACs), per Section A.2.c of the CAO, will commence 2 years after the completion date by the beginning of a site-wide (North and South Shipyards) post-remedial monitoring program. Post-remedial monitoring will occur at 2 and 5 years following completion of remediation and again after 10 years if the goals were not achieved during year 5.

Section 4 of this report includes a summary of remedial actions completed at the Site and provides a sound technical analysis showing that remedial activities stipulated in Directive A.2.a and A.2.b have been completed.

1.2.1 Statement of Qualifications

Anchor QEA, LLC, was the lead design Engineer and on-site construction management firm for this work, led the construction management team during project implementation, and prepared this report. Anchor QEA is a leading environmental and engineering consulting company that specializes in projects with aquatic, shoreline, and water resource components. Anchor QEA is nationally recognized for coastal development, engineering, landscape architecture, dredging management, resource and regulatory agency permitting, water quality, habitat restoration, and construction management.

Anchor QEA's staff in California and across the Unites States includes environmental planners, scientists, landscape architects, and construction managers who apply their technical skills and creativity on a wide range of projects. The firm has offices on the West, East, and Gulf coasts as well as the Great Lakes and Alaska, including locations in Southern California and the Bay Area Anchor QEA leads and supports many high-profile local, regional, and national waterfront cleanup projects, including such recent regional examples as the South Shipyard portion of the Site, NW Portion of the East Bay, Rhine Channel sediment cleanup in Newport Beach; IR Site 7 (West Basin), Pier G slip fill, and Middle Harbor slip fill at the Port of Long Beach; and the Port of Hueneme Confined Aquatic Disposal Facility in Port Hueneme.

2 SITE DESCRIPTION AND REGULATORY BACKGROUND

Over time, waste discharges to San Diego Bay have resulted in the accumulation of elevated levels of pollutants above background conditions in marine sediments along the eastern shore of central San Diego Bay. This accumulation resulted in conditions identified by the Regional Water Quality Control Board (Water Board) as adversely impacting beneficial uses (i.e., aquatic life, aquatic-dependent wildlife, and human health).

The Water Board identified affected areas as waters adjacent to two adjoining, active shipyard facilities in San Diego Bay—the North Shipyard and the South Shipyard, together termed the Site. In March 2012, the Water Board issued a CAO for remediation of marine sediments containing elevated chemical concentrations within the Site.

The North Shipyard has been operated by BAE Systems San Diego Ship Repair (BAE Systems; formerly known as Southwest Marine, Inc.) since 1979. The North Shipyard includes a 6-acre parcel (2 acres of land and 4 acres of water) along the north end of the site, which was historically used to support the Silvergate Power Plant, including intake and discharge cooling water tunnels. The site has been used as a ship/boat repair, alteration, and overhaul facility since the early 1900s. The site includes approximately 39.6 acres of tidelands (23 acres on land and 16.6 acres offshore). The North Shipyard includes offices; buildings for blasting and painting and other production activities; four piers (Pier 2 was demolished in support of remedial activities, resulting in three piers); and one floating dry dock. Two remnant in-water portions of marine railways were partially removed in 1998, with the remaining sections completely removed in support of remedial activities.

In October 2012, a RAP (Anchor QEA 2012) was developed and submitted in compliance with CAO Directive B.1 and describes the process by which the cleanup of the Site will be managed, designed, planned, implemented, and monitored in accordance with the CAO and consistent with the U.S. Environmental Protection Agency's (USEPA's) National Contingency Plan.

Figure 1 depicts the location of the Site. The remedial footprint extends from the U.S. Bulkhead Line (shoreline) to San Diego Bay's main shipping channel to the west. To create

an orderly and systematic dredge plan for a contractor's use, the remedial footprint was divided into separate units of dredging, termed Sediment Management Units (SMUs). These SMUs were generated prior to development of a construction schedule and sequence, without knowledge of existing site operations, or other extraneous limitations.

Implementation was conducted on an active shipyard, which involved vessels being berthed and relocated, generally being conducted on a moving and typically non-negotiable schedule. This necessitated an updated delineation of dredge areas, as in many occasions a portion of the SMU would be inaccessible (e.g., a vessel located a Pier 4 North would preclude sections of SMU-11, SMU-12, and SMU-13 from being dredged). As a result, dredging was conducted by berthing area, corresponding to its adjacent pier. The North Shipyard was further divided into Dredge Cells (DCs) by the Contractor to provide for increased control over dredge area remediation progress and to account for frequent vessel movement and related accessibility of dredge areas. DCs were used for internal progress tracking and are not presented elsewhere in this document. Dredge areas are illustrated in Figure 2.

2.1 Remedial Action Objectives

Cleanup objectives for the primary contaminants of concern (COCs) were stipulated by the Water Board in the CAO (Water Board 2012a). COCs with established cleanup levels include copper, mercury, high-molecular weight polycyclic aromatic hydrocarbons (HPAHs), total polychlorinated biphenyls (PCBs), and tributyltin. Cleanup objectives stipulated by the CAO are presented in Table 1.

Table 1
Cleanup Objectives Mandated by the CAO

Chemical	Units (dry weight)	Targeted Post-remedial Dredge Area Concentrations	Estimated Post-remedial SWAC	Post-remedial Trigger Concentrations
Copper	mg/kg	121	159	185
Mercury	mg/kg	0.57	0.68	0.78
HPAH	µg/kg	663[1]	2,451[2]	3,208
Total PCB Congeners[3]	µg/kg	84	194	253
Tributyltin	µg/kg	22	110	156

Notes:
Table taken from the CAO (Water Board 2012a).
1. HPAHs = sum of six PAHs: Fluoranthene, Perylene, Benzo(a)anthracene, Chrysene, Benzo(a)pyrene, and Dibenzo(a,h)anthracene.
2. HPAHs = sum of 10 PAHs: Fluoranthene, Pyrene, Benz[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, indeno[1,2,3-c,d]pyrene, Dibenz[a,h]anthracene, and Benzo[g,h,i]perylene.
3. Total PCB Congeners = sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

µg/kg = micrograms per kilogram
HPAHs = high-molecular weight polycyclic aromatic hydrocarbons
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl

2.2 Permits Obtained

Several state and federal permits and approvals were received prior to commencing remedial activities, as follows:

- **California Environmental Quality Act**. The Water Board, acting as lead agency, certified the Final Program Environmental Impact Report (EIR; Water Board 2012b) on March 14, 2012, in which all work complied with the preferred alternative selected. An addendum to the EIR was issued by the Water Board on June 27, 2013 (Water Board 2013a), which addressed changes to the project since the previous issuance of the EIR. Changes included increasing the overall dredge volume (for both the North and South Shipyards).
- **U.S. Army Corps of Engineers Individual Permit.** The U.S. Army Corps of Engineers (USACE) Individual Permit (IP; SPL-2013-00146-RRS) was issued by USACE on November 20, 2013 (USACE 2013). A modification to the permit was issued by USACE on September 12, 2014, to include additional work, which included

installation of a permanent, vertical sheetpile bulkhead/submerged wall along the shoreline of BAE Systems lease, removal of a submerged sheetpile wall and marine railway debris, removal of Pier 2 structure and elimination of on-site dredge handling by transferring sediment from a barge or scow directly to trucks (USACE 2014). A second modification to the permit was issued by USACE on September 4, 2015, to dredge and dispose of an estimated 250 cubic yards of material misplaced from the Contractor's material scow on June 21 and increase the total project permitted amount to a maximum of 120,000 cubic yards to be dredged and disposed (USACE 2015).

- **Unified Port of San Diego Coastal Development Permit.** The Coastal Development Permit (CDP; CDP-2013-06) was issued by the Unified Port of San Diego on August 1, 2013. An amendment to the CDP was issued by the Port of San Diego on September 24 to include additional work, which included installation of a permanent, installation of a vertical sheetpile bulkhead/submerged wall along the shoreline of BAE Systems lease, removal of a submerged sheetpile wall and marine railway debris, removal of Pier 2 structure, and elimination of on-site dredge handling by transferring sediment from a barge or scow directly to trucks.
- **Industrial User Discharge Permit.** The Industrial User Discharge Permit (IUDP; Industry Number 11-0564) was issued by the City of San Diego (City) Industrial Wastewater Control Program on October 23, 2014.
- **Trucked Industrial Waste Generator Permit.** The North Trust obtained a Trucked Industrial Waster Generator Permit (IWGP; Permit Number 25-0475-01A) to dispose of residual wastewater located below the discharge point in the pretreatment system. The City issued this permit to the North Trust on February 22, 2016.
- **California State Lands Commission Lease**. The fully executed dredging lease (PRC 9077.9) was issued by the California State Lands Commission (CSLC) on August 5, 2013.
- **State Water Resources Control Board General Permit to Discharge Stormwater Associated with Construction Activity.** A Waste Discharge Identification Number (WDID; 9 37C370655) was received on August 22, 2014, after the submittal of the Notice of Intent (NOI). The Stormwater Pollution Prevention Plan (SWPPP) was submitted as part of the NOI.

- **Water Board Waste Discharge Requirements/Water Quality Certification.** The final version of the Waste Discharge Requirements/Waste Quality Certification (WDR/WQC) was issued by the Water Board on July 10, 2013.

All work was completed in accordance with the requirements of the above permits.

3 REMEDIAL DESIGN

3.1 General Approach

The general approach for remediation is detailed in the Basis of Design Memorandum (BODM; Anchor QEA 2013). The overall project objective was to remove chemically impacted sediments (those exceeding CAO-mandated concentrations) to the degree economically and technologically feasible.

The remedial approach involved mechanically dredging impacted sediments within a defined remedial footprint, stabilizing sediment (if necessary), offloading dewatered sediment to haul trucks for off-site disposal, and remediation of under pier and sloped areas with sand cover placement. Additional sand cover was placed over other dredged areas as determined necessary by the Engineer. An onshore area Sediment Management Area (SMA) was used to support the offloading activity including ingress/egress, truck cleaning and inspection, decant water processing, and other miscellaneous support activities.

The total volume of dredged material was initially estimated, based on limited data prior to design, as being 90,800 cubic yards, as documented in the CAO (Water Board 2012a) and RAP (Anchor QEA 2012). After the design was completed and more precise dredging extents were developed, including the demolition of structures and installation of a submerged bulkhead to increase dredge volumes, the total projected removal volume was increased to 105,800 cubic yards. This section provides further information on the development of the total projected removal volume, and Section 4 documents the actual amount of sediment removed.

3.2 Dredge Design

The dredge design accounted for technical feasibility, stability of existing site features and facilities, and site restrictions that had the potential to hinder the construction and sediment removal process and thus the achievement of cleanup objectives. Important design considerations included sediment properties, physical constraints, equipment selection, and dredging performance criteria. Dredge boundaries and cut elevations were established after considering physical and chemical properties of the sediment and the layout the remedial footprint, as detailed in the BODM (Anchor QEA 2013).

The horizontal and vertical (cut depth) boundaries of the dredge prisms, provided in the BODM (Anchor QEA 2013), were developed based on the remedial footprint for the Site (i.e., North and South Shipyard), site physical boundaries such as the shoreline and existing structures, site bathymetry, and the vertical delineation of existing site sediment data. In particular, results of sediment coring conducted during the pre-design investigation phase and the observed depth to refusal in apparent native soils informed the selection of dredge depths. Physical site boundaries (such as shorelines, bulkheads, and existing structures) were analyzed for structural stability of support piles and stability of slopes by examining the geotechnical properties of adjacent sediments.

Precautionary measures were integrated into the dredge design to maintain the stability of site marine structures during dredging in their vicinity. The dredge design involved analyzing the stability of the structures and slopes and determining specific offsets or pile exposure limits that should be maintained during dredging operations. To properly evaluate structures and slopes, a variety of analytical models and programs were used to determine factors of safety and acceptable removal limits. Triton Engineers, Inc., provided additional analytical evaluations for these site structures. The BODM provides a detailed analysis of the structural stability of site structures (Anchor QEA 2013).

Prior to the dredge design process, the dredge volume for the North Shipyard was originally estimated as 90,800 cubic yards, as presented in the CAO (Water Board 2012a) and RAP (Anchor QEA 2012). This estimated volume was based on the remedial footprint presented in the RAP and current bathymetry at the time (i.e., before any additional field investigations and design work was conducted) and whether existing structures could be modified or demolished in an effort to remove additional potentially contaminated sediments. This volume was appropriate for obtaining initial project permits, which were later modified due to updated volumes generated during the design process.

During the dredge design process, the dredge volume was refined based on the results of the slope stability assessment that prescribed appropriate and protective dredging extents and side slope as well as provided structural offsets from bulkheads and other marine structures to maintain the stability of those existing features and facilities. In addition to these general

conditions, specific physical limitations that affected the remedial footprint and volumes at each dredge area (delineated by existing BAE Systems pier locations) are presented below.

- Pier 1 North (SMU-1, SMU-2, and SMU-3): A submerged vertical sheetpile wall was installed along the shoreline of SMU-1 to facilitate required remedial dredging. To the north of the San Diego Gas & Electric (SDG&E) Inlet Tunnel, dredging was not allowed within 5 feet of the structure's wingwall to avoid any potential sloughing of shoreline material. In addition, adjacent to the BAE System's bulkhead (between the SDG&E Outlet Tunnel and Pier 1), a maximum dredging elevation of -4 feet mean lower low water (MLLW) was allowed in addition to a 5-foot dredging offset. Maximum dredging limits were established by Triton Engineers north of Pier 1 based on the allowable maximum sediment removal at the existing pier piles, which also included a 5-foot dredging offset.
- Pier 1 South (SMU-4, SMU-5, and SMU-6): The submerged marine railways and Pier 2 were demolished to facilitate required remedial dredging. Maximum dredging limits were established by Triton Engineers to protect various structures (including the BAE Systems bulkhead, Ramp Wharf, and Pier 1), which included maximum sediment removal at piles and a 5 -dredging offset.
- Pride of San Diego (POSD) Dry Dock Berthing Area (SMU-7 and portions of SMU-8 and SMU-9): Maximum dredging limits were established by Triton Engineers to protect various structures (including the BAE Systems bulkhead, Ramp Wharf, Building 13, and existing dolphin), which included maximum sediment removal at piles and a 5-foot dredging offset.
- Pier 3 North (portions of SMU-8 and SMU-9 and SMU-10): Maximum dredging limits were established by Triton Engineers to protect existing structures (including BAE Systems Break Area and Pier 3), which included maximum sediment removal at piles and a 5-foot dredging offset.
- Pier 3 South and Pier 4 North (SMU-11, SMU-12, and SMU-13): Maximum dredging limits were established by Triton Engineers to protect existing structures (including Pier 3 and BAE Systems bulkheads), which included maximum sediment removal at piles or bulkhead walls and a 5-foot dredging offset.
- Pier 4 South (SMU-14, SMU-15, SMU-16, SMU-17, and SMU-18): The remnant Pier 5 structure was removed to facilitate additional dredging. Maximum dredging limits were established by Triton Engineers to protect existing structures (including Pier 4

and BAE Systems bulkhead), which included maximum sediment removal at piles or bulkhead walls and a 5-foot dredging offset.

These physical limitations are presented on the as-built drawings included in Appendix A. For areas that were unable to be dredged to a confirmed z-layer surface with analytical concentrations lower than the CAO requirements (such as dredging offsets, slopes, or other structural limitations), a layer of sand was placed as discussed in Section 4.6.

As a result of these physical limitations on dredging extents and cut depths, the design volume estimation for the defined dredge template and specified dredge elevations equated to a volume of approximately 96,700 cubic yards of sediment to be removed. An assumed overdredge depth of 0.5 foot (of the 1-foot allowable overdepth provided in the Contract Drawings [Anchor QEA 2014b]) increased the predicted dredge volume by approximately 7,400 cubic yards. Additional "3-foot cut" areas (without specified final dredge elevations) were created to conform to irregular bathymetry. The inclusion of the assumed overdredge depth and the 3-foot cut areas increased the design removal volume for the designed dredge prism to approximately 104,100 cubic yards. Various areas within the remedial footprint were outside of the dredge template due to the extrapolation of the dredging daylight line. For these areas, a 3-foot cut was prescribed, increasing the dredge volume by approximately 1,700 cubic yards (including a 0.5-foot allowable overdredge), increasing the overall design volume to approximately 105,800 cubic yards. Table 2 below presents the total dredge volume broken down by dredge area.

Table 2
Design Dredge Volumes

Dredge Area	SMUs	Design Volume (cubic yards)	0.5-foot Overdredge Allowance (cubic yards)	3-foot Cut Volume, including 0.5 foot Overdredge Allowance (cubic yards)	Design Dredge Volume (cubic yards)
Pier 1 North	1, 2, 3	37,000	2,300	0	39,300
Pier 1 South	4, 5, 6	13,200	1,100	1,100	15,400
POSD Dry Dock Berthing Area and Pier 3 North	7, 8, 9, 10	11,500	1,400	0	12,900
Pier 3 South and Pier 4 North	11, 12, 13	14,000	1,200	200	15,400
Pier 4 South	14, 15, 16, 17, 18	21,000	1,400	400	22,800
	Total	**96,700**	**7,400**	**1,700**	**105,800**

A comparison between the design volume and actual dredged volume is presented in Section 4.4.1. An overall comparison between the design and actual removed quantities is presented in Section 6.

3.3 Sand Cover Design

Sediment removal from under piers (i.e., Piers 1 and 3) and other marine structures (i.e., Ramp Wharf, Building 13, and Break Area) was technically infeasible and would have threatened the structural stability of these structures; therefore, an alternative remedial approach was required to achieve cleanup objectives as identified in the CAO (Water Board 2012a). To promote physical isolation and stabilize contaminated sediments under piers and over-water structures within the remedial footprint, and to recognize and anticipate some post-remedial natural mixing of sand with deeper materials, a layer of sand was placed to promote mixing, natural recovery, and achievement of cleanup objectives for contaminated sediments and post-dredge surfaces over time. A specified placement rate of 6 tons per 100 square feet (equating to a nominal average of 12 inches in thickness) was used on the surface of the existing sediment layer in a continuous and consistent layer without significant gaps in coverage or excessive high-mounded areas. Additionally, sand cover placement on slopes

where complete removal of sediment threatened structural stability and in open-water areas was conducted subject to the discretion of the Engineer following dredging operations.

Sand cover placement was specified for the following distinct areas in the North Shipyard:

- All sloping areas where complete removal of potentially contaminated sediments was infeasible due to structural limitations
- Below existing piers within the remedial footprint (i.e., Piers 1 and 3)
- Below existing structures within the remedial footprint (i.e., Ramp Wharf, Building 13, and Break Area)
- The continuous open-water area north of Pier 4 within the remedial boundary
  - As Pier 4 was demolished and re-constructed prior to construction, a small area (approximately 9,800 square feet) which previously existed within the dredge remedial area was shifted north of Pier 4. As further dredging in this small area may have destabilized the newly installed Pier 4, sand cover was placed over the area.

Two types of sand cover material were specified: sand material and gravelly sand material. The sand material (containing particles smaller than 0.375 inch in size) was used over relatively flat areas of the dredge prism, including under pier and structure areas as well as the continuous open area north of Pier 4. Gravelly sand (containing 25 to 50 percent larger than 0.75 inch in size) was used over sloping areas due to its higher internal friction angle and greater ability to remain stable on sloping ground surfaces.

The surficial chemical concentrations of the post-remedial sediment will be monitored as part of the post-remedial monitoring program outlined in the CAO (Water Board 2012a) and as detailed in the RAP (Anchor QEA 2012) and Post-Remedial Monitoring Plan (PRMP; Exponent 2012).

4 SUMMARY OF REMEDIAL ACTION

This section describes remedial activities undertaken to address impacted sediments at the North Shipyard portion of the Site. The activities are listed in chronological order and include the following:

- Preparation and use of SMA and other landside facilities
- Site mobilization and preparation
- Debris removal and demolition
- Contaminated sediment dredging
- Sediment handling and offloading
- Sand cover placement
- Ancillary construction activities
- Demobilization and site restoration

Each step was a necessary part of accomplishing the overall project goal of achieving the requirements of Directives A.2.a and A.2.b of the CAO. R.E. Staite Engineering, Inc. (RES) was the selected contractor to complete remedial activities.

4.1 Preparation and Use of SMA and Other Landside Facilities

Prior to construction, the northwestern corner of the BAE Systems' property (identified as "Sub City" in the Contract Drawings) was identified as the SMA, available to the Contractor for dredged material and debris offloading, dewatering, and sediment management; haul truck loading; water management; and related staging activities. The SMA measured approximately 0.48 acre, and was located adjacent to San Diego Bay. Prior to mobilization, all structures and materials were removed from the area. Landside access to the SMA was via Belt Street, entering through the RES facility immediately north of the SMA. Contractor vessels and barges accessed the SMA from water at the installed floating offload platform (Section 4.2.).

Additional areas were provided to the Contractor, as needed due to space restrictions, to facilitate demolition of the submerged marine railways (Section 4.3.3) and to stockpile sand cover materials. Specifically, approximately 0.95 acre of BAE Systems Pier 1 and adjacent landside facilities were used to facilitate the demolition of the marine railways. Landside

access to Pier 1 was through the BAE Systems facility, and the pier was generally used to load debris from the demolition for offloading.

To facilitate the stockpiling (and subsequent loading of barges) of sand cover material, a Clean Sand Containment Area (CSCA) was provided to the Contractor, directly south (landside) of Pier 1. The 0.15-acre CSCA was used to stockpile, manage, and load sand cover materials onto adjacent barges. Landside access to the CSCA was through the BAE Systems facility. Contractor vessels and barges accessed the CSCA between Pier 1 and the POSD Dry Dock Berthing Area.

4.2 Site Mobilization and Preparation

The Contractor began mobilizing to the Site in the beginning of September 2014. Initial mobilization involved establishing the sandbag perimeter berm and k-rail barriers at the SMA. Baker and weir tanks were leased from Bradley Tanks, Inc., and mobilized to process water generated during dredging operations, truck washing activities, and pooled stormwater within the SMA. Additional Baker tanks were placed on a floating flexi-float barge to collect water during dredging activities prior to subsequent treatment and discharge.

Beginning on September 11, 2014, the Contractor began a limited landside excavation to install the floating offload platform abutment along the shoreline of the SMA, which was used to stabilize the Contractor's floating offload platform. Prior to floating offload platform installation, limited dredging was conducted in the footprint of the platform (Pier 1 North) to allow for barge access. The floating offload platform was mobilized to Pier 1 North on November 2 and installed on November 6 after all on-site material barges were full, awaiting offloading. The floating offload platform was approximately 12,000 square feet, and secured to the abutment pad by a ramp and spudded in place. Metal spill plates were welded to the perimeter of the floating offload platform and ramp to contain any sediment and to direct stormwater.

Following the floating offload platform installation, an excavator was staged on the floating offload platform, allowing the operator to access sediment in the material scows and load directly to haul trucks positioned on the platform. A spill plate was installed along the rails of

the floating offload platform, connecting the deck of the platform to the material scows before offloading activities. Weights were added to the southwestern corner of the floating offload platform to provide counterweight to the offloading excavator and offloading activities.

4.3 Debris Removal and Demolition

4.3.1 Identified and Unidentified Debris Removal

A total of 11 debris targets were identified during the design phase, which included analysis of a side-scan sonar survey conducted in 2013 (Environmental Data Solutions 2013). The identified debris included but was not limited to relic pier piles, a sunken partially buried boat, and a sunken dock. The Contractor removed the identified debris targets using a dredging bucket during dredging operations.

In addition to the identified debris, incidental debris (i.e., debris incidental to dredging and not identified during the design phase but encountered during the work) was removed from within the remedial footprint during dredging operations. Typically, removed debris consisted of wooden piles, ropes, cables, chains, rocks, and small (less than a 2 feet in diameter) miscellaneous scrap metal objects.

All debris, including identified and incidental, was stockpiled within the SMA, transported separately from the dredged material, and was either transported using debris manifests to the Otay Landfill or recycled at Enniss Inc.

4.3.2 Pier 2 Demolition

As shown in Figure 2, the previously existing Pier 2 (located between Pier 1 and the POSD Dry Dock Berthing Area) was approximately 260 feet long and 17 feet wide, consisting of a timber deck with asphalt overlay contained with a steel curb. The pier was supported by 12-inch-square concrete piles with unknown tip elevations, spaced between 10 and 15 feet on center, and attached to the decking through a timber pile cap. The pier contained other ancillary materials, including various steel channel beams, steel pipe fenders, and utility pipes. Due to the age, condition, and limited utility of the structure, it was determined that the demolition of Pier 2 was an economically feasible and preferable approach to the

remedial efforts, because the pier would not need to be replaced. Demolition efforts were less costly and complicated than reinforcing the existing pier to allow for dredging adjacent to, and sand cover placement beneath, the structure.

Demolition of Pier 2 commenced on January 5, 2015, and was completed on January 22 prior to dredging operations in the vicinity of the pier. Once all utility disconnections were verified, the Contractor cut the pier deck into several sections and removed using the Contractor's crane. Following removal of the pier decking, all piles were removed using an American Pile Driving Equipment (APE) Model 200T vibratory hammer. Removed material was stockpiled on a flat-deck barge, which was subsequently transported to the SMA for further breakdown that was then salvaged by the Contractor, transported to Ennis for recycling, or transported using debris manifests to the Otay Landfill, as appropriate.

4.3.3 Submerged Marine Railways

The previously existing submerged marine railways in Pier 1 South consisted of two rows of rails, with each rail containing two square piles with unknown tip elevations, supported at the sediment surface with a concrete cap. The northern and southern row contained approximately 28 and 19 rails, respectively, as shown in the project as-built drawings (Appendix A). As the marine railways are no longer in use, it was determined that the demolition of marine railways was an economically feasible and preferable approach to the remedial efforts, because the structure would not need to be replaced.

Demolition of the submerged marine railways commenced on January 5, 2015, and was completed on June 9, 2015 (work was conducted intermittently during this time based on Contractor staffing and equipment availability). In general, the Contractor used a specialized shearing tool that reached under the existing pile cap, sheering the cap from the square concrete piles. After shearing was complete, the concrete caps were lifted out of the bay using the Contractor's crane and stockpiled on Pier 1 using appropriate containment best management practices (BMPs) or placed directly onto haul trucks. After all pile caps were removed, the square concrete piles were removed using the APE Model 200T vibratory hammer and stockpiled on Pier 1 using appropriate BMPs or placed directly onto haul trucks.

After any visual sediment was removed from the concrete (pile caps and piles), the material was transported directly to Ennis for recycling.

4.4 Contaminated Sediment Dredging

As stated in Section 2, dredging was conducted by berthing area corresponding to its adjacent pier, as opposed to by SMU, due to dredging feasibility within an active shipyard. Dredging operations commenced on September 23, 2014, in Pier 1 North and concluded on December 16, 2015, in Pier 1 South. Consistent with the dredge design and regulatory requirements, dredging was conducted to the extent feasible without destabilizing or undermining existing structures and shoreline features. In addition, dredging was suspended above design elevations in isolated area if the presence of hard, consolidated material was encountered, limiting the amount of material that could be removed. Hard, consolidated material was interpreted as being the underlying Bay Point Formation, a native geologic layer, assumed to be free of chemical impacts. The purpose of dredging was to remove sediments that contain elevated concentrations of COCs; it is not necessary to remove underlying Bay Point Formation material. In general, when the Bay Point Formation was encountered, the Contractor notified the Field Engineer, who verified in the field that that the material being recovered (typically minimal due to the density of the underlying material) was native and that no additional removal of potentially contaminated non-native sediments was occurring. This verification was conducted at each location where the hard, consolidated material was encountered, with the location logged for later verification with bathymetric survey results.

Dredging operations were conducted using mechanical dredging methodology supported by two separate cable-arm dredging platforms. Sediment was dredged using two types of clamshell buckets. Dredging was initiated in each area using an environmental cable-arm bucket; however, due to the density of material and presence of debris, the majority of dredging was conducted with a 5-cubic yard standard clamshell bucket, supplemented with a 3-cubic yard heavy clamshell bucket if conditions warranted. The bucket was positioned using GPS software.

Dredged material was placed in water-tight scows that were transferred to the SMA by tugboats for processing. Typical scow haul routes from the dredge areas to the offloading area

in the SMA are presented in Figure 3. During dredging operations, a loaded sediment barge was transported to the SMA daily. Sediment handling and offloading is detailed in Section 4.5.

4.4.1 Type and Volume of Dredged Material

Concurrent with dredge design, a pre-dredge bathymetric survey was conducted by Environmental Data Solutions, Inc., between April 10 and 11, 2013. The results of the survey were presented in the Contract Drawings (Anchor QEA 2014b) and were provided to the Contractor prior to mobilization to represent the baseline pre-dredging conditions for its use in planning purposes. At the beginning of construction (on September 10 and 23, 2014), the Contractor's third-party surveyor, eTrac, Inc., conducted an updated pre-dredge survey in Pier 1 North, Pier 3 South, Pier 4 North, and Pier 4 South as those areas were available to the surveyor. The remaining areas were unable to be surveyed at that time and were completed prior to dredging operations being conducted in that area, with the final pre-dredge bathymetry obtained on May 22, 2015. All of the collected surveys were integrated to generate the final pre-dredge bathymetric survey, which is presented in Figure 2. The final pre-dredge bathymetric survey was compared to the final post-dredge bathymetric survey (Figure 4) to generate final dredge volumes. The final post-construction (post-sand cover) conditions are shown in Figure 5.

Consistent with the findings from the pre-design field investigations, material dredged from the Site primarily consisted of fine-grained material and sand. A third-party bathymetric survey was conducted following completion of dredging in each dredge area to confirm dredge depths (based on conformance to design elevations or observations made by the Engineer) and to determine final dredge volumes. Following or concurrent with the review of the third-party bathymetric survey, post-dredge confirmatory sampling (discussed in Section 5.4.2) was conducted to determine if post-dredge cleanup objectives were met or if additional dredging was necessary below the design elevations. At the discretion of the Engineer, additional dredging passes were required in targeted areas and a second subsequent third-party survey was conducted to confirm completion. Total dredge volumes per dredge area are presented in Table 3. Details regarding the completion of dredging in each dredge area is discussed in Section 4.4.3.

Table 3
Final Dredge Volumes

Dredge Area	Number of Dredging Passes	Approximate Design Volume (cubic yards)	Actual Volume Removed (cubic yards)	Difference Between Design and Actual Volumes (cubic yards)
Pier 1 North	4	39,300	45,182	5,882
Pier 1 South	2	15,400	15,352	-48
POSD Dry Dock Berthing Area	2	9,400	9,999	599
Pier 3 North	1	3,500	4,282	782
Pier 3 South	3	7,000	8,074	1,074
Pier 4 North	1	8,400	8,916	516
Pier 4 South	2	22,800	20,950	-1,850
Scow 3002 Misplaced Material Area[1]	2	---	1,330	1,330
Total		**105,800**	**114,085**	**8,285**

Note:
1. The inclusion of the Scow 3002 Misplaced Material Area is discussed in Section 4.4.4.

As shown in Table 3, the volume of material removed was 8,285 cubic yards (approximately 8 percent) greater than the design volume, reflecting the fact that additional sediment removal below design depths was required. Anchor QEA generated a technical memorandum (Anchor QEA 2015b) discussing the basis for the volume increase (the final dredge volume was projected to be between 114,000 and 120,000 cubic yards at the time). It was determined that permit modifications were not required from the Port of San Diego (Medel 2015) and the Water Board (Becker 2015), as the additional volume provided in the project permits was an estimate and as the total combined volume dredged between the South Shipyard and North Shipyard was not expected to exceed the total volume allowed by the CAO (i.e., 158,800 cubic yards). In consideration of the Scow 3002 Misplaced Material Area (discussed further in Section 5.4.4), USACE issued a permit modification that not only considered the Scow 3002 Misplaced Material Area but also increased the permitted volume to maximum 120,000 cubic yards (USACE 2015).

As discussed in the technical memorandum, key reasons for the final dredge volume exceeding the design volume are as follows:

- After dredging reached the required depths, post-dredge confirmatory sampling was performed to determine whether CAO requirements have been met. In several locations, impacted sediments extended deeper than expected during the design process, thus additional dredging has been required, increasing the total dredged volume.
- Where possible, the dredge design was further refined to maximize removal of potentially contaminated sediments. Near Pier 1 and the northern site boundary, additional removal was identified that could be completed without impacting site structures, and therefore able to remove more potentially contaminated sediments than originally anticipated in these areas.
- The Contractor was provided a full foot of allowable overdredging below the required elevations. Based on the post-dredge conditions at the South Shipyard (completed in 2014), it was originally projected that the Contractor would remove only a portion of this extra foot, on average. However, on average, more than half of the full overdredge foot was removed, also increasing the volume total.
- The Contractor needed to remove an additional 1,330 cubic yards of material as part of the Scow 3002 Misplaced Material Area dredging (Section 4.4.4). The total amount removed was greater than the original estimate of 250 cubic yards (as mentioned in Section 2.2) due to a second dredging pass being conducted based on results of post-dredge confirmatory sampling as well as dredging additional depth to ensure that all spilled material was removed.

4.4.2 Post-dredge Confirmatory Sampling

Following review of third-party post-dredge survey data and field observations, post-dredge confirmatory samples were collected to analyze for chemical constituents in the remaining sediment subgrade. These results were then used, in conjunction with other observations of the dredging process, to determine whether further dredging was warranted. The sampling and decision-making processes were completed consistent with Section 3 of the Remedial Monitoring Plan (RMP; Anchor QEA 2012).

4.4.2.1 Sampling Procedures

All post-dredge confirmatory samples were collected in accordance with applicable sections of the RMP and Sampling and Analysis Plan (SAP; Appendices C and D of Anchor QEA 2012, respectively). All sample collection and handling procedures, sample processing, and quality assurance and quality control procedures were implemented as described in applicable sections of the RMP and SAP. Post-dredge confirmatory sampling locations, presented in Figure 6, were selected to adequately represent each polygon presented in the CAO and targeted for remediation.

Tierra Data, Inc., and Pi Environmental (subcontracted to Anchor QEA) collected samples from aboard a sampling vessel using a vibracore sampler advanced to refusal below the sediment surface. Station coordinates, mudline elevation, estimated penetration, and retrieved core length for the collected samples are shown in the sediment core logs provided in Appendix B. All sampling and processing was conducted on the sampling vessel.

Sediment cores were segmented by depth, and discrete and composite samples of the residual (top 5 to 6 centimeters [cm]) and underlying layers were collected and archived. As discussed in the RMP (Anchor QEA 2012), the top 5 cm were excluded from the sample, as the layer may represent the thin surface layer of unconsolidated residual sediment that was anticipated to remain in place after dredging was completed. A 30-cm interval below the residual layer was analyzed for COCs, as this depth represented the appropriate minimum sample volume required to analyze for the chemical parameters. Physical characteristics of the core were noted on the sediment core collection form, and a representative core from each location was photographed.

The sediment core logs and photographs for each dredge area (for the final dredging pass, representing the pre-sand cover or existing sediment surface layer, as applicable) are included in Appendix B. Interpretation of the core log layer descriptions and physical characteristics indicate increased consolidation and density.

As shown in Figure 6, 34 samples were attempted for the project and were all collected successfully. During the design phase, locations of composite and discrete samples were identified to meet the requirement of one sample per Thiessen Polygon (per CAO

requirements). However, during implementation, all samples were taken as discrete samples to provide additional spatial post-dredge analytical information throughout the dredge area. A summary of sampling locations/identifiers (representing the final pass conducted in the dredge area) and corresponding GeoTracker field point names are presented in Table 4.

Table 4
Summary of Post-dredge Confirmatory Sampling Designations

Dredge Area	Sampling Location	Sampling Identification[1]	GeoTracker Field Point Name
Pier 1 North	SD-N-C-01A-D	SD-N-C-01A-D-0535-150730	N-SMU1D
	SD-N-C-01B-D	SD-N-C-01B-D-0535-150505	N-SMU1B
	SD-N-C-01C-D	SD-N-C-01C-D-0535-150730	N-SMU1A
	SD-N-C-02-D	SD-N-C-02-D-0535-150509	N-SMU1C
	SD-N-C-03-D	SD-N-C-03-D-0535-150812	N-SMU2A
	SD-N-C-04A-D	SD-N-C-04A-D-0535-150812	N-SMU2B
	SD-N-C-04B-D	SD-N-C-04B-D-0535-150812	N-SMU3A
	SD-N-C-05A-D	SD-N-C-05A-D-0535-151202	N-SMU2C
	SD-N-C-05B-D	SD-N-C-05B-D-0535-151121	N-SMU3B
Pier 1 South	SD-N-C-06-D	SD-N-C-06-D-0535-151202	N-SMU4A
	SD-N-C-07A-D	SD-N-C-07A-D-0535-151212	N-SMU4B
	SD-N-C-07B-D	SD-N-C-07B-D-0535-151212	N-SMU4C
	SD-N-C-08-D	SD-N-C-08-D-0535-151212	N-SMU5A
	SD-N-C-9D-D	SD-N-C-9D-D-0535-151202	N-SMU5B
POSD Dry Dock Berthing Area	SD-N-C-10-D	SD-N-C-10-D-0535-150603	N-SMU7A
	SD-N-C-11-D	SD-N-C-11-D-0535-150626	N-SMU6A
	SD-N-C-12-D	SD-N-C-12-D-0535-150619	N-SMU6B
	SD-N-C-13-D	SD-N-C-13-D-0535-150626	N-SMU9A
	SD-N-C-13A-D	SD-N-C-13A-D-0535-150623	N-SMU9C
Pier 3 North	SD-N-C-14-D	SD-N-C-14-D-0535-150306	N-SMU10A
	SD-N-C-14A-D	SD-N-C-14A-D-0535-150306	N-SMU9B
Pier 3 South	SD-N-C-15-D	SD-N-C-15-D-0535-151030	N-SMU11A
	SD-N-C-17-D	SD-N-C-17-D-0535-151111	N-SMU12A
	SD-N-C-18A-D	SD-N-C-18A-D-0535-151111	N-SMU12B
	SD-N-C-18B-D	SD-N-C-18B-D-0535-151111	N-SMU13A
	SD-N-C-20-D	SD-N-C-20-D-0535-151125	N-SMU13B
Pier 4 North	SD-N-C-16-D	SD-N-C-16-D-0535-150518	N-SMU11B
	SD-N-C-19-D	SD-N-C-19-D-0535-150518	N-SMU12C

Dredge Area	Sampling Location	Sampling Identification[1]	GeoTracker Field Point Name
Pier 4 South	SD-N-C-21-D	SD-N-C-21-D-0535-151207	N-SMU17A
	SD-N-C-21A-D	SD-N-C-21A-D-0535-150717	N-SMU14
	SD-N-C-22A-D	SD-N-C-22A-D-0535-150721	N-SMU16A
	SD-N-C-22B-D	SD-N-C-22B-D-0535-150724	N-SMU16B
	SD-N-C-23-D	SD-N-C-23-D-0535-151030	N-SMU17B
Scow 3002 Misplaced Material Area	Scow 001	SD-N-C-D-Scow-01-0535-150924	SCOW-01

Note:
1. Sampling locations are presented in Figure 6. Core logs for each sampling location are included in Appendix B.

4.4.2.2 Analytical Results

Sediment samples were analyzed by Eurofins Calscience Environmental Laboratories, Inc., for COCs established in the RMP (Anchor QEA 2012) and were compared to the post-remedial dredge area concentrations shown in Table 3 of the RMP. Specifically, sediment samples were analyzed for copper, mercury, tributyltin, HPAHs, and total PCBs. Sediment conventional analyses (ammonia, total organic carbon, and grain size) were not conducted or required as part of post-dredge confirmatory sampling. The threshold for additional action (including additional sampling, additional dredging, and sand placement) was a chemical concentration greater than 120 percent of the post-remedial dredge area concentration (also provided in Table 3 of the RMP). Such cases triggered an evaluation of potential remedial actions, as discussed in Section 3.5 of the RMP.

Summary tables and laboratory analytical results for each dredge area (for the final dredging pass, representing the pre-sand cover or existing sediment surface layer, as applicable) are included in Appendix C. These analytical results, the post-dredge bathymetry, and other observations made by the Engineer were used to provide a sound technical analysis showing the requirements of Directive A.2 have been achieved. Section 4.4.2.3 provides a summary of the laboratory data validation. Section 4.4.3 provides a narrative of remedial activities, per dredge area, which include an evaluation of potential remedial actions based on the results of the post-dredge confirmatory sampling.

4.4.2.3 Laboratory Data Validation

Anchor QEA conducted a data validation of the post-dredge confirmatory sampling laboratory results in accordance with USEPA Stage 1 validation guidance (USEPA 2009). The results of the data validation are presented in Appendix D. Any instances where method blanks, surrogate recoveries, laboratory control samples and laboratory control sample duplicates, or matrix spike and matrix spike duplicate samples where measured results were outside of the laboratory's control limits are discussed in Appendix D. In summary, the laboratory followed the specified analytical methods and accuracy and precision were acceptable; thus, the post-dredge confirmatory sampling laboratory results are validated.

4.4.3 Summary of Dredge Area Remedial Completion

Remediation dredging commenced at Pier 1 North on September 23, 2014, and completed within the final Pier 1 South dredge area on December 16, 2015. The dredge sequence was in a great part dictated by vessel movements within the shipyard. A detailed summary of completion dates for each dredge area is provided in Table 5. Further discussion of the completion of each dredge area is provided below.

Table 5
Dredging Completion Schedule

Dredge Area	Start Date	Completion Date
Pier 1 North	September 23, 2014	December 2, 2015
Pier 1 South	December 16, 2014	December 16, 2015
POSD Dry Dock Berthing Area	May 23, 2015	June 25, 2015
Pier 3 North	February 23, 2015	March 5, 2015
Pier 3 South	June 26, 2015	November 25, 2015
Pier 4 North	April 10, 2015	May 15, 2015
Pier 4 South	November 14, 2014	December 4, 2015

4.4.3.1 Pier 1 North

Pier 1 North was split into a Northern Section (Pier 1 North-N) and Southern Section (Pier 1 North-S) due to the complexity of the conditions within the dredge area. Specifically:

- Pier 1 North was required to be completed expeditiously due to expected obstructions from future BAE Systems shipyard improvements.
- Pier 1 North was occupied by a vessel for a significant portion of the project, which did not allow for dredging for Pier 1 North-S until later.
- Dredging in the vicinity of the floating offload platform required multiple removals and reinstallations of the barge, which was sequenced for when offloading could be suspended without affecting the project schedule.

For these reasons, the following discussion provides separate descriptions of details associated with the northern and southern sections of the Pier 1 North area.

4.4.3.1.1 Northern Section of Pier 1 North Area

Dredging in Pier 1 North-N was conducted intermittently from September 23, 2014, through completion on August 11, 2015. Post-dredge bathymetric surveys were conducted concurrently with dredging operations to allow for concurrent post-dredge confirmatory sampling.

Post-dredge confirmatory sampling was conducted on July 30, 2015 within the -20 -foot, -16-foot, and -19-foot MLLW dredge floors, specifically collecting SD-N-C-01C-D, SD-N-C-01A-D, SD-N-C-03-D, and SD-N-C-04A-D. Based on this sampling event, two of the four samples collected (SD-N-C-03-D and SD-N-C-04A-D) had analytical concentrations above the threshold for additional action. The Contractor was directed to conduct additional dredging to 2 feet below the design dredge floor in the -16-foot and -19-foot MLLW dredge floors. In addition, the Engineer field verified that non-native potentially contaminated sediments existed at the design depth within the -26-foot MLLW dredge floor. Due to project schedule constraints, the Contractor was provided an additional dredging allowance in this area to remove all non-native sediments based on visual observations by the Contractor and Engineer if identified below the design grade to a limit of -29.5 feet MLLW.

Dredging within the -26 feet MLLW dredge floor and the additional dredging pass was conducted between August 5 and 11, 2015. Post-dredge sampling was conducted on August 12, which included the collection of SD-N-C-04B-D, and the recollection of SD-N-C-03-D and SD-N-C-04A-D following the additional dredging pass. All three samples showed analytical results below the threshold for additional action.

Because dredging operations either met design depths or encountered native material and results of the post-dredge confirmatory sampling showed no analyte concentrations greater than the threshold for additional action, the Engineer judged dredging in Pier 1 North-N complete. The Engineer directed sand cover placement per the revised gravelly sand cover limits (discussed in Section 5.7.5).

The pre-dredge, post-dredge, and post-sand cover bathymetry surveys in Pier 1 North-N are presented in Figures 7a through 7c, respectively. Representative cross sections are provided in Figure 7d. Results of the post-dredge confirmatory sampling analytical results (representing the final dredging pass for each sample) are summarized in Appendix C. The sediment quality objectives have been met for this area.

As shown on the post-dredge bathymetric survey (Figure 7b), the post-dredge elevations in the northeastern corner of the dredge prism are higher than design elevations. The design, which showed dredging continuing through the SDG&E Inlet Tunnel wingwall, was determined in the field to potentially undermine the existing shoreline north of the structure. The Contractor was directed to "field fit" this corner, starting at the existing sediment elevations adjacent to the wingwall continuing to the -20 feet MLLW dredge floor. This area was subsequently covered with gravelly sand.

4.4.3.1.2 Southern Section Pier 1 North Area

Initial dredging in Pier 1 North-S was conducted intermittently from September 23, 2014, through May 8, 2015, when operations in Pier 1 North-S were suspended due to the arrival of a vessel in Pier 1 North.

Bench Area at -20 Feet MLLW. Post-dredge confirmatory sampling in the -20-foot-MLLW bench in Pier 1 North-S was initially conducted on April 30, 2015. Due to visual observations (consisting of non-native sediment with sheening and odor) within the samples collected (Samples SD-N-C-01B-D and SD-N-C-02-D) and project schedule constraints, the Contractor was directed to conduct an additional dredging pass in this area prior to any analytical testing, as the samples likely had analytical concentrations above the threshold for additional action. Due to the thickness of non-native sediments observed in the post-dredge confirmatory samples, the additional dredging pass was specified as up to 2 feet below the original overdredge allowance (resulting in an additional dredging floor of -23 feet MLLW), as well as an additional 2-foot overdredge allowance, was provided to the Contractor in the presence of non-native material.

The additional dredging pass was conducted on May 4, with subsequent post-dredge confirmatory sampling conducted on May 5. Based on the re-sampling of the two samples, one sample (SD-N-C-02-D) continued to show analytical results above the threshold of additional action. Due to this, the Contractor was directed to conduct a limited third dredging pass (2-foot cut) over the area represented by this sample. The third dredging pass was completed on May 8, where results of the post-dredge confirmatory sampling (on May 9) showed no analytical concentrations above the threshold of additional action.

Bench areas at -34 and -36 Feet MLLW. Post-dredge confirmatory sampling of the -34-foot and -36-foot-MLLW bench was conducted on May 2, 2015. Both samples collected in this area (SD-N-C-05A-D and SD-N-C-05B-D) showed analytical concentrations above the threshold of additional action. The Contractor was directed to conduct additional dredging within the areas represented by these samples, which consisted of a 2-foot cut below the existing overdredge allowance, resulting in additional dredging floors of -37 feet and -39 feet MLLW, with an additional 2 foot overdredge in the presence of non-native material. The second dredging pass was completed on May 8, where results of the post-dredge confirmatory sampling (on May 9) showed analytical concentrations above the threshold for additional action at both sampling locations.

Dredging was suspended at this time due to the presence of a vessel in Pier 1 North. Dredging was able to continue in Pier 1 North-S on November 18, 2015, and continued through

December 2. Post-dredge bathymetric surveys were conducted following each additional dredging pass. The third additional dredging pass in the -34-foot and -36-foot MLLW dredge floors was completed on November 20, with subsequent post-dredge confirmatory sampling conducted on November 21.

Based on the re-sampling of samples SD-N-C-05A-D and SD-N-C-05B-D, sample SD-N-C-05A-D continued to show analytical concentrations above the threshold of additional action. The Contractor was directed to conduct a fourth dredging pass of the area represented by sample SD-N-C-05A-D (2-foot cut), which was completed on December 2. Post-dredge confirmatory sampling conducted that day showed that the sample contained no analytical concentrations above the threshold for additional action.

Because dredging operations either met design depths or encountered native material and results of the post-dredge confirmatory sampling showing no analyte concentrations greater than the threshold for additional action, the Engineer judged dredging in Pier 1 North-S complete. The Engineer directed sand cover placement per the revised gravelly sand cover limits (discussed in Section 5.7.5). The pre-dredge, post-dredge, and post-sand cover bathymetry surveys in Pier 1 North-N are presented in Figures 7a through 7c, respectively. Representative cross sections are provided in Figure 7d. Results of the post-dredge confirmatory sampling analytical results (representing the final dredging pass for each sample) are summarized in Appendix C. The sediment quality objectives have been met for this area.

4.4.3.2 Pier 1 South

Dredging in Pier 1 South began on December 16, 2014, and was conducted intermittently through construction, completed on December 16, 2015. Post-dredge bathymetric surveys were conducted after completing a section of the dredge area to allow for post-dredge confirmatory sampling.

Based on the results of the post-dredge confirmatory sampling (on December 2, 2015), four of the five samples (SD-N-C-07A-D, SD-N-C-07B-D, SD-N-C-08-D, and SD-N-09-D) collected had analytical concentrations above the threshold of additional action. Sample SD-N-C-09-D,

which is located in the 3-foot cut located adjacent to Pier 1 South contained analytical concentrations of the following analytes which were above the threshold of additional action:

- Tributyltin at 130 micrograms per kilogram (µg/kg; threshold of additional action is 26 µg/kg)
- Total PCB Congeners at 148 µg/kg (threshold of additional action is 101 µg/kg)

However, the Engineer concluded that further additional dredging was considered technically infeasible because it could result in additional upslope sloughing under Pier 1, which would result in further reduction of sediment depth at the existing Pier 1 piles needed to maintain structural stability of the pier. Sand cover (as mentioned below) was used as a technically feasible alternative to additional dredging.

In additional to sample SD-N-C-09-D, samples SD-N-C-07A-D, SD-N-C-07B-D, and SD-N-C-08-D showed analytical values above the threshold for additional action. The Contractor was directed to conduct an additional dredging pass in the -19-foot, -25 foot, and -38 foot MLLW dredge floors, which consisted of a nominal 2-foot cut below the first-pass dredge elevations (or until native material was encountered as confirmed by the Engineer).

The additional dredging pass was conducted between December 7 and 11, 2015, with subsequent post-dredge confirmatory sampling conducted on December 12. Based on the re-sampling of the four samples, one sample, SD-N-C-07B-D continued to show analytical results above the threshold of additional action. Due to this, the Contractor was directed to conduct a limited third dredging pass over the area represented by this sample. The third dredging pass was completed on December 16, where results of the post-dredge confirmatory sampling (conducted on December 18) showed no analytical concentrations above the threshold of additional action.

Because dredging operations either met design depths or encountered native material and results of the post-dredge confirmatory sampling showing no analyte concentrations greater than the threshold for additional action (not including sample SD-N-C-09-D where further additional dredging was infeasible), the Engineer judged dredging in Pier 1 South complete. The Engineer directed sand cover placement per the Contract Drawings (Anchor QEA 2014b), placing gravelly sand over all sloping areas.

The pre-dredge, post-dredge, and post-sand cover bathymetry surveys in Pier 1 South are presented in Figures 8a through 8c, respectively. Representative cross sections are provided in Figure 8d. Results of the post-dredge confirmatory sampling analytical results (representing the final dredging pass for each sample) are summarized in Appendix C. The sediment quality objectives have been met for this area.

As shown on the project as-built drawings (Appendix A), a submerged sheetpile cut off wall is located west of the previously existing submerged marine railways. The submerged sheetpile wall was slated for demolition in the Contract Drawings (Anchor QEA 2014b). However, the wall was not encountered during dredging activities, with the top of wall presumably existing below the required and additional dredge design elevation. As further dredging was un-necessary based on post-dredge confirmatory sampling, no further dredging was conducted to locate the submerged sheetpile wall, thus leaving the wall in place.

4.4.3.3 POSD Dry Dock Berthing Area

Dredging in the POSD Dry Dock Berthing Area began on May 23, 2015, and was completed on June 25. Dredging, post-dredge bathymetric surveys, and gravelly sand cover placement were conducted sequentially at the POSD dry dock berthing area due to project requirements and schedule constraints. Post-dredge bathymetric surveys were conducted concurrently with dredging operations to allow for post-dredge confirmatory sampling, and the subsequent placement of gravelly sand cover.

Based on the results of the first-pass post-dredge confirmatory sampling, additional dredging was required (approximate 2-foot cut below existing bathymetry unless native material was encountered) in the areas represented by samples SD-N-C-11-D and SD-N-C-13-D due to analytical concentrations above the threshold of additional action. Following the completion of the additional dredging pass (conducted between June 24 and 25, 2015), sample SD-N-C-13-D showed little to no improvement, containing analytical concentrations above the threshold of additional action. Specifically:

- Copper at 215 mg/kg (threshold for additional action is 145 mg/kg)
- Total HPAHs at 1,314 µg/kg (threshold for additional action is 796 µg/kg)
- Tributyltin at 110 µg/kg (threshold for additional action is 26 µg/kg)

- Total PCB Congeners at 382 µg/kg (threshold for additional action is 101 µg/kg)

However, the Engineer concluded that further additional dredging was infeasible in this area due to structural limitations of the existing BAE Systems structures. The soft material observed at the top of the additional dredging post-dredge confirmatory sample indicated that sloughing of upslope material was likely occurring. Additional dredging in this area may have resulted in additional upslope sloughing, which would result in further reduction of sediment depth at the structure's pier pilings and against the BAE Systems bulkhead. This reduction would remove sediment below the levels needed to maintain structural stability of the bulkhead. Sand cover (as mentioned below) was used as a technically feasible alternative to additional dredging.

Because dredging operations either met design depths or encountered native material and results of the post-dredge confirmatory sampling showing no analyte concentrations greater than the threshold for additional action (not including sample SD-N-C-13-D where further additional dredging was infeasible), the Engineer judged dredging in the POSD Dry Dock Berthing Area was complete. The Engineer directed sand cover placement per the Contract Drawings (Anchor QEA 2014b), placing gravelly sand over all sloping areas. The pre-dredge, post-dredge, and post-sand cover bathymetry surveys for the POSD Dry Dock Berthing Area are presented in Figures 9a through 9c, respectively. Representative cross sections are provided in Figure 9d. Results of the post-dredge confirmatory sampling analytical results (representing the final dredging pass for each sample) are summarized in Appendix C. The sediment quality objectives have been met for this area.

4.4.3.4 Pier 3 North

Dredging of Pier 3 North began on February 23, 2015, and was completed on March 5. Due to the presence of hard, consolidated material, some areas were limited on the amount of material that could be removed, and therefore, dredged to elevations above the design depth (verified in accordance with Section 5.5).

Concurrent with the post-dredge bathymetric survey, post-dredge confirmatory sampling was conducted on March 6, 2015. As shown, both discrete post-dredge analytical samples

(SD-N-C-14-D and SD-N-C-14A-D) had no analytical concentrations above the threshold for additional action.

Because dredging operations either met design depths or encountered native material and results of the post-dredge confirmatory sampling showing no analyte concentrations greater than the threshold for additional action, the Engineer judged dredging in Pier 3 North complete. The Engineer directed sand cover placement per the Contract Drawings (Anchor QEA 2014b), placing gravelly sand over all sloping areas.

The pre-dredge, post-dredge, and post-sand cover bathymetry surveys for Pier 3 North are presented in Figures 10a through 10c, respectively. Representative cross sections are provided in Figure 10d. Results of the post-dredge confirmatory sampling analytical results (representing the final dredging pass for each sample) are summarized in Appendix C. The sediment quality objectives have been met for this area.

4.4.3.5 Pier 3 South

Dredging of Pier 3 South initially occurred in a limited area along the eastern limits of Pier 3 South from June 26 to 29, 2015, on the sloping area adjacent to the BAE Systems bulkhead. Following this limited dredging event, a post-dredge confirmatory survey (on June 30) and subsequent post-dredge confirmatory sampling was conducted.

Based on the post-dredge confirmatory sampling results in this limited area, additional dredging was required due to analytical levels above the threshold of additional action. Specifically, the -13 feet MLLW floor was removed, allowing for additional dredging as the slope continues from the BAE Systems bulkhead to the -38 foot MLLW floor. This additional dredging was conducted concurrently with the remaining dredging required in Pier 3 South.

The remaining dredging in Pier 3 South (including first-pass and additional dredging) was conducted between October 28, 2015 and November 25. Post-dredge bathymetric surveys were conducted after completing a section of the dredge area to allow for subsequent placement of gravelly sand cover.

Based on the results of the post-dredge confirmatory sampling on October 30, 2015, two samples were collected with values above the threshold of additional action. Sample SD-N-C-15-D, which underwent an additional dredging pass contained analytical concentrations of the following analytes which were above the threshold of additional action. Specifically:

- Total HPAHs at 924 µg/kg (threshold of additional action is 796 µg/kg)
- Tributyltin at 39 µg/kg (threshold of additional action is 26 µg/kg)
- Total PCB congeners at 955 µg/kg (threshold of additional action is 101 µg/kg)

However, the Engineer concluded that further additional dredging was infeasible in this area as it would likely result in additional upslope sloughing, which would result in further reduction of sediment depth at the existing bulkhead and Pier 3 piles, which was needed to maintain structural stability of the bulkhead and pier. Sand cover (as mentioned below) was used as a technically feasible alternative to additional dredging.

In additional to sample SD-N-C-15-D, sample SD-N-C-17-D showed analytical values above the threshold for additional action. Due to project schedule constraints, the Contractor was not only required to conduct additional dredging in the area represented by sample SD-N-C-17-D; but was also provided an additional dredging allowance over the entire -38-foot-MLLW bench in Pier 1 South (first pass dredging west of the sample was not completed as of this date), lowering the maximum design dredge depth to -41 feet MLLW (unless native material was encountered at a higher elevation).

The Contractor completed the additional dredging/first pass dredging pass on November 10, 2015, with post-dredge confirmatory sampling conducted on November 11. Of the four samples collected (SN-N-C-17-D [second pass], SD-N-C-18A-D, SD-N-C-18B-D, and SD-N-C-20-D), one sample (SD-N-C-20-D) showed analytical concentrations above the threshold of additional action. Due to this, the Contractor was directed to conduct an additional dredging pass over the limited area represented by sample SD-N-C-20-D, which consisted of a nominal 2-foot cut.

The additional dredging pass over the limited area was conducted between November 17 and 18, 2014, with subsequent post-dredge confirmatory sampling conducted on November 19. Based on the re-sampling of SD-N-C-20-D, a third dredging pass was required over the same

limited area due to analytical concentrations above the threshold of additional action. The third dredging pass was completed on November 25, where results of the post-dredge confirmatory sampling (conducted on the same day) showed no analytical concentrations above the threshold of additional action.

Because dredging operations either met design depths or encountered native material and results of the post-dredge confirmatory sampling showing no analyte concentrations greater than the threshold for additional action (not including sample SD-N-C-15-D where further additional dredging was infeasible), the Engineer judged dredging in Pier 3 South complete. The Engineer directed sand cover placement per the Contract Drawings (Anchor QEA 2014b), placing gravelly sand over all sloping areas.

The pre-dredge, post-dredge, and post-sand cover bathymetry surveys for Pier 3 South are presented in Figures 11a through 11c, respectively. Representative cross sections are provided in Figure 11d. Results of the post-dredge confirmatory sampling analytical results (representing the final dredging pass for each sample) are summarized in Appendix C. The sediment quality objectives have been met for this area.

4.4.3.6 Pier 4 North

Dredging at Pier 4 North began on April 10, 2015, and was completed on May 15. Due to the presence of hard, consolidated material, some isolated areas (typically at the base of the sloping cut) was limited on the amount of material that could be removed, and therefore, dredged to elevations above the design depth (verified in accordance with Section 5.5). A post-dredge bathymetric survey was conducted on May 18.

Dredging extended below the design limits in the southeastern section of the dredge area (within SMU-11). As significant sheen generation was encountered during dredging in this area, and the North Trust sought to maximize contaminated sediments removal during first pass dredging operations (to lessen the need for an additional dredging pass), the Contractor was directed to dredge deeper in this area prior to post-dredge confirmatory sampling due to the presence of sediment expected to have analytical concentrations above the threshold for

additional action. This direction was based on visual evidence reported by the Engineer, who observed sheen producing material at design depths.

Concurrent with the post-dredge bathymetric survey, post-dredge confirmatory sampling was conducted on May 18, 2015. The collected post-dredge analytical samples (SD-N-C-16-D and SD-N-C-19-D) had no analytical concentrations above the threshold for additional action.

Because dredging operations either met design depths or encountered native material and results of the post-dredge confirmatory sampling showing no analyte concentrations greater than the threshold for additional action, the Engineer deemed dredging in Pier 4 North complete. The Engineer directed sand cover placement per the Contract Drawings (Anchor QEA 2014b), placing gravelly sand over all sloping areas.

The pre-dredge, post-dredge, and post-sand cover bathymetry surveys for Pier 4 North are presented in Figures 11a through 11c, respectively. Representative cross sections are provided in Figure 11d. Results of the post-dredge confirmatory sampling analytical results (representing the final dredging pass for each sample) are summarized in Appendix C. The sediment quality objectives have been met for this area.

4.4.3.7 Pier 4 South

Dredging in Pier 4 South began on November 14, 2014, and was conducted intermittently during construction, being completed on December 4, 2015. Post-dredge bathymetric surveys were conducted concurrently with dredging operations to allow for post-dredge confirmatory sampling and subsequent placement of gravelly sand cover sequential with dredging operations due to schedule constraints.

Based on the results of the first-pass post-dredge confirmatory sampling conducted on November 11, 2015, limited additional dredging was required (approximate 2-foot cut below existing bathymetry unless native material was encountered) in the area represented by sample SD-N-C-21-D due to analytical concentrations above the threshold of additional action. Following the additional dredging pass, this sample, as well as those samples collected during the first pass post-dredge conformational sampling (including SD-N-C-21A-D on July 17, SD-

N-C-22A-D on July 21, SD-N-C-22B-D on July 24, and SD-N-C-23-D on October 30) all had analytical concentrations below the threshold for additional action.

Because dredging operations either met design depths or encountered native material and results of the post-dredge confirmatory sampling showing no analyte concentrations greater than the threshold for additional action, the Engineer deemed dredging in Pier 4 South complete. The Engineer directed sand cover placement per the Contract Drawings (Anchor QEA 2014b), placing gravelly sand over all sloping areas.

The pre-dredge, post-dredge, and post-sand cover bathymetry surveys for Pier 4 South are presented in Figures 12a through 12c, respectively. Representative cross sections are provided in Figure 12d. Results of the post-dredge confirmatory sampling analytical results (representing the final dredging pass for each sample) are summarized in Appendix C. The sediment quality objectives have been met for this area.

4.4.4 Misplaced Material Event

Between June 20 and 22, 2015, while moored at the northern end of Pier 3, and outside the remedial footprint, the material barge Scow 3002 leaked sediment due to a mechanical issue to the material barges hydraulic system. The material barge was immediately relocated to Pier 1 North and offloaded. Notification of the discharge was made within 24 hours of confirmation of the incident to the Unified Port of San Diego, CSLC, Water Board, USACE, and the National Oceanic Atmospheric Administration.

In accordance with the Corrective Action Work Plan (Anchor QEA 2015a), all appropriate repairs were conducted prior to returning the material barge to service. A notice to proceed for recovering the spilled material was provided by USACE on September 4, 2015, in the form of a permit modification (USACE 2015), as well as acknowledgment from the Water Board (Water Board 2015) that the additional cleanup was consistent with the existing WDR/Section 401. As part of the USACE approval process, the Engineer reinitiated consultation with the National Marine Fisheries Service (NMFS) regarding Environmental Fish Habitat Assessment (Anchor QEA 2015; Chavez 2015). This area has been identified as

the "Scow 3002 Misplaced Material Area," is included in Figure 2, and in subsequent dredging discussions.

Initial dredging operations were conducted on September 11, 2015, with post-dredge bathymetric survey and post-dredge confirmatory sampling conducted on September 14. Based on the results of the post-dredge confirmatory sampling, additional dredging was required in the scow's footprint as the sample had analytical concentrations above the threshold for additional action. The Contractor was directed to conduct an additional dredging pass, which consisted of a minimum 2 foot, maximum 3-foot cut or until native material was encountered over the entire Scow 3002 Misplaced Material Area.

The second dredging pass was conducted between September 16 and 23, 2015, with post-dredge confirmatory sampling conducted on September 24 and post-dredge bathymetric survey conducted on September 25.

The pre-spill, post-spill, and post-dredge bathymetry surveys for the Scow 3002 Misplaced Material Area are presented in Figures 13a and 13c, respectively. Representative cross sections are provided in Figure 13d. Results of the post-dredge confirmatory sampling analytical results (representing the final dredging pass for each sample) are summarized in Appendix C.

The results of the post-dredge confirmatory sampling showed no analytical concentrations above the threshold for additional action. As the post-dredge elevations were below those observed in the pre-spill condition (signifying that all spilled material was removed) and results of the post-dredge confirmatory sampling showed no analyte concentrations greater than the threshold for additional action, the Engineer deemed dredging in the Scow 3002 Misplaced Material Area complete and that sediment quality objectives were met for this area.

The Engineer compared the post-spill bathymetric survey with the bathymetric survey data obtained prior to the leakage event along the Scow 3002 haul route (the pre-spill bathymetric survey data included various bathymetric surveys obtained during the remedial action as well as historic bathymetric survey information). The comparison of pre-spill to

post-spill bathymetry is graphically depicted to generate an elevation isopach, included in Figure 13e. The green shading identified those areas where the post-spill survey is equal to or deeper than the pre-spill conditions (i.e., no effect of leakage is evident), and the yellow to red areas are where the post-spill survey is higher than the pre-spill conditions. The area in which the spill occurred is observed adjacent to Pier 3 North, where more than 1 foot of bathymetric rise (presumed spilled material) is observed on the isopach.

As shown, no significant bathymetric variations signifying the presence of additional spilled material are observed between the pre- and post-spill surfaces along the scow haul route (extending from Pier 3 North to the offloading location). The elevation differences are between 0.5 to -0.5 foot, indicating equipment tolerances and/or minor, random changes in the sediment surface over the years. Thus, there is no evidence of any additional spillage on the route of the spill scow to the offloading location.

4.5 Sediment Handling and Offloading

4.5.1 Dewatering and Discharge

As material scows were filled throughout the course of dredging, accumulated dredge water was pumped to a decant barge (and deck barge with six 20,000-gallon tanks). Accumulated decant water was then transferred to the onshore dredge water treatment system located at the SMA. Once the dredge barge(s) were loaded, they were transported to the SMA for stabilization, offloading, and transportation off site for disposal. As the scows arrived at the SMA, residual-free water generated during dredging operations was present in varying quantities. This water was pumped to the on-site water treatment system in the SMA to facilitate the sediment dewatering process. The on-site water treatment system consisted of multiple 18,000-gallon weir and 21,000-gallon Baker tanks. In accordance with the IUDP (Permit Number 11-0564) obtained from the City, the Contractor used a modular setup, which was scalable depending on the quantity of discharge and the space available. Each modular setup consisted of three weir tanks, one Baker tank, followed by the final discharge tank which was sampled by the Engineer and the City in accordance with the IUDP. Each weir tank had three separate chambers which allowed sediment in the pumped water to settle to the bottom of the tank while water entered the subsequent chambers by passing

over weirs. The Baker tank (open chamber) was used to hold the water for a pre-determined length of time to allow fine particles to settle.
Finally, water was pumped to a final Baker tank from which a discharge pump was suspended approximately 3 feet from the bottom of tank. The discharge pump was connected to a City sewer connection in accordance with IUDP, which was issued on October 23, 2014, with no further discharge occurring after January 27, 2016. Approximately 900,500 gallons of water was discharged during construction.

Because discharge pump was suspended 3 feet from the bottom of the compliance discharge tank, the final 3 feet of residual water and any settled fine particles within the tank were unable to be discharged into the City sewer system under the IUDP. After no further discharge could be conducted, the residual water and remaining settled sediment was pumped into a scow adjacent to the SMA. The returned sediment was then amended with Portland cement and was disposed of along with the dredged material (Section 4.5.3). Any residual water (approximately 5,200 gallons) in the scow was pumped back into a Baker tank for final disposal.

The North Trust obtained a Trucked IWGP (Permit Number 25-0475) on February 22, 2016, from the City, allowing for the discharge of this residual water to the City Pump Station #1, located at 2550 East Harbor Drive., San Diego, California. The water was transported on February 23, 2015 under a Trucked Industrial Waste Manifest to Pump Station #1 by Green Clean Water & Waste Services, Inc. utilizing a vacuum truck. However, the waste hauler inadvertently disposed of the wastewater under their personal Trucked IWGP (Permit Number: 25-0404), as opposed to the permit obtained by the North Trust. The waste hauler was issued a Notice of Violation, administratively transferring the manifests (Manifest Numbers 203624 and 203625) to the North Trust's Trucked IWGP (Permit Number 25-0475).

All associated discharge sampling is described in Section 5.5.

4.5.2 Sediment Stabilization

After the free water was removed by pumping into the water treatment system, sediment contained within the material scows was mixed with Portland cement at the SMA. Mixing

was conducted by pouring cement directly into the bucket of the offloading excavator and then placing the cement into the full scow. The cement was then mixed with the dredged material using the excavator bucket to rotate the material. Approximately 5 percent cement by weight was mixed into the barge depending on the composition of the dredged material (i.e., dense, sandier material required less or even no cement for proper stabilization). Following a stabilization period, typically between 12 and 24 hours, a paint filter test (USEPA Method 9095B) was conducted by the Engineer to determine acceptability for transport. One passed paint filter test was required for each barge offloaded during construction. Once the material passed the paint filter test, the material was offloaded directly to covered haul trucks using the offloading excavator.

4.5.3 Transport and Disposal

Trucks loaded with dewatered and/or stabilized sediment (following the material passing the paint filter test) were used to transport dredged material from the SMA to the Otay Landfill for final disposal. The Otay Landfill, operated by Republic Services, Inc., previously approved site sediments for disposal based on the waste profile, including the results of a comprehensive physical and chemical characterization program conducted during project design. The results of the sediment characterization program are documented in the BODM (Anchor QEA 2013).

Trucking operations began on November 10, 2014, and were conducted throughout dredging operations with the bulk of the dredged material being transported off site by the middle of November 2015. Trucking operations were conducted 5 to 6 days per week, on average, between November 2014 and November 2015. Disposal trucking was conducted sporadically from the middle of November 2015 through early February 2016 to dispose of remnant sediment within scows, from scow cleaning, and sediment that had settled in the water management system tanks and sediment collected in the truck wash station area. The final load of sediment was transported to the landfill on February 5, 2015, with a total of 8,338 total truckloads sent off site. During offloading activities, the Engineer periodically inspected the roadways adjacent to the site (Belt Street and Sampson Street) for evidence of track-out. If observed, the Engineer notified the Contractor, who immediately rectified the issue.

4.6 Sand Cover Placement

As stated in Section 3.3, two types of cover material were used: sand material and gravelly sand material, where sand cover was placed in under pier areas and gravelly sand placed over sloping areas (due to its higher internal friction angle). Prior to conducting sand cover placement, approval of the cover material was required by the Engineer and USACE (discussed in Section 5.7.1). Sand cover placement commenced on May 28, 2015, in Pier 4 North and concluded on January 22, 2015, in Pier 4 South. Cover placement was conducted in accordance with the project's Technical Specifications and regulatory requirements. Placement limits included sloping and under pier areas, as well as a small area in Pier 4 South directed by the Engineer due to visual observations. A detailed summary of completion dates for each Dredge Area are provided in Table 6.

Table 6
Sand Cover Placement Completion Schedule

Dredge Area	Start Date	Completion Date
Gravelly Sand (Open Water)		
Pier 1 North	December 10, 2015	December 15, 2015
Pier 1 South	December 17, 2015	January 12, 2016
POSD Dry Dock Berthing Area	June 12, 2015	July 6, 2015
Pier 3 North	June 17, 2015	September 9, 2015
Pier 3 South	November 16, 2015	December 3, 2015
Pier 4 North	May 28, 2015	September 28, 2015
Pier 4 South	July 22, 2015	January 20, 2016
Sand (Open Water)		
Pier 4	September 29, 2015	October 1, 2015
Pier 4 South[1]	January 21, 2016	January 22, 2016
Sand (Under Pier)		
Pier 1	January 4, 2016	January 14, 2016
Ramp Wharf	June 23, 2015	July 16, 2015
Building 13 and Lunch Wharf	June 20, 2015	September 16, 2015
Pier 3	June 29, 2015	November 13, 2015

Note:
1. Additional sand cover was directed by the Engineer in Pier 4 South due to visible sheening present during second pass dredging operations (post-dredge confirmatory sampling showed no analytes above the threshold for additional action).

4.6.1 Cover Material Source Approval

All cover placement material was provided by the Vulcan Materials Company's (Vulcan's) Chula Vista plant at 2041 Heritage Road. Vulcan provided both the 3/8-inch minus sand cover and the 4 inches minus gravelly sand cover material. Both materials were mined from aggregate pits, with crushing required for the gravelly material, and both materials underwent screening and washing as necessary to achieve the desired physical gradations. Materials were then stockpiled in preparation for loading and hauling to the Site. Vulcan's Chula Vista Plant is an upland off-site borrow source, which does not consist of reused dredge material.

The following sand cover graduation documentation is provided in Appendix E:

- Gradation of material used as sand cover, which was washed concrete sand with minimal fines (i.e., 2.6 percent) from Vulcan
- Gradation of material used as the gravelly sand cover, which was a gravel cover material with minimal fines (i.e., 1.1 percent) from Vulcan
- Sand cover material chemical analysis completed by EnviroMatrix Analytical, Inc. (EnviroMatrix)
- Gravelly sand cover material chemical analysis completed by EnviroMatrix

Based on review of chemical and physical data, the two submitted materials were approved and confirmed by the Engineer. The materials were approved for use at the Site by USACE, in coordination with USEPA, on December 30, 2014, via email communication (Smith 2014a). Finally, the Water Board concurred that the sand cover was consistent with the RAP and other requirements of the WDR/WQC, via email communication (Barker 2015a).

4.6.2 Methods of Cover Placement

Sand cover placement was conducted using three distinct operations: 1) the Contractor's dredge barges equipped with a 10-cubic yard slip box; 2) a telescoping conveyor-belt system mounted to a floating platform; and 3) a pneumatic pump system mounted on a spudded barge.

The slip box operation was conducted by placing the slip box onto the material barge and loading the box to a pre-determined fill line using a skid steer. Once full, the box was lifted into position using the crane and GPS software to determine location. The boxes were then tilted to open the box side gate to a pre-determined fixed height (approximately 6 to 12 inches) and rotated along a pre-determined pass length. The slide gate fixed height and pass length were finalized using an on-land "mock-up" which was conducted prior to the start of the slip box operations. The "mock-up" was supervised by the Engineer, and was used to verify the capability of the equipment to achieve a consistent cover material thickness (projected at 6 inches per pass). The slip box operation was used open-water sand and gravelly sand placement.

The under pier placement assembly consisted of a telescoping conveyor belt mounted on to a floating, flat-deck barge. The conveyor belt was fed continuously from a 22-cubic yard hopper that was loaded by a mini-excavator operating from the material barge. An operator positioned on the conveyor-belt barge remotely controlled the telescoping belt to extend/retract and move laterally beneath the pile-supported pier structure. Similar to the slip-box operations discussed above, a mock-up was conducted on a flat deck barge (as opposed to on-land), with the Engineer verifying the capability of the equipment to achieve a consistent cover material thickness.

Finally, the pneumatic system was used to place sand under pile-supported pier structures in which the telebelt was unable to reach, specifically under BAE Systems Building 13 and Break Area. A pneumatic placement truck was loaded onto a floating barge, which was moored to the wharf requiring under-structure sand placement. Sand was continuously fed into the truck's hopper, transporting sand through pressurized high-velocity air up to 60 meters (200 feet) through a series of hoses. For transportation purposes, hoses were placed throughout the length of the wharf using hooks drilled into the decking of the wharf. In order to ensure the required quantity (6 tons per 100 square feet), the Contractor fabricated a floating placement barge, which consisted of a 1-foot by 1-foot metal placement grid. Two operators guided the placement hose over each grid at a set time interval (dependent on the pump rate) to achieve a desired placement coverage rate and coverage thickness. Similar to the slip-box and telebelt operations discussed above, an on-land "mock-up" was conducted to finalize the pump rate and

placement time in each placement grid to confirm that the required quantity met the required average placement height (approximately 1 foot on average).

4.6.3 Post-sand Cover Placement Surveys

Following completion of sand cover placement in a particular dredge area, a third-party survey was conducted to determine the placement thicknesses by comparing the survey with the third-party post-dredge survey. This comparison, as well as direct field observation and quantifications of weight tickets, the Engineer determined whether the sand cover placement met the requirements of the project's Technical Specifications, requiring an average placement rate of 6 tons per 100 square feet. The final post-sand cover surveys are presented in the as-built drawings (Appendix A).

In general, surveys conducted under piers encountered obstructions (such as the pier face and piles, or sides of existing vessels) that make the placement of thin sand layers difficult to discern. Due to these limitations, the review and approval of these areas were based largely on direct observation of the work by the Engineer, and quantification of material placed.

4.6.4 Cover Material Quantities

Throughout sand cover placement, material delivery weigh tickets were collected and tabulated to verify that the proper amount of sand cover had been delivered to the Site. Weigh tickets, field observations, and survey analysis were used to verify the required quantity of material had been placed in the under pier and open-water areas in appropriate thicknesses and without significant gaps. Table 7 provides a summary of the materials placed on site, based on tabulating weight tickets for materials trucked to the Site.

Table 7
Sand Cover Placement Quantities

Sand Placement Type	Dredge Areas	Required Cover Placement Quantity Per Design (tons)	Estimated Actual Cover Placement Quantity (tons)	Percent Sand Cover Placed Above Design Estimated Quantity
Gravelly Sand (open water)	Pier 1 North Pier 1 South POSD Dry Dock Berthing Area Pier 3 North Pier 3 South Pier 4 North Pier 4 South	13,190	17,117	30%
Sand (open water)	Pier 4 North Pier 4 South	5,050	5,309	5%
Sand (under pier)	Pier 1 Ramp Wharf Building 13 and Lunch Wharf Pier 3	480	512	7%
	Total	**18,720**	**22,938**	**23%**

As summarized in Table 7, more cover material was placed at the site than the design quantity, to ensure the requirements of the Technical Specifications were met. The additional sand cover placement counteracted material losses that were found to occur during the sand cover placement process. Section 4.6.5 provides a summary of the approval process for each dredge area.

4.6.5 Cover Material Approval

The review of cover material in each area began with the review of the cover material thickness (through comparison of post-sand and post-dredge bathymetric surveys), and a quantification of sand placed through visual observations by the Engineer and quantification of weight tickets. If the post-sand cover bathymetric survey indicated that the cover material did not meet the required thickness (average of 12 inches with a minimum thickness of 6 inches), the placed quantity was reviewed with the design quantity and technical specifications to

confirm whether the appropriate amount of material was placed. Table 8 presents the decision making process and subsequent approval of sand cover in each dredge area.

Table 8
Sand Cover Placement Approval Decision Making Matrix

Sand Placement Area	Design	Verification
Gravelly Sand (Open Water)		
Pier 1 North	The gravelly sand limits were modified during the construction process due future BAE Systems shipyard improvement projects and visual observations. Gravelly sand was originally required over all sloping areas, but was modified to include two isolated sloping areas in the northeastern and southeastern corners as shown in Figure 7c. Any gravelly sand placed along the northern and southern side slopes would have been re-dredged during the BAE Systems shipyard improvement project, thus the Engineer removed the requirement for sand in these areas. In addition, native material in the area adjacent to new submerged bulkhead was confirmed by the Engineer with visual observations. The requirement for gravelly sand was removed in this area as any placed sand would have very little additional remedial benefit.	After comparison of the post-sand and post-dredge bathymetric survey data, direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete as they have met the requirements of the Project Specifications. As shown in the cross-sections presented in Figure 7d, generally over a foot of gravelly sand was placed throughout the required area.

Sand Placement Area	Design	Verification
Pier 1 South	Gravelly sand was required per design (6 tons per 100 square feet) over the entirety of the sloping area as shown in Figure 8c.	After comparison of the post-sand and post-dredge bathymetric survey data, direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete. As shown on the cross-sections presented in Figure 8d, generally over a foot of gravelly sand was placed in the eastern sloping area adjacent to the BAE Systems bulkhead, however, it appears that some of the material placed in northern and southern placement area (adjacent to Pier 1 and the POSD Dry Dock Berthing area) may have migrated into the base of the dredge prism. The Engineer determined that sand cover operations were completed as the Contractor placed material at a rate greater than 6 tons per 100 square feet, this meeting the requirements of the Project Specifications.
POSD Dry Dock Berthing Area	Gravelly sand was required per design (6 tons per 100 square feet) over the entirety of the sloping area as shown in Figure 9c.	After comparison of the post-sand and post-dredge bathymetric survey data, direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete as they have met the requirements of the Project Specifications. As shown on the cross-sections presented in 9d, generally over a foot of gravelly sand was placed throughout the required area.
Pier 3 North	Gravelly sand was required per design (6 tons per 100 square feet) over the entirety of the sloping area as shown in Figure 10c.	After comparison of the post-sand and post-dredge bathymetric survey data, direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete as they have met the requirements of the Project Specifications. As shown on the cross-sections presented in Figure 10d, generally over a foot of gravelly sand was placed throughout the required area.

Sand Placement Area	Design	Verification
Pier 3 South	Gravelly sand was required per design (6 tons per 100 square feet) over the entirety of the sloping area as shown in Figure 11c.	After comparison of the post-sand and post-dredge bathymetric survey data, direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete. As shown on the cross-sections presented in Figure 11c, generally over a foot of gravelly sand was placed in the eastern sloping area adjacent to the BAE Systems bulkhead, however, it appears that some of the material placed in northern placement area (adjacent to Pier 3) may have migrated into the base of the dredge prism. The Engineer determined that sand cover operations were completed as the Contractor placed material at a rate greater than 6 tons per 100 square feet, this meeting the requirements of the Project Specifications.
Pier 4 North	Gravelly sand was required per design (6 tons per 100 square feet) over the entirety of the sloping area as shown in Figure 11c.	After comparison of the post-sand and post-dredge bathymetric survey data, direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete as they have met the requirements of the Project Specifications. As shown on the cross-sections presented in Figure 11d, generally over a foot of gravelly sand was placed throughout the required area.
Pier 4 South	Gravelly sand was required per design (6 tons per 100 square feet) over the entirety of the sloping area as shown in Figure 12c.	After comparison of the post-sand and post-dredge bathymetric survey data, direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete. As shown on the cross-sections presented in Figure 12d, over a foot of gravelly sand was generally placed in the eastern sloping area adjacent to the BAE Systems bulkhead, however, it appears that some of the material placed in southern placement area (adjacent to BAE Systems property line) may have migrated into the base of the dredge prism. The Engineer determined that sand cover

Sand Placement Area	Design	Verification
		operations were completed as the Contractor placed material at a rate greater than 6 tons per 100 square feet, this meeting the requirements of the Project Specifications.
Sand (Open Water)		
Pier 4 (Adjacent to Pier)	Sand was required per design (6 tons per 100 square feet) in an area of approximately 9,800 square feet directly North of Pier 4 as shown in Figure 12c.	After comparison of the post-sand and post-dredge bathymetric survey data, direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete. Though the placement thickness is variable, the Contractor exceeded the required placement rate of 6 tons per 100 square feet, thus meeting the requirements of the Project Specifications.
Pier 4 South	Sand was directed by the Engineer in the area of additional dredging (approximately 7,950 square feet) due to visual observations during the additional dredging operations. The gravelly sand and sand limits are shown in Figure 12c	After comparison of the post-sand and post-dredge bathymetric survey data, direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete. Though the placement thickness is variable, the Contractor exceeded the required placement rate of 6 tons per 100 square feet, thus meeting the requirements of the Project Specifications.
Sand (Under Pier)		
Pier 1	Sand was required per design (6 tons per 100 square feet) under the entirety of the under-pier structure as shown in Figure 7c.	After direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete. The Contractor placed material at a rate greater than 6 tons per 100 square feet, thus meeting the requirements of the Project Specifications.

Sand Placement Area	Design	Verification
Ramp Wharf	Sand was required per design (6 tons per 100 square feet) under the entirety of the under-pier structure as shown in Figure 8c.	After direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete. The Contractor placed material at a rate greater than 6 tons per 100 square feet, thus meeting the requirements of the Project Specifications.
Building 13 and Break Area	Sand was required per design (6 tons per 100 square feet) under the entirety of the under-pier structure as shown n Figure 9c.	After direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete. The Contractor placed material at a rate greater than 6 tons per 100 square feet, thus meeting the requirements of the Project Specifications.
Pier 3	Sand was required per design (6 tons per 100 square feet) under the entirety of the under-pier structure as shown in Figure 10c.	After direct field observations by the Engineer, and quantification of weight tickets, the Engineer determined that sand cover operations were complete. The Contractor placed material at a rate greater than 6 tons per 100 square feet, thus meeting the requirements of the Project Specifications.

4.7 Ancillary Construction Activities

4.7.1 POSD Dry Dock Anchor Removal and Replacement

Prior to dredging in the POSD Dry Dock Berthing Area, the POSD Dry Dock was relocated to Pier 4 South to allow for dredging within the dry dock's berthing footprint. To facilitate this relocation, as well as to maximize the removal of potentially contaminated sediment, the existing mooring anchors were removed following the re-location, and subsequently re-established following the completion of dredging. The existing mooring anchors consisted of a Danforth 17,000 pound and U.S. Navy Stockless 17,000 pound anchors, attached at a common shackle, and connected to the POSD Dry Dock with a 1.75-inch stud-link chain.

The removal of the anchors occurred on June 15, 2015, stockpiled overnight on the Contractor's dredge barge, and subsequently placed on the BAE Systems northern ramp wharf on June 16 for temporary storage. The anchors were placed on plastic and dunnage to

protect the northern ramp wharf from damage and contamination due to lodged sediment. The anchors were replaced on July 7 in the locations shown on the project as-built drawings (Appendix A). The anchor closer to the BAE Systems bulkhead (Anchor "A") was placed in an undredged location within Pier 1 South, and required an additional removal of the anchor concurrent with dredging activities, with final replacement on December 1.

To install the mooring anchors, the Contractor dredged a 5-foot-deep pit, placed the anchors, and subsequently filled the pit with gravelly sand following anchor placement. All dredged material was disposed of in the same fashion as the remedial dredged material (Section 4.5.3). Following placement, BAE Systems conducted load test on each anchor to confirm the installed anchors met the minimum capacity to withstand the forces of the POSD Dry Dock.

4.7.2 Pier 4 South Shoreline Protection

The initial dredge design in SMU-18 (Pier 4 South) was based on the expectation that the BAE Systems bulkhead extends continuously from Pier 4 south to the waterside property line with the National Steel and Ship Building Company (NASSCO) property. However, it was determined during construction that the landside property line between the two shipyards is actually located approximately 50 feet north of the waterside line (approximate edge of the Pier 4 South bulkhead). As a result, the dredge design initially prescribed would infringe on NASSCO's revetment located south of the Pier 4 South bulkhead, which may have reduced the stability of those structures. Due to this, the dredge design in SMU-18 was repositioned farther north to protect the existing NASSCO revetment, including a 5-foot buffer from the assumed toe of revetment. As dredging was initially prescribed in this area, shoreline protection was required to prevent existing sediment in this area from sloughing into the dredge prism.

To complete the installation of shoreline protection in Pier 4 South, the Contractor completed the following three tasks:

- Removal of broken concrete and other surficial debris in the placement area. This removal was conducted by the Contractor's crane, with debris placed on a flat deck barge for transfer to the SMA.
- Dredge a "key" at the toe of the proposed revetment, to prevent unraveling of revetment during placement and over time due to erosive forces. This dredging was

conducted by the Contractor's crane, with the dredged material be placed in a material scow, transferred to the SMA, and disposed of as dredged material (discussed in Section 5.6.3).

- Placement of revetment to generate a stable slope. This placement used the same means, methods, and materials used for the SMA submerged sheetpile wall, discussed in Section 4.7.3.3.

Installation of the Pier 4 South shoreline protection began on October 5, 2015, with the removal of surficial debris, and was completed on October 27 following the placement and compaction of the rip rap. The shoreline protection was bounded to the south by the existing NASSCO revetment, to the west by the "key," and to the north by a tapering of the revetment to generate a stable side slope. All removed debris was transported to the SMA for subsequent recycling at Ennis or disposal at the Otay Landfill using debris manifests.

4.7.3 SMA Submerged Sheetpile Wall

As discussed in Section 3.2, a submerged sheetpile wall was designed adjacent to the SMA to maximize the removal of sediment which would further allow the Site to reach intended SWACs, as stipulated in the CAO. As shown in the Contract Drawings (Anchor QEA 2014b), the installation of the SMA submerged sheetpile wall included the following elements:

- Installation of submerged sheetpile wall
- Shoreline demolition, debris removal, and excavation
- Installation of shoreline protection
- Installation of concrete retaining wall, backfill, and asphalt repair

4.7.3.1 Installation of Submerged Sheetpile Wall

The installation of the submerged sheetpile wall was necessary to complete dredging in Pier 1 North. Sheetpile wall installation began following the completion of Phase 1 of the shoreline debris removal activities (discussed in Section 5.4.3.2) on March 27, 2015, conducted intermittently with other project activities through May 27. As of that date, all sheets were installed with the exception of the sheet extending under the offloading ramp. These final sheets were installed between July 4 and 7 when the Contractor had availability

to relocate the floating offload platform and ramp, suspending offloading operations during that time.

Prior to installation of a section of the submerged sheetpile wall, the Contractor installed a driving template using temporary H-beams and steel whalers, which was used to align the sheets and aide in driving. Sheetpiles (AZ 38-700 N Double) were installed in pairs to the degree feasible using the APE Model 200T vibratory hammer, where after each individual pile was installed separately to grade or refusal. In general, all piles were installed to a top of pile elevation at or below +3 feet MLLW, less than three feet higher required in the Project Specifications (Anchor QEA 2014d), with the exception of one return sheet adjacent to the SDG&E Outlet Tunnel which encountered refusal at a top of pile elevation of +12 feet MLLW. After review by the Engineer, the submerged bulkhead was approved as installed. Following the installation of the SMA shoreline protection (Section 4.7.3.3), the Contractor cut the piles to grade and installed the appropriate grout closures.

The distances between the SDG&E Intake and Outlet Tunnel wing walls were based on the tunnel's original Contract Drawings (as opposed to as-built conditions), and were not re-surveyed during the design process. This resulted in an approximate distance of 65 feet between the wing walls, resulting in 15 pairs of sheets (including two return sheets) to complete the submerged bulkhead in this area. However, based on field measurements conducted by the Contractor, the distance between the wing walls measured approximately 72 feet, which resulted in an increase of the required sheetpile pairs to 18. With five pairs of sheetpile required to complete the length of wall between the existing BAE Systems bulkhead and the SDG&E Outlet Tunnel, a total of 23 pairs of sheetpile were installed to complete both sections of the submerged bulkhead.

4.7.3.2 Shoreline Demolition, Debris Removal, and Excavation

Shoreline demolition, debris removal, and excavation were required to complete the installation of the submerged sheetpile wall as the material existed along the alignment of the wall.

In general, the shoreline demolition (of previously existing concrete curb), debris removal, and excavation activities were conducted in three phases to accommodate ongoing dredging operations and the floating offload platform and ramp, as described below:

- Phase 1: March 19 through April 4, 2015, the Contractor conducted limited shoreline debris removal to facilitate installation of the submerged bulkhead. Minimal shoreline excavation and demolition of the existing concrete curb was conducted.
- Phase 2: October 6 through December 9, 2015, the Contractor conducted shoreline demolition, debris removal, excavation, and subsequent placement of the shoreline protection materials between the SDG&E Outlet Tunnel and BAE Systems bulkhead.
- Phase 3: February 5 through March 23, 2016, the Contractor completed the remaining shoreline demolition, debris removal, excavation, and placement of shoreline protection materials between the SDG&E Inlet and Outlet Tunnels.

Shoreline demolition, debris removal, and excavation was generally conducted using a land-based excavator. Prior to starting shoreline excavation, a turbidity curtain was installed to encapsulate the work area, preventing turbidity and debris generated from migrating. The excavator used a toothed bucket (separate from the bucket used for sediment offloading) to remove debris and sediment landside of the installed submerged sheetpile wall (Section 4.7.3.1) to the grades stipulated in the Contract Drawings (Anchor QEA 2014b). Shoreline debris was placed directly into haul trucks and transported to Ennis for recycling or the Otay Landfill using debris manifests, as appropriate. Shoreline excavation soils were also placed directly into haul trucks, and transported to the Otay Landfill for disposal.

During shoreline excavation, two events occurred which were changed conditions, discussed below:

- On February 10, 2016, while conducting shoreline excavation adjacent to the SDG&E Intake Tunnel, the soils between the tunnel and a distance of approximately 60 feet to the south appeared to be unstable at the design slope of 1 Vertical to 1.75 Horizontal (1V:1.75H). The Contractor placed additional filter stone in this area to stabilize the slope prior to the placement of shoreline protection materials.
- On February 18, 2016, an existing sheetpile wall was encountered perpendicular to the shoreline excavation approximately 60 feet south of the SDG&E Intake Tunnel (as

shown on the project as-built drawings; Appendix A). As removal of sheetpile wall provided minimal to no additional environmental benefit, and the top of wall was below the final grade (top of wall was measured at approximately +0 feet MLLW), the wall was left in place.

- On February 25, 2016, while conducting shoreline excavation adjacent to the SDG&E Intake Tunnel, a void was observed under the existing slab adjacent to the tunnel. As the void may have caused material loss following placement of the revetment, the Contractor filled this void using a cement grout on March 8, 2016. The Contractor erected formwork to encapsulate the void, drilled holes through the top of the existing concrete slab, then injected grout through the drilled holes to fill the annular space.

4.7.3.3 Installation of Shoreline Protection

Following the completion of Phase 1 and 2 of the shoreline excavation, the Contractor began installation of the shoreline protection. The shoreline protection consisted of the following materials which were approved by the Triton Engineers prior to use:

- Geotextile: Consisted of Reed & Graham Geosynthetics RG700W Monofilament Woven Geotextile.
- Filter Stone: Consisted of No. 3 backing material provided by Perrault Corporation in Bonsall, California.
- Rip Rap: Consisted of 0.25-ton riprap provided by Perrault.
- Gravel: Consisted of 0.75-inch crushed gravely supplied by Vulcan.

After the shoreline excavation was completed, the Contractor placed the shoreline protection system downslope of the forthcoming concrete retaining wall (Section 4.7.3.4). The remaining section of shoreline protection was installed after the installation of the concrete retaining wall. A continuous length of geotextile (perpendicular to shoreline) was placed starting at the toe of slope, with additional perpendicular sheets overlapped by approximately 2 feet and staked to hold in place. After the geotextile was installed, the Contractor installed filter stone starting at the toe of slope, working up the slope to a nominal top elevation of +5 feet MLLW. At this stage, gravel was installed under the base of the forthcoming concrete retaining wall, to allow for water to drain behind the wall following installation. After the concrete retaining wall was installed, filter stone was then installed to a final elevation of

approximately +8.25 feet MLLW, followed by riprap installed to a nominal elevation of +11.0 feet MLLW, sloping to approximately +10 feet MLLW at the existing SDG&E Inlet and Outlet tunnels to prevent migration of materials.

4.7.3.4 Installation of Concrete Retaining Wall, Backfill, and Asphalt Repair

The concrete retaining wall was installed in conjunction with the shoreline protection materials. After the wall was installed and allowed to cure, the excavation landside of the wall was backfilled, and the area finished with asphaltic concrete. Materials pertaining to these activities were approved by the Engineer prior to use, and consisted of the following:

- Concrete Retaining Wall: Consisted of a 4,000 pounds per square inch mix from Robinsons Ready Mix, consisting of a water content ratio of 0.40 and maximum aggregate size of 1 inch. Portland cement meeting the requirements of ASTM C-150 was provided by Mitsubishi Cement Corporation, and fly ash class F meeting the requirements of ASTM C-618 was provided by Headwaters Resources. Rebar was provided by Blue Star Steel, Inc., located in Santee California.
- Select Compacted Granular Backfill (Granular Backfill): Consisted of "Rockdust" branded structural backfill supplied by Vulcan.
- Class 2 Aggregate Base and Asphaltic Concrete: Installation of the Class 2 aggregate base, asphaltic concrete, and tack coat was conducted by Angus Asphalt, Inc. from Santee, California. Asphalt emulsion SS-1 h was used in lieu of the specified SC-250 liquid asphalt as the primer coat, which was approved by Triton Engineers prior to use.

Following the placement of gravel, the Contractor installed formwork where the rebar was set. Generally, the concrete placement for the concrete retaining wall consisted of two pours, the first for the footer and the final pour to complete the stem wall. During each concrete pour, Testing Services and Inspection, Inc. (TSI), subcontracted to the Engineer, collected concrete cylinders which confirmed that the placed concrete met the minimum strength requirements provided in the Project Specifications (Anchor QEA 2014d).

Following concrete curing, the forms were removed, and the annual space landside of the concrete retaining wall backfilled with Granular Backfill to a nominal elevation of +11 feet MLLW, or approximately 10 inches below the final asphalt concrete elevation. The granular

backfill was placed in maximum eight inch lifts. TSI conducted periodic inspections during the backfilling activities to confirm that the backfill compaction effort met the minimum percent compaction provided in the Project Specifications (Anchor QEA 2014d).

Following the complete of backfilling operations, the Contractor installed six inches of aggregate base, followed by four inches of asphaltic concrete. The asphaltic concrete was installed on March 30, 2016, completing the SMA landside activities. Note that a portion of asphaltic concrete was installed by BAE Systems on January 30, 2016 (corresponding to Phase 2 of the shoreline excavation discussed in Section 4.7.3.2) to facilitate an early turnover of a portion of the SMA back to BAE Systems.

4.8 Demobilization and Site Restoration

Demobilization efforts began near the completion of sand cover placement activities in late January 2016, and continued through the installation of the concrete retaining wall (as Section 4.7.3.4). A punch-list was generated by the Engineer on March 18, 2016, listing items which must be completed to achieve substantial completion. A site inspection to determine substantial completion was conducted at the Site on April 1. Final completion was achieved by the Contractor on April 15, with the final demobilization of silt curtains from BAE Systems facility.

5 ENVIRONMENTAL PROTECTION, MONITORING, AND REPORTING

Monitoring conducted as part of the North Shipyard project is described below.

5.1 Water Quality Monitoring

Water quality monitoring was conducted during dredging, sand cover placement, and debris removal in accordance with the approved RAP (Anchor QEA 2012). Water quality monitoring was conducted by a manual monitoring program (Section 5.1.1) and supplemented by an automated monitoring program (Section 5.1.2). The monitoring stations used for manual water monitoring are described below:

- Compliance Stations. Four compliance stations were located 500 feet from the construction area. Two compliance stations were located on the north and south sides of the 500-foot compliance arc at approximately the same distance from shore as the construction activity. Two additional compliance stations (Compliance Station Offshore North and Compliance Station Offshore South) were located on the north and south sides of the 500-foot compliance arc offshore from the construction activity.
- Early Warning Stations. Two early warning stations were located 250 feet from the construction area. The north and south early warning stations were spaced evenly along the north and south sides of the 250-foot early warning arc. The early warning stations were used to alert the Contractor of potential water quality impacts at the construction work area and to adjust dredging operations or BMPs before an exceedance occurred at the compliance stations.
- Background Station. The background station was located 1,000 feet from the remedial footprint (located in the vicinity of the Coronado Bridge) in the direction of the head of the bay and beyond the influence of dredging operations. The background station was monitored during every event, because the turbidity criterion is based on an acceptably small increase in the vicinity of the construction activity relative to ambient background levels.

Water quality measurements were taken at a depth of 10 feet below the water surface at each of the stations.

5.1.1 Manual Monitoring

Manual water quality (i.e., turbidity, dissolved oxygen [DO], and pH) monitoring was performed on a daily basis (over a 3-day span) at the initiation of dredging, debris removal, and sand cover placement. All water quality parameter measurements were monitored on two arcs (at the locations discussed in Section 6.1) at a depth of 10 feet below water. Two early warning and four compliance stations were spaced evenly along the arcs to capture all tidal and current conditions. Examples of the manual monitoring station layout are presented in Figures 14a through 14g for the various dredge areas. Slight variations to the early warning and compliance arc occurred during water quality monitoring due to shipyard operations (e.g., ship movements and inaccessibility due to ship moorings at Pier 1, Pier 3, and Pier 4). In accordance with the Technical Report for the CAO (Water Board 2012c), sampling was reduced to weekly as no water quality exceedances were observed after 3 consecutive days of monitoring during each intensive events. Temperature, water depth, and visual indicators were also recorded at each sampling station.

Throughout the duration of construction, no apparent exceedances occurred as a result of construction activity. However, on several occasions one or more of the parameters tested (turbidity, DO, and pH) were observed at minor levels above or below compliance criteria when compared to the reference station. On each occasion, visual evidence of the surrounding water and BMPs were inspected to be working properly. The double silt curtain was continually monitored throughout manned water quality monitoring and found to be in working order. Due to the visual evidence observed, it was concluded that dredging, sand cover, and/or debris removal operations were not the cause of the elevated levels and most likely attributed extraneous factors (e.g., malfunctioning water quality monitoring equipment or natural variability in San Diego Bay) and not a result from construction activity.

A summary of the monitoring results throughout the project are included in Appendix F.

5.1.2 Automated Water Quality Buoys

In addition to manual water quality monitoring, water quality conditions were monitored using an automatic system throughout dredging and sand cover placement. Automated monitoring buoys were installed by Anchor QEA at strategic locations at the Site to monitor

turbidity, DO, and pH. Three buoys were installed: two early warning stations positioned approximately 300 feet from the limits of the dredging operations and a background station positioned outside of the remedial footprint (in close proximity to the Coronado Bridge), approximately 1,000 feet from dredging operations.

The early warning station measurements were continuously compared to the readings at the reference station and thresholds were set up by Anchor QEA to alert oversight staff when certain parameters were elevated or depressed. The thresholds set included the following:

- Turbidity increased +10 Nephelometric Turbidity Units compared to the reference station.
- pH increased or decreased 0.4 pH compared to the reference station.
- DO depressed by10% compared to the reference station.

In the event that one of the early warning stations recorded evidence of an exceedance, an early warning alert was sent to the project team via email. On several occasions, the early warning system alerted Anchor QEA to evidence of a possible exceedance. However, most alerts triggered were due to a number of extraneous factors (e.g., vessel movements, silt curtains movements, or biofouling to the instrument sensors) and not associated with construction activity. Whenever an alert was received during construction activity, Anchor QEA oversight personnel visually inspected the BMPs surrounding dredging or sand cover placement to ensure that the alerts were not caused by construction activity.

Anchor QEA personnel performed regular maintenance to the buoys and data loggers to verify the systems were performing properly. Turbidity, DO, and pH were logged and available real-time throughout construction and subsequently archived. On two occasions, damage to the buoys anchoring resulted in the temporary removal of the buoys from the Site for off-site repair. Once repair was completed, the buoy was relocated back to its previous location. The automated buoy system was removed from the Site on February 2, 2016, at the conclusion of sand cover placement.

5.2 Water Quality Protection

Throughout dredging and sand cover placement operations, silt curtains were used to contain resuspended sediment during dredging, sand cover, and debris removal operations. A double silt curtain configuration was used at all times during dredging operations. The double silt curtain configuration typically consisted of two silt curtains encompassing an entire dredge area. Each silt curtain included an oil boom component contained within the silt curtain, which floated on the water surface. Silt curtains were weighted and positioned by the Contractor using anchors, marine structures, and shoreline tie-off locations.

5.2.1 Agency Notifications

During dredging at the North Shipyard, three events triggered notifications to the appropriate agencies within 24 hours of the event, and were immediately rectified. The three incidents occurred and were remediated as follows:

On April 20 and 21, 2015, while dredging in the southeastern corner of Pier 4 North, the Contractor encountered petroleum or old creosote-pile sheening. Following dredging operations on April 21, 2016, the Contractor removed the double silt curtain prior to the sheen to fully dissipating, resulting in sheen migration along the BAE Systems bulkhead (extending to Pier 1 South). Following the incident, the Contractor bolstered BMPs (e.g., oil absorbent pads and boom placed in the known areas where sheens were present) to further contain the sheen. In addition, prior to restarting dredging at the southeastern corner of Pier 4 North, the Contractor added additional oil containment measures (oil absorbent boom) along the inside of the inner silt curtain to fully contain any generated sheens.

On May 6, 2015, a buried oil drum was encountered and partially ruptured while dredging in the northeastern section of Pier 1 North. The Contractor immediately ceased all construction operations, removed the drum from the water, placed it in the material barge, and deployed oil containment measures (e.g., oil absorbent pads and booms) to contain the oil from leaving the immediate vicinity of dredging. An oil containment perimeter was established and the following day, the National Response Corporation Environmental Services (NRCES) provided assistance in containment and cleanup. In addition, California Marine Cleaning,

Inc. removed the oil drum and oil that was present within the material barge for proper disposal.

On June 3, 2015, the Contractor's workboat leaked approximately 2 quarts of hydraulic oil into San Diego Bay. The leak occurred within the double silt curtains, and was contained within the project area. Following the leak, the Contractor immediately ceased construction operations, and deployed hydrophobic boom around the inner silt curtain for additional containment. Additional hydrophobic boom was placed around the vessel as it was towed back to the Contractor's yard for repair. After further investigation, the cause of the leak was due to a loss of four mounting bolts, resulting in a loss of seal between the vessels outdrive and drive shaft. Prior to the vessel being brought back into use, the entirety of the outdrive unit was replaced.

5.3 SWPPP Monitoring

A SWPPP (Anchor QEA 2014e) was developed for the Site to effectively control stormwater runoff to San Diego Bay. SWPPP inspections were typically conducted weekly during construction, with additional inspections being conducted before, during (every 24 hours), and after each qualifying rain event (rainfall greater than 0.5 inch as measured by the on-site rain gauge). Inspections were conducted to ensure that all runoff controls were properly maintained, and any repairs or adjustments to the BMPs were immediately discussed with the Contractor. There was no authorized or non-authorized non-stormwater discharge observed throughout the construction activities.

The Permit Registration Documents, including the NOI, Risk Assessment, Site Map, SWPPP, Annual Fee, and signed Certification Statement was submitted into the Storm Water Multiple Application and Report Tracking System (SMARTS) on August 19, 2014. Receipt of these documents and issuance of a WDID was issued on August 22. An Annual Report (documenting compliance with the SWPPP) was summited into SMARTS on August 10 following the first reporting period (July 1 through June 30).

An additional Annual Report and Notice of Termination (NOT) were submitted into the SMARTS following the demobilization of the Contractor from the SMA on April 13 and 28,

2016, respectively. Approval of the NOT was received from the Water Board on following submittal on April 28, thus discontinuing the Site's WDID. The SWPPP and inspection forms will be maintained on site (at BAE Systems) for a period of 3 years following the approval of the NOT.

5.4 Dust and Odor Control

Trucks loaded with sediment were subject to cleaning prior to departure from the Site to avoid material being tracked out of the SMA. The truck washing operation consisted of a raised washing platform (metal grates) underlain with a non-permeable liner. In addition, a sump was constructed at the low point of the truck wash to remove water as needed which was discharged through the water handling system. Loaded trucks drove on to a platform with installed rumble strips and were washed on the washing platform by a two team member system using pressure washers. On a routine basis the Contractor removed the raised washing platform to remove residual sediment within the truck wash, which was transported to a scow and disposed of as dredged material.

Throughout the course of dredging operations and sand cover placement activities, general maintenance of the SMA was conducted to manage accumulation of dust, sediment, and/or sand material. A vacuum truck and bobcat with a sweeper attachment were used by the Contractor throughout construction, as necessary. Additionally, the Contractor occasionally used a third-party street sweeper to clean the SMA and surrounding areas.

5.5 IUDP Discharge Monitoring

Sampling of the water treatment system was conducted in accordance with the IUDP, which was conducted monthly. All discharge met and were significantly below the prescribed discharge values. The prescribed discharge values and a summary of the analytical results of the IUDP sampling are included in Table 9.

Table 9
Summary of IUDP Sampling Analytical Results

Parameter	Units	Prescribed City of San Diego Discharge Standards	IUDP Measured Discharge Values	Were Discharge Standards Met?
Minimum Discharge Rate	Gallons/minute	50	Met	Yes
Maximum Discharge Rate	Gallons/minute	300	Met	Yes
Maximum Daily Discharge	Gallons/day	432,000	62,900	Yes
Arsenic	mg/L	5	0.00386 – 0.0684	Yes
Total Mercury	mg/L	0.2	0.0000488 – 0.000252	Yes
Total PCBs	µg/L	3	<0.48 - <1.0	Yes
Chemical Oxygen Demand	mg/L	N/A[1]	260 – 2,700	N/A[1]
Total Suspended Solids	mg/L	N/A[1]	<1.0 – 261	N/A[1]
Copper	mg/L	11[2]	0.0154 – 0.117	Yes
Lead	mg/L	5[2]	0.0125 – 0.0683	Yes
Nickel	mg/L	13[2]	0.0110 – 0.0201	Yes
Zinc	mg/L	24[2]	0.0439 – 0.190	Yes

Notes:
1. North Trust was required to sample for chemical oxygen demand and total suspended solids; however, no prescribed discharge standards were provided.
2. The North Trust was required to sample for copper, lead, nickel, and zinc; however, no prescribed discharge standards were provided in the North Trust's IUDP. However, results of the IUDP measured discharge values were compared with the City of San Diego's current local limits for Significant Industrial Users.

µg/L = micrograms per liter
IUDP = Industrial User Discharge Permit
mg/L = milligrams per liter

As discussed in Section 5.6.1, water which existed below the discharge point was discharged at Pump Station #1 under a Trucked IWGP. The water was discharged as a single batch discharge, and required a single discharge sample which were below the required Trucked IWGP discharge constituent limitations. The prescribed discharge values and a summary of the analytical results of the Trucked IWGP sampling are included in Table 10.

Table 10
Summary of Trucked IWGP Sample Analytical Results

Parameter	Units	Prescribed City of San Diego Discharge Standards	IWGP Measured Discharge Values	Were Discharge Standards Met?
Arsenic	mg/L	5	0.00313	Yes
Total Mercury	mg/L	0.2	0.0000551	Yes
Total PCBs	µg/L	3	<0.96	Yes
Total Suspended Solids	mg/L	N/A[1]	92	N/A[1]
Copper	mg/L	11	0.0121	Yes
Lead	mg/L	5	0.00286	Yes
Nickel	mg/L	13	0.0107	Yes
Zinc	mg/L	24	0.0440	Yes

Notes:
1. North Trust was required to sample for total suspended solids; however, no prescribed discharge standards were provided.

µg/L = micrograms per liter
IWGP = Industrial Waste Generator Permit
mg/L = milligrams per liter

Laboratory results for all discharge samples are included in Appendix G.

5.6 Biological and Environmental Monitoring

Biological monitoring was conducted during dredging and sand cover placement to comply with the Mitigation Monitoring and Reporting Program (Water Board 2012b), USACE IP (USACE 2013), and the WDR/WQC (Water Board 2013b). Specifically, monitoring included training of the Contractor's crew on eelgrass avoidance and sea turtles, marine mammals, and special status bird life and observing, documenting, and reporting the presence and behaviors of these species.

5.6.1 Pre-construction Biological Monitoring

Per Mitigation Measure (MM) 4.5.9, a pre-construction biological monitoring event was conducted prior to commencing dredging operations. The project biologist performed pre-construction monitoring for the presence and behavior of California least tern (*Sternula*

antillarum browni) and other special status birds. This monitoring included a monitoring event performed on September 15, 2014, prior to the start of debris removal activities in Pier 1 North on September 19. The monitoring event was focused specifically to observing (via binoculars) the North Shipyard portion of the Site for special status birds. Observations were conducted within monitoring areas as identified in Figure 15, which correspond to approximately 500 feet surrounding the anticipated dredging operations. No California least tern or other special status birds were observed during pre-construction monitoring. Results of the pre-construction biological monitoring are provided in Appendix H.

5.6.2 Contractor Training

Per MMs 4.5.3 and 4.5.6 and WDR/WQC Discharge Requirement VI-C, the project biologist trained the Contractor's crew to identify potential sea turtles, marine mammals, and special status birds, such as California least tern. An initial training was conducted by the project marine biologist on October 8, 2014 with the Contractor's crew. Training included identifying characteristics of species with the potential to be present at the Site and providing instructions on how to contact the project biologist if these species were observed. Periodic updates with the Contractor's crew were conducted during the Contractor's morning safety briefings.

5.6.3 Green Sea Turtle and Marine Mammal Monitoring

Per MM 4.5.5, WDR/WQC Section V-N.10, WDR/WQC VI-C, and USACE IP Essential Fish Habitat and Green Sea Turtle Condition 32, barges and work vessels were operated in a manner to ensure that green sea turtles (*Chelonia mydas*) and marine mammals were not injured or harassed via excessive vessel speed or propeller damage. No green sea turtles were sighted during dredging operations. Some marine animal activity was observed at the Site, which consisted of observing harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*). All marine animal activity occurred outside of the active work area with exception of one occasion. On January 19, 2015, a Harbor seal was observed swimming in Pier 1 North. The Contractor was notified. No work took place within 100 meters of the observed Harbor seal until the Harbor seal was observed leaving Pier 1 North, at which point work was resumed (in accordance with MM 4.5.7 and WDR/WQC VI-C).

Results of the monthly biological monitoring are provided in Appendix H.

5.6.4 Special Status Bird Monitoring

In order to meet the compressed construction schedule, remediation was required during the nesting season (April 1 through September 15). On February 11, 2015, the Project Biologist requested authorization from USACE and Water Board to continue sediment remediation dredging during the California least tern nesting season (Merkel & Associates 2015). Approval was received from USACE and Water Board on February 11 (Smith 2014b) and March 5 (Barker 2015b), respectively.

In accordance with MM 4.5.9, WDR/WQC VI-B, and USACE IP Endangered Species Act Condition 31, a qualified biologist familiar with the California least tern and other special status seabirds and waterfowl was on site to assess the roosting and foraging behavior of special status seabirds and waterfowl at the Site and the staging area. Special status bird species are defined herein as those that are federally listed (endangered, threatened, or proposed endangered or threatened or candidate) under the Endangered Species Act or classified with special status in the State of California (endangered, threatened, rare, candidate endangered or threatened; species of special concern; or special animal; Water Board 2012c).

Daily monitoring was performed by Anchor QEA in the areas identified in Figure 15 under the direction of the Project Biologist to document observations of special status bird species while performing other project duties. The Project Biologist conducted weekly monitoring. Daily monitoring began prior to the commencement of debris removal on September 16, 2014, and was suspended in early February 2016 at the conclusion of in-water work. Weekly monitoring by Merkel & Associates biologists commenced on October 16, 2014, and continued through the conclusion of in-water work. Various special status birds were observed during the daily and weekly monitoring, which included the California brown pelican (*Pelecanus occidentalis*), the double-crested cormorant (*Phalacrocorax auritus)*, and the California least tern, in which no disturbance occurred during the project. Monthly biological monitoring reports from Merkel & Associates are provided in Appendix H.

5.6.5 Eelgrass Monitoring

Unavoidable impacts to eelgrass resulted during dredging and sand cover placement. For areas outside those designated for disturbance and in accordance with MM 4.5.4, the project biologist (Merkel & Associates) inspected and confirmed that protective measures were implemented for eelgrass when project-related barges and work vessels were operating in areas where eelgrass beds exist. In addition, the project biologist inspected and confirmed that all operations were conducted in a manner to minimize the potential impacts to eelgrass beds through grounding, propeller damage, or other activities that may have disturbed the seafloor.

The post-construction eelgrass survey was conducted on March 4, 2016, to quantify the final impacts to eelgrass to quantify the amount of mitigation required. Based on differences between the pre-construction and post-construction eelgrass surveys, and after considering the activities undertaken and physical evidence of work conducted in the area, it was concluded that the remediation work resulted in a loss of 1.02 acres of eelgrass (Merkel & Associates 2016). Based on the 1.2:1 eelgrass replacement ratio outlined in the Southern California Eelgrass Mitigation Policy, 1.22 acres of eelgrass habitat was recommended to be planted as mitigation impacted by the remedial cleanup actions.

Due to time constraints, the eelgrass mitigation area originally approved (located on the western side of San Diego Bay, North of the Coronado Cays) was not used as the area would have required a lease from the CSLC and lost its intended source of fill sediment. Subsequently, a trust account was established with USACE and NMFS to ensure faithful completion of the mitigation project. The current approach, which has now been permitted with NMFS, USACE, the Water Board, and the Port of San Diego, is to combine the North Shipyard Mitigation Requirements with other mitigation required for BAE Systems shipyard improvements. This mitigation plan is to conduct mitigation within the cooling water intake channel of the now decommissioned South Bay Power Plant. The mitigation site would use dredge materials from the BAE Systems shipyard improvement project, and has already received a Clean Water Act Section 401 Water Quality Certification (Water Board), completed an Essential Fish Habitat and Endangered Species Act Section 7 consultation, received a CDP (Unified Port of San Diego), and an approval for use on the Port-administered Tidelands. Suitability has been verified by USACE and USEPA. Construction of

this mitigation site is scheduled to commence in summer 2016, with eelgrass restoration planting being performed in spring 2017.

5.7 Reporting

A significant amount of reporting was required by the project permits discussed in Section 2.2. These reporting requirements are detailed in Table 11.

Table 11
Reporting Required by Project Permits

Required Reporting	Regulatory Reference	Frequency
CAO		
Final Cleanup and Abatement Completion Report	CAO Directive C	One time following project completion
Quarterly Progress Reports	CAO Directive E	Quarterly
Mitigation Monitoring and Reporting Program		
Weekly Water Quality Monitoring Report	MM 4.2.4	Weekly
Monthly Biological and Environmental Monitoring Report[1]	MM 4.5.3 MM 4.5.4 MM 4.5.5 MM 4.5.6	Monthly
Annual Report into SMARTS	MM 4.2.12	Annually
Notice of Termination into SMARTS	MM 4.2.12	One time following final stabilization of SMA
Pre-construction Eelgrass/Caulerpa Survey	MM 4.5.1 WDR/WQC VI.A WDR/WQC VII C Special Condition 5	One time prior to construction
Post-construction Eelgrass Survey	MM 4.5.1 WDR/WQC VI A	One time following project completion
Final Eelgrass Mitigation Plan	MM 4.5.1 WDR/WQC VI A	One time following project completion
USACE IP		
Weekly and Monthly Water Quality Monitoring[2]	General Condition 5	Weekly and Monthly
Weekly Water Quality and Biological Monitoring Report	Dredging Condition 28	Weekly

Required Reporting	Regulatory Reference	Frequency
Weekly Water Quality Monitoring Report	WDR/WQC Condition 33	Weekly and Monthly
Monthly Biological and Environmental Monitoring Report[1]	Endangered Species Act Condition 31	Monthly
Pre- and Post-project Eelgrass Survey	Special Condition 6	One time following project completion
Essential Fish Habitat Mitigation Plan[3]	Special Condition 7	One time following USACE direction
Post-project Implementation and Dredging Completion Memorandum	Special Condition 1 Special Condition 5 Dredging Condition 11 Dredging Condition 15 Dredging Condition 30	One time following project completion
Structure Survey	Special Condition 11	One time following project completion
WDR/WQC		
Monthly Water Quality Monitoring Report	VIII A	Monthly
Compensatory Mitigation Completion Report[4]	VIII B	One time following eelgrass planting
MMRP Verification Report	VIII E	One time following construction
IUDP		
Monthly Industrial User Discharge Report	Attachment B	Monthly
California States Lands Commission Dredging Lease		
Dredging Report[4]	Dredging Lease	Annually

Notes:
All the above reports were completed and submitted as required by regulatory documents.

1. Monthly Biological and Environmental Monitoring Reports were submitted to both the Water Board and USACE. The monthly and weekly reports were combined for the final monitoring report for each month.
2. All debris and sediment manifests shipped to the Otay Landfill were included in the Monthly Water Quality Monitoring Reports.
3. The Essential Fish Habitat Mitigation Plan has not been requested by USACE.
4. The Compensatory Mitigation Completion Report has not been submitted at the date of this report and will be submitted following the completion of eelgrass planting in accordance with Post-project Eelgrass Survey.
5. The Dredging Report includes the Final Cleanup and Abatement Completion Report and the Lessee's Yearly Report of Operations.

5.8 Geotracker

In addition to the reporting listed above, Directive G.10 the CAO listed the electronic and paper media reporting requirements, which detailed how submittals to the Water Board

must be conducted. As part of these requirements, Provision G.10(b) describes various electronic data submittal requirements for the project that must be submitted into the Water Board's Geotracker database. Appendix I includes a summary of the provisions and a list of documents and/or data submitted to the Water Board's Geotracker database.

6 SUMMARY AND COMPLETION STATEMENT

As presented in Section 2.1, the cleanup objectives for the primary COCs were stipulated by the Water Board in the CAO, which include established cleanup levels for copper, mercury, HPAHs, PCBs, and tributyltin. As documented in this report, remedial action at the North Shipyard portion of the Site achieved the required CAO remedial goals and was conducted in accordance with all CAO requirements. Table 12 provides a comparison between estimated remedial quantities presented in Attachment 3 of the CAO and actual remedial quantities achieved.

Table 12
Remedial Quantity Comparison

Remedial Quantity	CAO Estimated Quantity	Actual Achieved Quantity	Discussion
Dredge remedial area (square feet)	438,300	403,312	Actual achieved dredge area includes side slopes, from design plans, after accounting for final design setbacks from existing slopes and structures. Some areas included in the CAO-estimated quantity could not be dredged due to presence of existing structures or already had existing elevations below the remedial target depth, resulting in a reduction in the technically feasible or appropriate dredging area. Areas that could not be dredged to the remedial target depth and had the potential for dredge residuals were covered with sand cover.
Designated additional sand cover placement for protection of existing structures (square feet)[1]	N/A	42,007	Specified areas for sand cover placement in open-water areas, required to maintain stability of existing slopes, structures, and bulkheads. As Pier 4 was demolished and re-constructed prior to construction, a small area (approximately 9,800 square feet) which previously existed within the dredge remedial area was shifted north of Pier 4. As further dredging in this small area may have destabilized the newly installed Pier 4, sand cover was placed over the area.

Remedial Quantity	CAO Estimated Quantity	Actual Achieved Quantity	Discussion
Under pier remedial area (square feet)	89,980	89,980	Pier 2 and the remnant Pier 5 were demolished during and prior to construction, respectively, allowing for dredging to take place in those areas (as remediation occurred in these under pier areas, they are included in the Actual Achieved Quantity).
Total remedial area (square feet)	528,295	506,400	The actual achieved quantity includes total footprint of dredging, sand cover placement, or a combination of the two. Some areas within the CAO-estimated remedial area had pre-existing elevations below the remedial target depth (specifically in the vicinity of POSD Dry Dock berthing area and Pier 4 North); thus, no dredging or sand cover was necessary.
Volume (cubic yards)	90,800	114,085	Actual dredge volumes generated during construction. Volumes exceed the CAO-estimated quantity due to multiple required additional dredging passes (based on results of post-dredge confirmatory sampling) as well as the inclusion of the Scow 3002 Misplaced Material Area.

Notes:
1. Not specifically quantified in CAO

The remedial action for the project consisted of mechanically removing approximately 114,085 cubic yards of material from a remedial footprint measuring approximately 403,312 square feet in area. The excavated dredge prism was designed to remove impacted sediment located at the Site. The dredged material was stabilized at the SMA with Portland cement and transported via truck to the Otay Landfill where it was disposed.

Approximately 900,500 gallons of water were treated on site over the course of the project, using multiple weir and Baker tanks to allow the suspended sediment to settle, and then eventually discharged into the City sewer system.

To cover potentially contaminated sediments that were unable to be dredged (in sloping and under-pier areas), 22,938 tons of cover material were placed, including 5,821 tons of sand and 17,117 tons of gravelly sand. The resulting sand cover placement resulted in a placement rate exceeding the 6 tons per 100 square feet required in the Project Specifications.

The Site has since been entirely demobilized and restored to conditions similar to those existing prior to commencement of dredging-related activities.

6.1 Post-remedial Monitoring

Compliance with required post-remedial SWACs at the North Shipyard will be measured through post-remedial monitoring, which will occur in accordance with requirements as outlined in the CAO and as detailed in the PRMP. Post-remedial monitoring will commence 2 years following completion of the North Shipyard Site (note that the South Shipyard portion of the remediation was completed previously). The objective of post-remedial monitoring is to verify that remediation was effective in reducing and maintaining acceptable SWAC levels. Post-remedial monitoring will be conducted 2 and 5 years after the completion of remediation to confirm the remedial goals are met. If the Year 5 remedial goals are not met, additional testing will be conducted in Year 10. As such, confirmation that the remedial action objectives were made will be provided under a separate cover after completion of post-remedial monitoring.

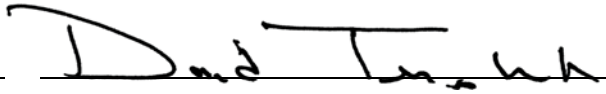
Post-remedial monitoring will include sediment sampling for chemistry analysis, bioaccumulation testing, and toxicity testing at specified locations to verify that remedial objectives are met. Chemistry analysis will verify that the remediation was successful in reducing site-wide SWACs to levels that have been determined to be protective of all beneficial uses, including human health and wildlife beneficial uses, under the CAO. Sediment toxicity tests will be used to compare the post-remedial sediment toxicity to pre-existing conditions at the reference stations described in Finding 17 and in the Technical Report for the CAO (Water Board 2012c).

Bioaccumulation testing will be used to compare the average bioaccumulation of stations sampled to pre-remedial levels. Benthic community assessment will also be performed in the remedial footprint to evaluate post-dredging benthic community development.

6.2 Completion Statement

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and believe, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

To the best of my knowledge, information and belief, based on observation of the work during and upon completion of construction by myself or the Resident Engineer under my supervision, the San Diego Shipyard Sediment Site – North Shipyard construction was completed in general conformance with the contract and permit documents and the project objectives as described in this North Shipyard RAP Implementation Report.

David Templeton		7/11/2016
Project Manager Anchor QEA, LLC	Signature	Date

7 REFERENCES

Anchor QEA, L.P., 2012. *Remedial Action Plan*. San Diego Shipyard Sediment Site. October 2012.

Anchor QEA, 2013. *Basis of Design Memorandum. San Diego Shipyard Sediment Site – North Shipyard*. August 2013.

Anchor QEA, 2014a. *South Shipyard Remedial Action Plan Implementation Repor*t. San Diego Shipyard Sediment Site - South Shipyard. June 2014. Revised April 2015.

Anchor QEA, 2014b. Contract Drawings. San Diego Shipyard Sediment Site. Remediation of North Shipyard. San Diego Bay Environmental Restoration Fund – North Trust. July 10, 2014.

Anchor QEA 2014c. *Revised Essential Fish Habitat Assessment for San Diego Shipyard Sediment Site – North Shipyard (USACE No. SPL-2013-00146-RRS)*. May 13, 2014.

Anchor QEA, 2014d. Technical Specifications. San Diego Shipyard Sediment Site – North Shipyard. July 2014.

Anchor QEA, 2014e. *Construction Storm Water Pollution Prevention Plan. San Diego Shipyard Sediment Site – North Shipyard, Risk Level 1*. August 27, 2014. Revised September 16, 2014, February 11, 2015, and May 4, 2015.

Anchor QEA, 2015a. *Corrective Action Work Plan for Barge Dredged Material Spill. San Diego Shipyard Sediment Site*. North Shipyard, San Diego, California. July 28, 2015.

Anchor QEA, 2015b. *Projection of Total Project Dredging Volume. San Diego Shipyard Sediment Site*. North Shipyard, San Diego, California. July 28, 2015.

Anchor QEA, 2015. *Essential Fish Habitat Consideration for San Diego Shipyard Sediment Site – North Shipyard (USACE No. SPL-2013-00146-RRS)*. July 28, 2015.

Barker, D., 2015a. Email to M. Whelan, Anchor QEA, LLC. Regarding: Borrow Source characterization and verification: San Diego Shipyard Sediment Site. February 20, 2015.

Barker, D., 2015b. Email to K. Merkel, Merkel & Associates. Regarding: Request to conduct CAO remediation work during California least tern season. March 5, 2015.

Becker, E., 2015. Email to M. Medel, Port of San Diego; and A. Gale and M. Whelan, Anchor QEA, LLC. Regarding: San Diego Shipyard Sediment Site – North Shipyard (Place ID 794466, Order No. R9-2013-0093. August 27, 2015.

Chavez, E., 2015. Email to R. Smith, USACE. Regarding: San Diego Shipyards Sediment site – North Shipyard – Corps reinitiating EFH consultation (UNCLASSIFIED). August 6, 2015.

Environmental Data Solutions, 2013. BAE Shipyard Sidescan Sonar Survey. April 10 to 12, 2013.

Exponent, 2012. *Work Plan for the San Diego Shipyards Post-Remedial Monitoring. Cleanup and Abatement Order No. R9-2012-024*. September 2012.

Medel, M., 2015. Email to A. Gale and M. Whelan, Anchor QEA, LLC. Regarding: San Diego Shipyard Sediment Site – North Shipyard (Place ID 794466, Order No. R9-2013-0093 (UNCLASSIFIED). August 5, 2015.

Merkel & Associates, Inc., 2015. *San Diego Shipyard Sediment Remediation Project North, 2015 Least Tern Season Work (SPL-2013-00146-RRS, Order No. R9-2013-0093)*. February 11, 2015.

Merkel & Associates, Inc., 2016. *Post-Construction Eelgrass Report for the San Diego Shipyard Sediment Remediation Project - North Shipyard Site – Waste Discharge Requirement Order No. R9-2013-0093*.

Smith, R., 2014a. Email to M. Whelan, Anchor QEA, LLC. Regarding: Determination on use of Sand and Gravelly Sand Cover Material for San Diego Shipyard Sediment Site, North Shipyard (Corps permit No. 2014-00146-RRS) – Corps and EPA determination (UNCLASSIFIED). December 30, 2014.

Smith, R., 2014b. Email to K. Merkel, Merkel & Associates; and David Barker, Water Board. Regarding: Request to conduct CAO remediation work during California least tern season. February 11, 2015.

USACE (U.S. Army Corps of Engineers), 2013. Department of the Army Permit, File No. SPL-2013-00146-RRS. Issued on November 20, 2013.

USACE, 2014. Modification of San Diego Shipyard Sediment Remediation Project North (Permit No. SPL-2013-00146-RRS). Issued on September 12, 2014.

USACE, 2015. Modification of San Diego Shipyard Sediment Remediation Project North (Permit No. SPL-2013-00146-RRS). Issued on September 4, 2015.

USEPA (U.S. Environmental Protection Agency), 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use.* USEPA 540-R-09-005. January 2009.

Water Board (Regional Water Quality Control Board), 2012a. Cleanup and Abatement Order R9-2012-0024 for the Shipyard Sediment Site. March 14, 2012.

Water Board, 2012b. *Final Environmental Impact Report (SCH#2009111098)*. March 14, 2012.

Water Board, 2012c. *Technical Report for Cleanup and Abatement Order No. R9-2012-0024 for the Shipyard Sediment Site*. March 14, 2012.

Water Board, 2013a. *San Diego Shipyard Sediment Remediation Project, Addendum to the Final Program Environmental Impact Report Related to Project Changes Identified in Tentative Order No. R9-2013-0093*. June 27, 2013.

Water Board, 2013b. Waste Discharge Requirements for National Steel and Shipbuilding Company, BAE Systems San Diego Ship Repair, Inc., San Diego Unified Port District. Order No. R9-2013-0093. San Diego Shipyard Sediment Remediation, San Diego Bay, San Diego, California. Issued on July 10, 2013.

Water Board 2015. *San Diego Shipyard Sediment Site, North Shipyard – Cleanup of Dredge Material Spill at Pier 3*. August 27, 2015.

FIGURES

AERIAL SOURCE: ESRI basemaps
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.

LEGEND:

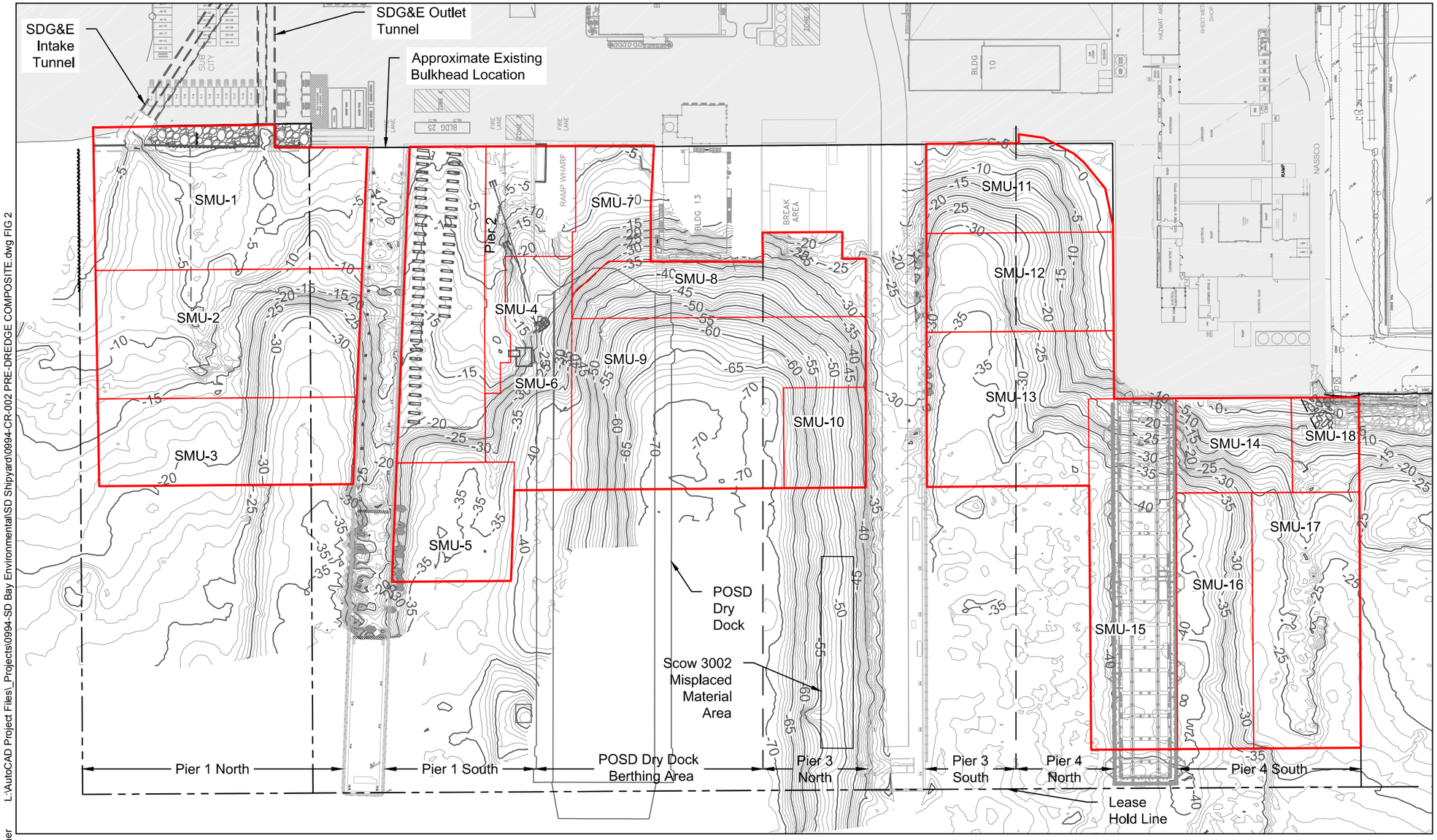
Remediation Boundary

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-RP-189 VIC SITES.dwg FIG 1

Jul 12, 2016 4:08pm mpratschner

ANCHOR QEA

Figure 1
Vicinity Map
San Diego Shipyards Sediment Site - North Shipyard



LEGEND:

- SMU Boundary
- -10 Major Contour (5' Interval)
- Minor Contour (1' Interval)

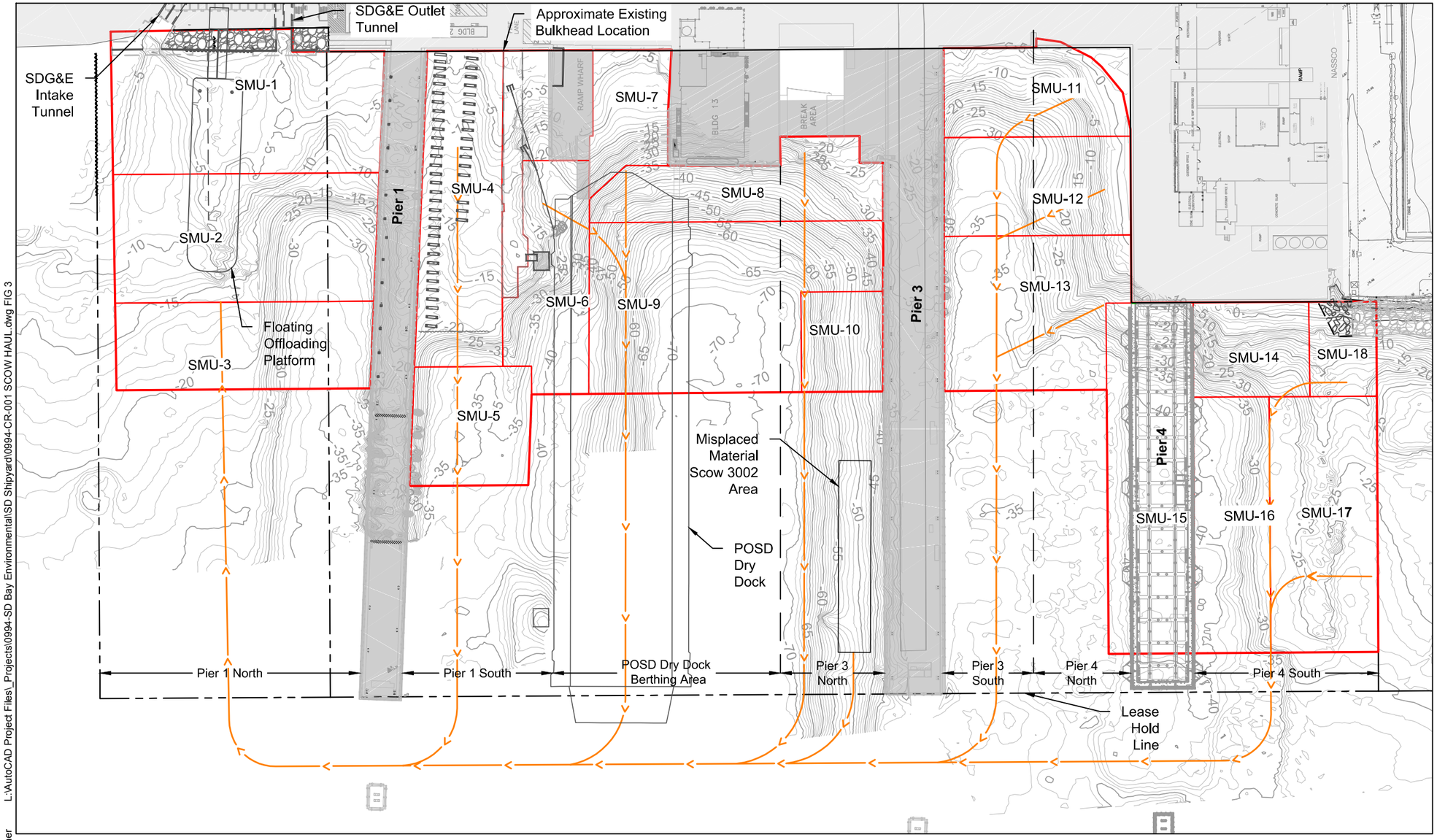
SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, supplemented by Environmental Data Solutions survey dated April 13, 2013. Bathymetric data from eTrac surveys dated September 10 and 23, supplemented by survey data dated November 11, 2014; December 4 and 19, 2014; April 10, 2015; May 22, 2015 as well as R.E. Staite Engineering survey dated January 22, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: NOAA Tidal Guage.

0 150
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-002 PRE-DREDGE COMPOSITE.dwg FIG 2
Jun 02, 2016 11:15am mpratschner

ANCHOR QEA

Figure 2
Composite Pre-dredge Bathymetric Survey
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

- SMU Boundary
- -10 Major Contour (5' Interval)
- Minor Contour (1' Interval)
- Typical Sediment Scow Haul Routes

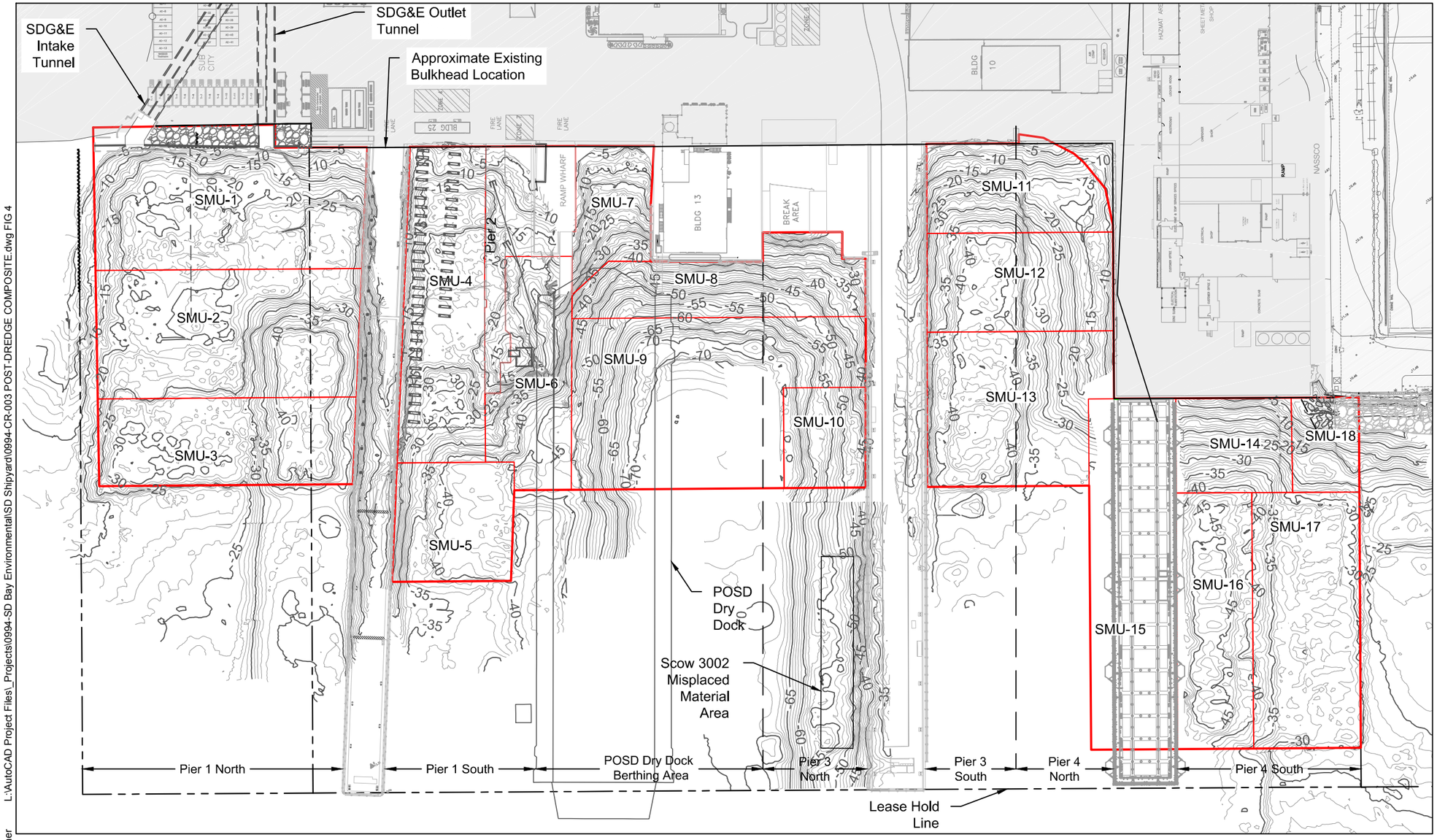
SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, supplemented by Environmental Data Solutions survey dated April 13, 2013. Bathymetric data from eTrac surveys dated September 10 and 23, supplemented by survey data dated November 11, 2014; December 4 and 19, 2014; April 10, 2015; May 22, 2015 as well as R.E. Staite Engineering survey dated January 22, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: NOAA Tidal Gauge

0 150
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-001 SCOW HAUL.dwg FIG 3
Jun 02, 2016 12:40pm mpratschner

ANCHOR QEA

Figure 3
Typical Sediment Scow Haul Route
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

- SMU Boundary
- -10- Major Contour (5' Interval)
- Minor Contour (1' Interval)

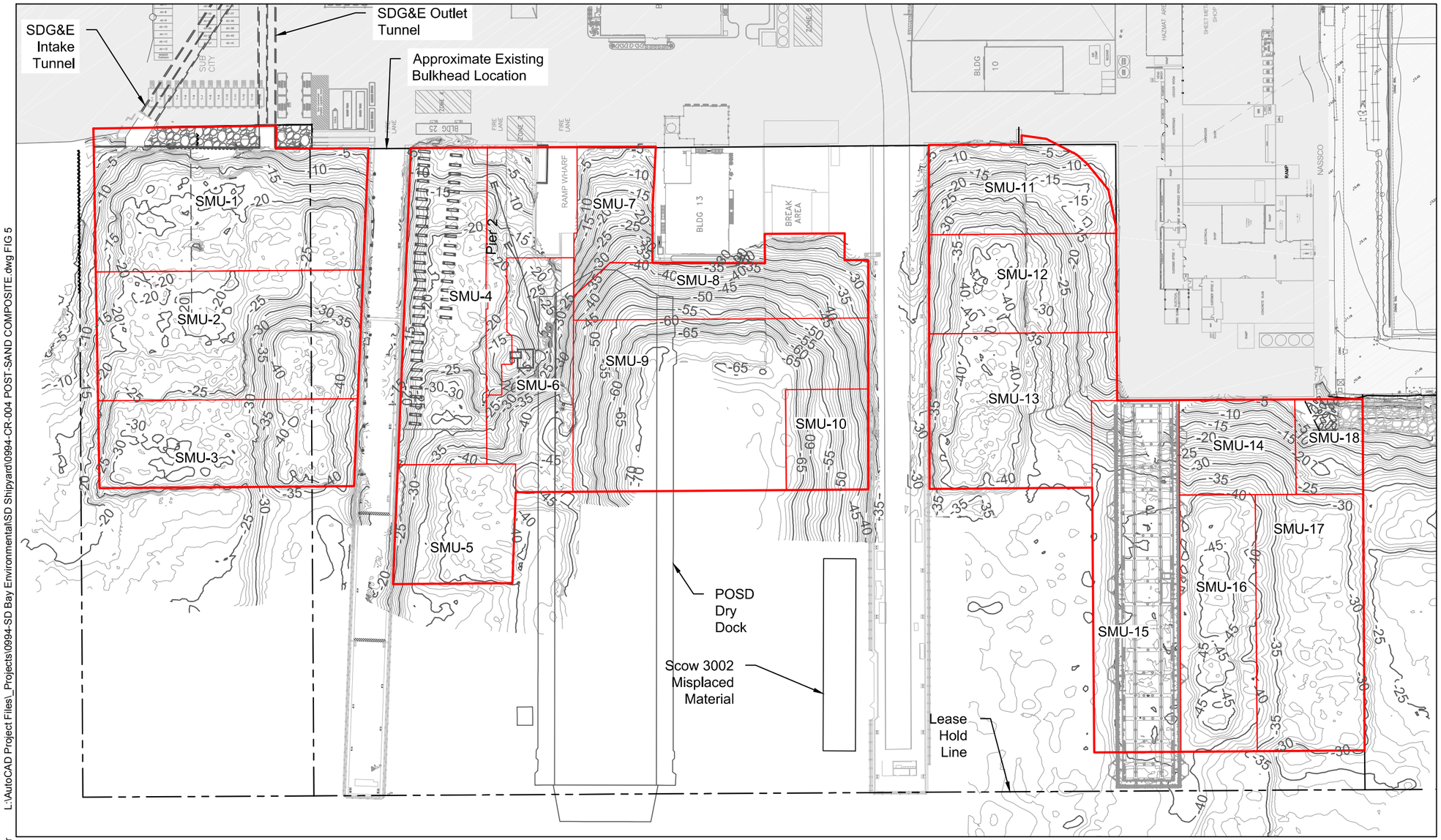
SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, supplemented by Environmental Data Solutions survey dated April 13, 2013. Bathymetric data from eTrac surveys dated September 10 and 23, supplemented by survey data dated November 11, 2014; December 4 and 19, 2014; April 10, 2015; May 22, 2015 as well as R.E. Staite Engineering survey dated January 22, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: NOAA Tidal Guage

0 150
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-003 POST-DREDGE COMPOSITE.dwg FIG 4
Jun 02, 2016 12:51pm mpratschner

ANCHOR QEA

Figure 4
Composite Post-dredge Bathymetric Survey
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

- SMU Boundary
- -10- Major Contour (5' Interval)
- Minor Contour (1' Interval)

SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, supplemented by Environmental Data Solutions survey dated April 13, 2013. Bathymetric data from eTrac surveys dated September 10 and 23, supplemented by survey data dated November 11, 2014; December 4 and 19, 2014; April 10, 2015; May 22, 2015 as well as R.E. Staite Engineering survey dated January 22, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: NOAA Tidal Guage

0 150
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-004 POST-SAND COMPOSITE.dwg FIG 5
Jun 02, 2016 1:03pm mpratschner

ANCHOR QEA

Figure 5
Composite Post-sand Bathymetric Survey
San Diego Shipyard Sediment Site - North Shipyard

Floating Offload Platform

SD-N-C-01C-D
SD-N-C-02-D
SD-N-C-01A-D
SD-N-C-01B-D
SD-N-C-03-D
SD-N-C-04A-D
SD-N-C-05A-D
SD-N-C-04B-D
SD-N-C-05B-D
SD-N-C-06-D
SD-N-C-07A-D
SD-N-C-07B-D
SD-N-C-08-D
SD-N-C-09-D
SD-N-C-10-D
SD-N-C-11-D
SD-N-C-12-D
SD-N-C-13-D
SD-N-C-13A-D
SD-N-C-14-D
SD-N-C-14A-D
SD-N-C-15-D
SD-N-C-16-D
SD-N-C-17-D
SD-N-C-18A-D
SD-N-C-18B-D
SD-N-C-19-D
SD-N-C-20-D
SD-N-C-21A-D
SD-N-C-21-D
SD-N-C-22A-D
SD-N-C-22B-D
SD-N-C-23-D
SCOW-01

SMU-1
SMU-2
SMU-3
SMU-4
SMU-5
SMU-6
SMU-7
SMU-8
SMU-9
SMU-10
SMU-11
SMU-12
SMU-13
SMU-14
SMU-15
SMU-16
SMU-17
SMU-18

Pier 1
Pier 2
Pier 3
Pier 4

RAMP WHARF
BLDG 25
BLDG 13
BREAK AREA
FIRE LANE
FIRE ZONE
NASSCO
RAMP
ELECTRICAL SHOP
CARPENTER SHOP
CUSTOMER OFFICE 1
CUSTOMER OFFICE 2
CONCRETE SLAB
DOME INCL

POSD Dry Dock

Scow 3002 Misplaced Material Area

Lease Hold Line

Sample ID	Latitude	Longitude	Sample ID	Latitude	Longitude
SD-N-C-01A-D	32°41.558'	117°08.758'	SD-N-C-13-D	32°41.495'	117°08.684'
SD-N-C-01C-D	32°41.563'	117°08.740'	SD-N-C-13A-D	32°41.488'	117°08.666'
SD-N-C-03-D	32°41.551'	117°08.769'	SD-N-C-14-D	32°41.469'	117°08.661'
SD-N-C-04A-D	32°41.539'	117°08.770'	SD-N-C-14A-D	32°41.481'	117°08.660'
SD-N-C-04B-D	32°41.527'	117°08.773'	SD-N-C-15-D	32°41.491'	117°08.607'
SD-N-C-01B-D	32°41.546'	117°08.732'	SD-N-C-17-D	32°41.472'	117°08.613'
SD-N-C-02-D	32°41.542'	117°08.723'	SD-N-C-18A-D	32°41.468'	117°08.619'
SD-N-C-05A-D	32°41.523'	117°08.741'	SD-N-C-18B-D	32°41.457'	117°08.628'
SD-N-C-05B-D	32°41.514'	117°08.753'	SD-N-C-20-D	32°41.442'	117°08.636'
SD-N-C-06-D	32°41.529'	117°08.698'	SD-N-C-16-D	32°41.477'	117°08.587'
SD-N-C-07A-D	32°41.518'	117°08.707'	SD-N-C-19-D	32°41.455'	117°08.600'
SD-N-C-07B-D	32°41.507'	117°08.722'	SD-N-C-21-D	32°41.403	117°08.585'
SD-N-C-08-D	32°41.488'	117°08.734'	SD-N-C-21A-D	32°41.422	117°08.580
SD-N-C-09-D	32°41.485'	117°08.749'	SD-N-C-22A-D	32°41.409	117°08.604
SD-N-C-10-D	32°41.515'	117°08.675'	SD-N-C-22B-D	32°41.389	117°08.613
SD-N-C-11-D	32°41.493'	117°08.704'	SD-N-C-23-D	32°41.381	117°08.598
SD-N-C-12-D	32°41.485'	117°08.711'	Scow-01	32°41.430	117°08.683

SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.

LEGEND:

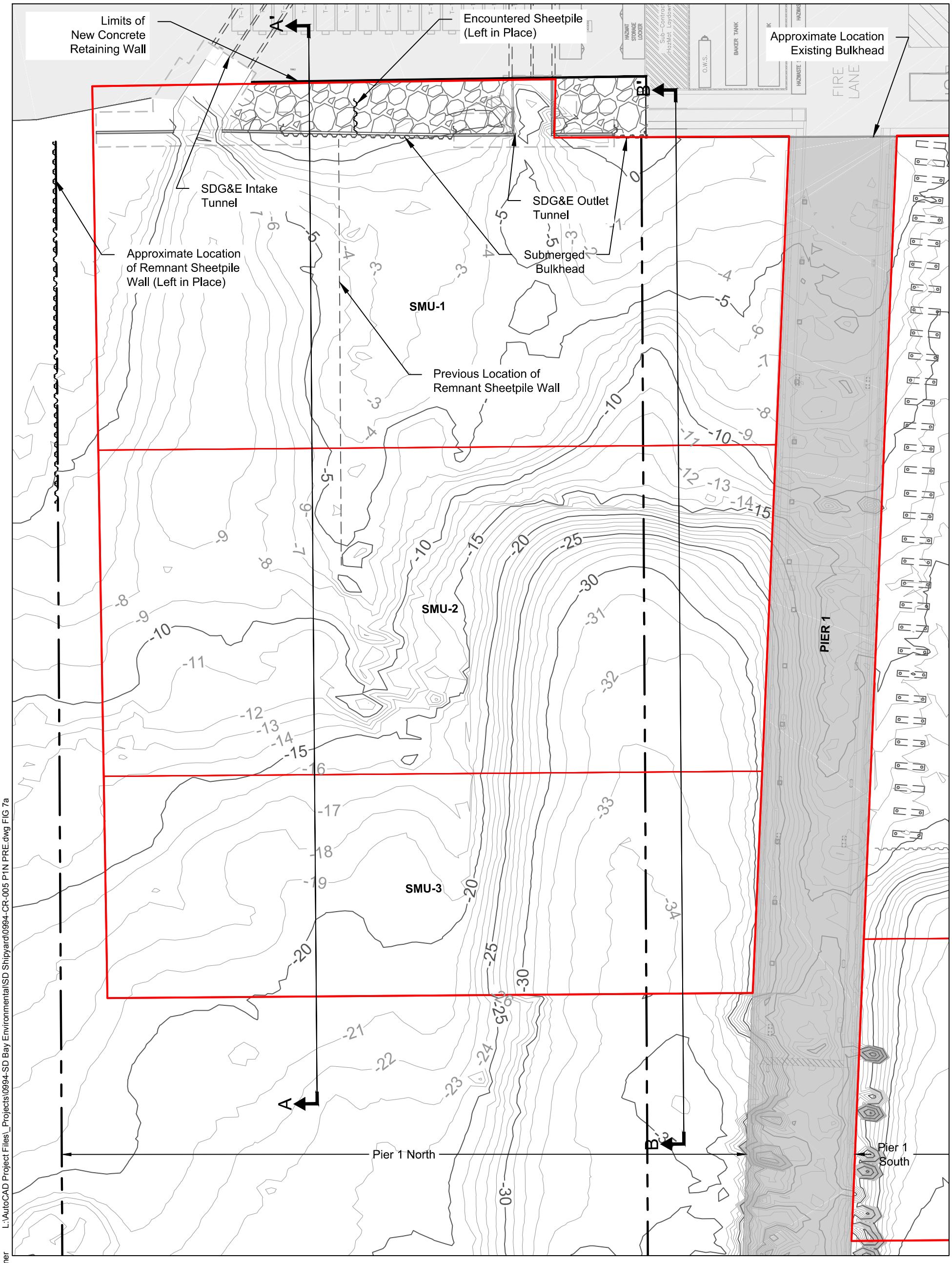
- Post-dredge Sampling Location
- Proposed Dredging (-20)
- 3-foot cuts

0 100
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-023 POST SAMPLES.dwg FIG 6
Jun 02, 2016 1:06pm mpratschner

ANCHOR QEA

Figure 6
Post-dredge Confirmation Sediment Sampling Locations
San Diego Shipyard Sediment Site - North Shipyard



L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-005 P1N PRE.dwg FIG 7a
Jun 02, 2016 1:16pm mpratschner

SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

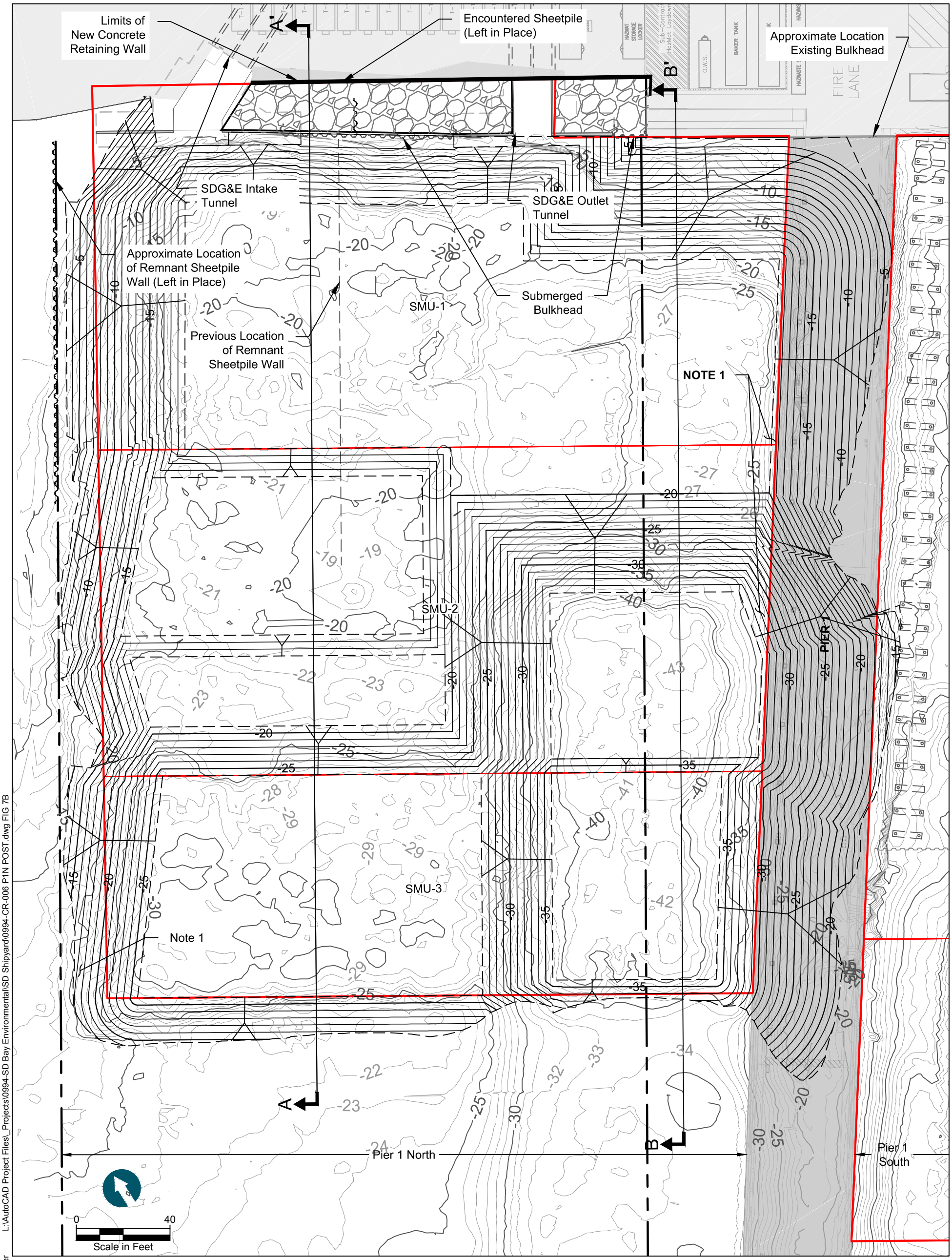
LEGEND:

- 5 — Pre-dredge Bathymetric Contours
- SMU Boundary
- Approximate Limits of New Revetment

0 40
Scale in Feet

ANCHOR QEA

Figure 7a
Pier 1 North: Pre-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

-10 — Post-Dredge Bathymetric Contours

-20 — Dredge Design Contours

SMU Boundary

Approximate Limits of New Revetment

NOTE:

1. Based on the engineer's further review of dredging limitations, the dredge design was modified in these areas to maximize the removal of potentially contaminated sediments.

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-006 P1N POST.dwg FIG 7B
Jul 14, 2016 9:26am mpratschner

ANCHOR QEA

Figure 7b
Pier 1 North: Post-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard

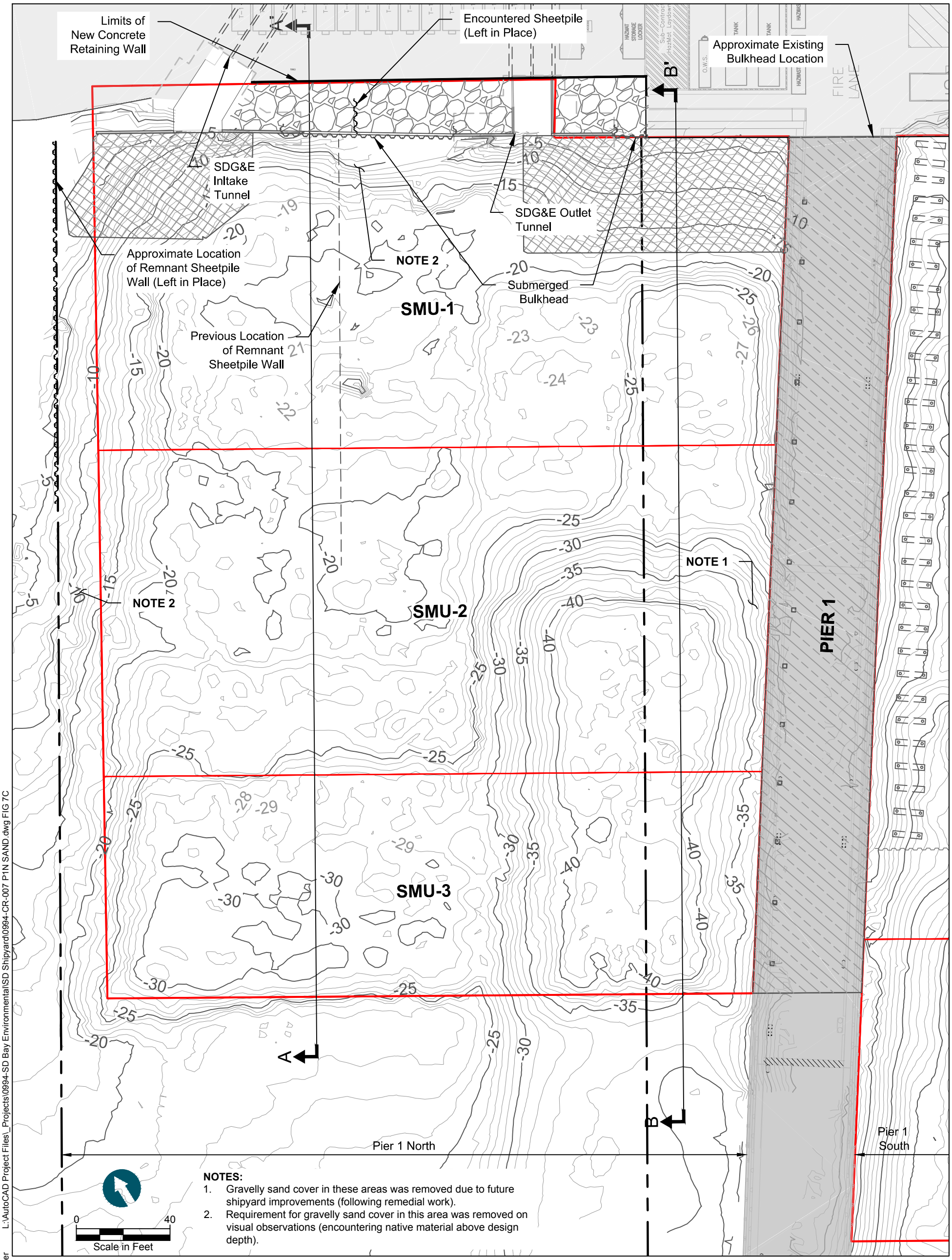
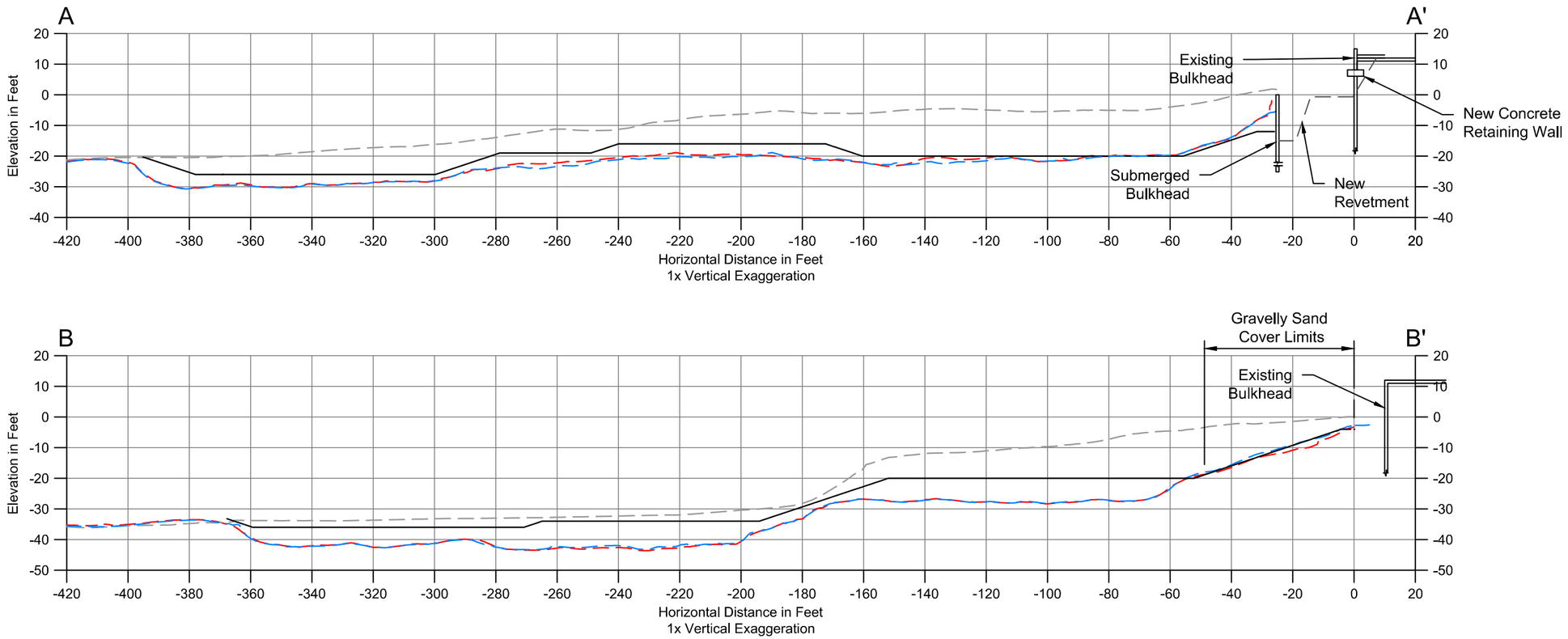


Figure 7c
Pier 1 North: Post-sand Cover Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

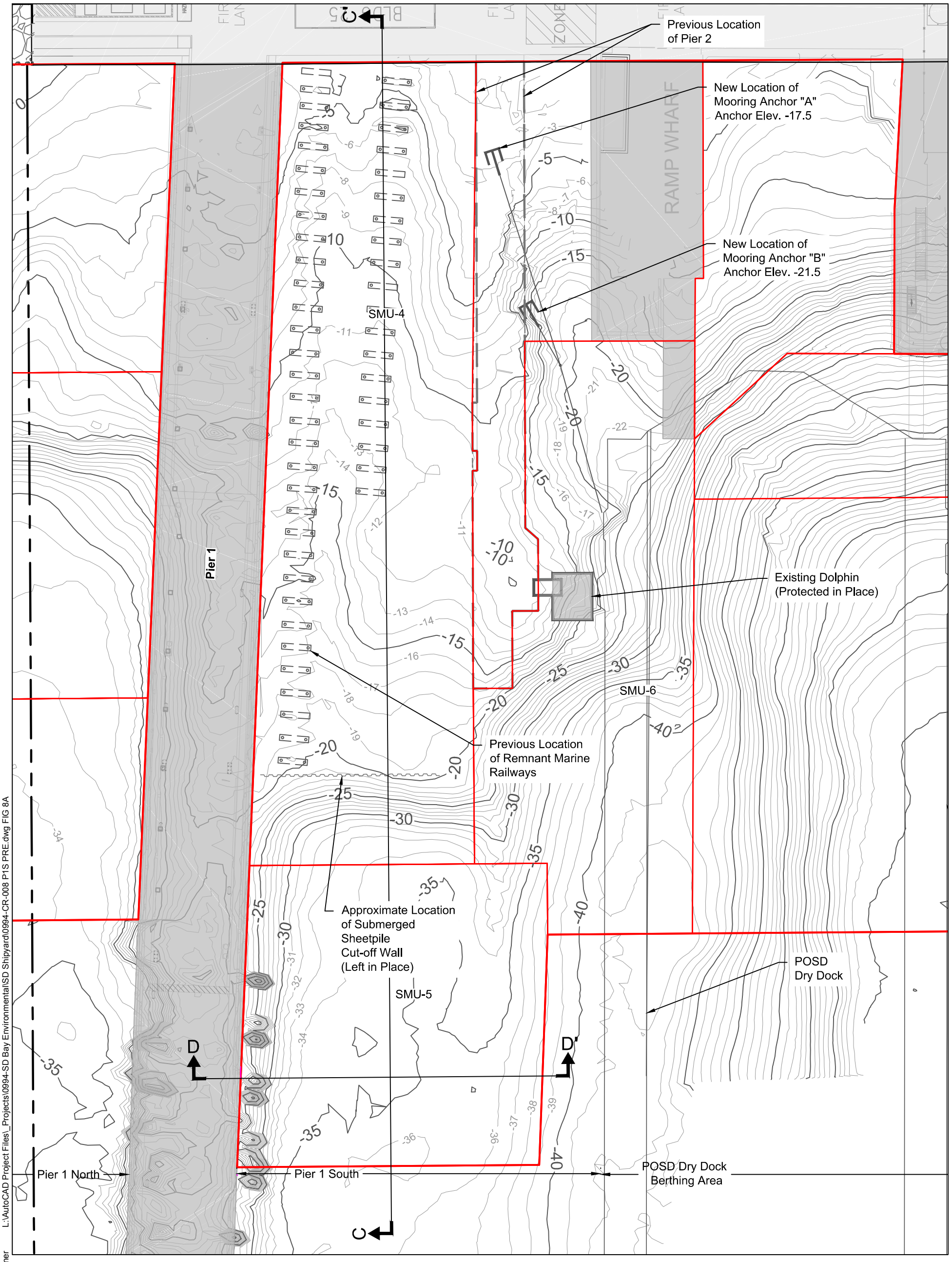
- Pre-construction Baseline Survey
- Required Dredge Line
- Post-dredge Survey
- Post-sand Cover Survey

0 40
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-007 P1N SAND.dwg FIG 7D
Jun 03, 2016 8:25am mpratschner

ANCHOR QEA

Figure 7d
Pier 1 North: Cross Sections
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

5 — Pre-dredge Bathymetric Contours

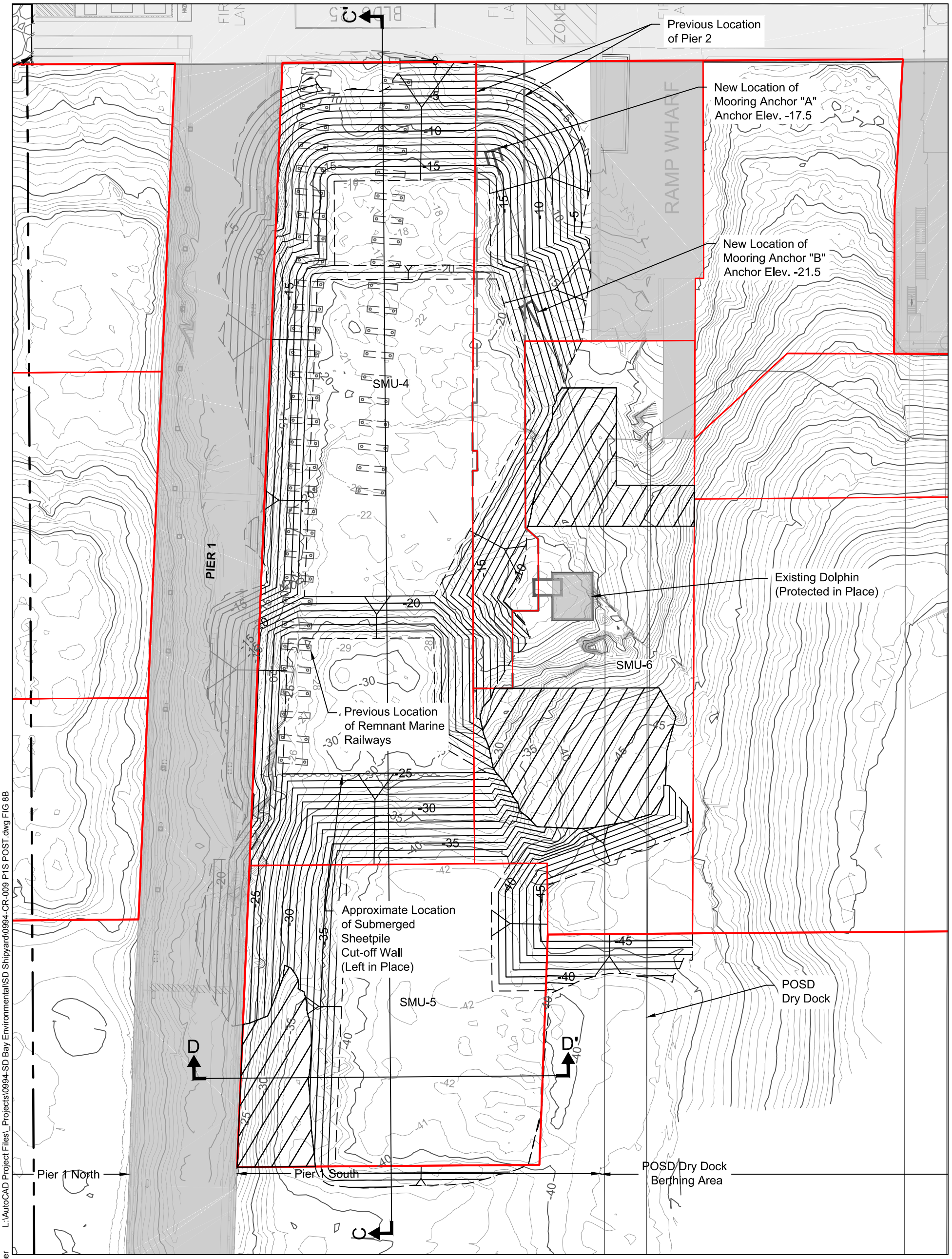
SMU Boundary

0 40
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-008 P1S PRE.dwg FIG 8A
Jun 02, 2016 2:26pm mpratschner

ANCHOR QEA

Figure 8a
Pier 1 South: Pre-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-009 P1S POST.dwg FIG 8B
Jun 02, 2016 2:39pm mpratschner

SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

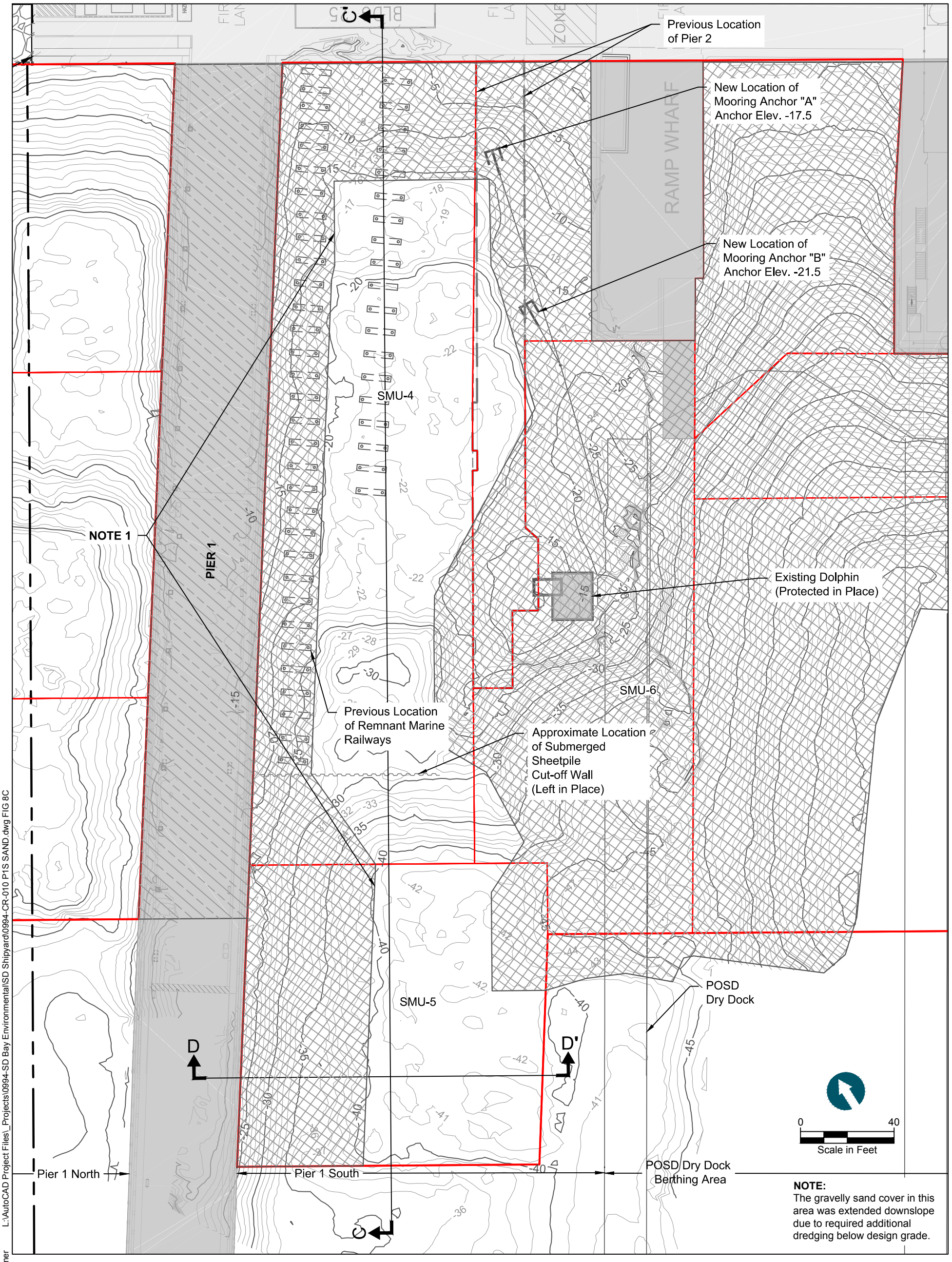
LEGEND:

- -10 — Post-dredge Bathymetric Contours
- -20 — Dredge Design Contours
- SMU Boundary
- 3-foot Cuts

0 40
Scale in Feet

ANCHOR QEA

Figure 8b
Pier 1 South: Post-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-010 P1S SAND.dwg FIG 8C
Jun 02, 2016 2:59pm mpratschner

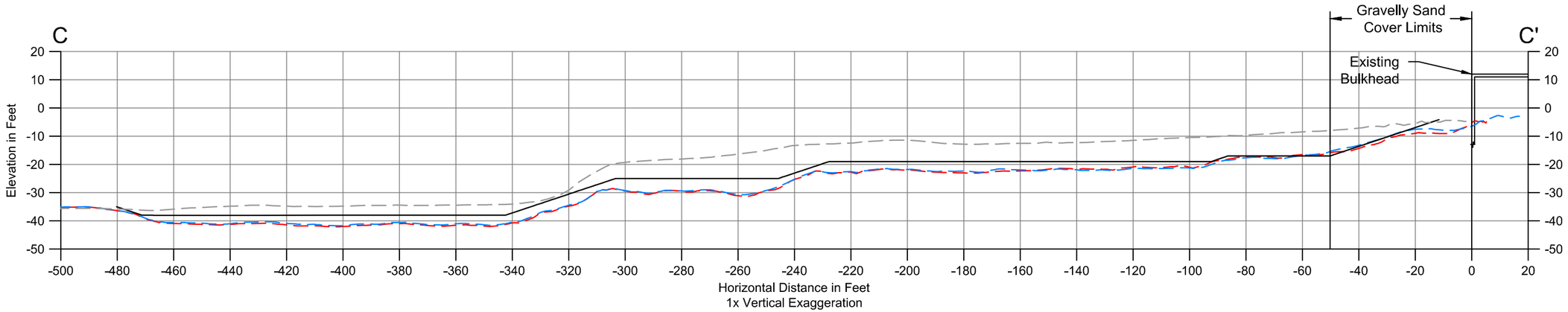
SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

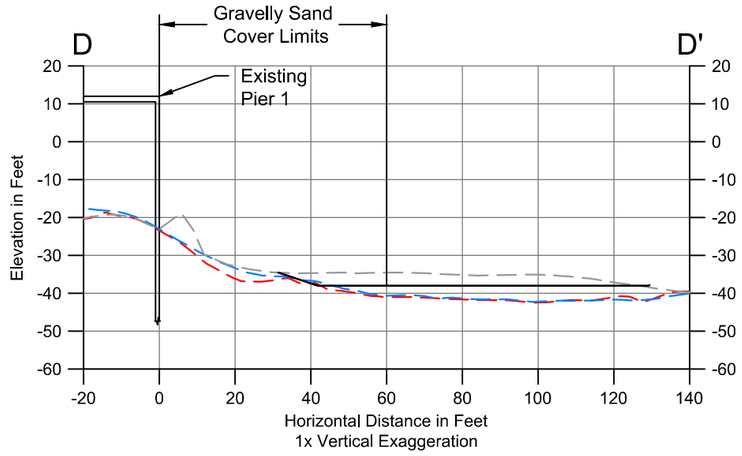
LEGEND:

- Gravelly Sand Cover
- Sand Cover
- SMU Boundary
- -25 Post-sand Placement Bathymetric Contours

ANCHOR QEA

Figure 8c
Pier 1 South: Post-sand Cover Bathymetry
San Diego Shipyard Sediment Site - North Shipyard





SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

- Pre-construction Baseline Survey
- Required Dredge Line
- Post-dredge Survey
- Post-sand Cover Survey

0 40
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-010 P1S SAND.dwg FIG 8D
Jun 03, 2016 8:30am mpratschner

ANCHOR QEA

Figure 8d
Pier 1 South: Cross Sections
San Diego Shipyard Sediment Site - North Shipyard

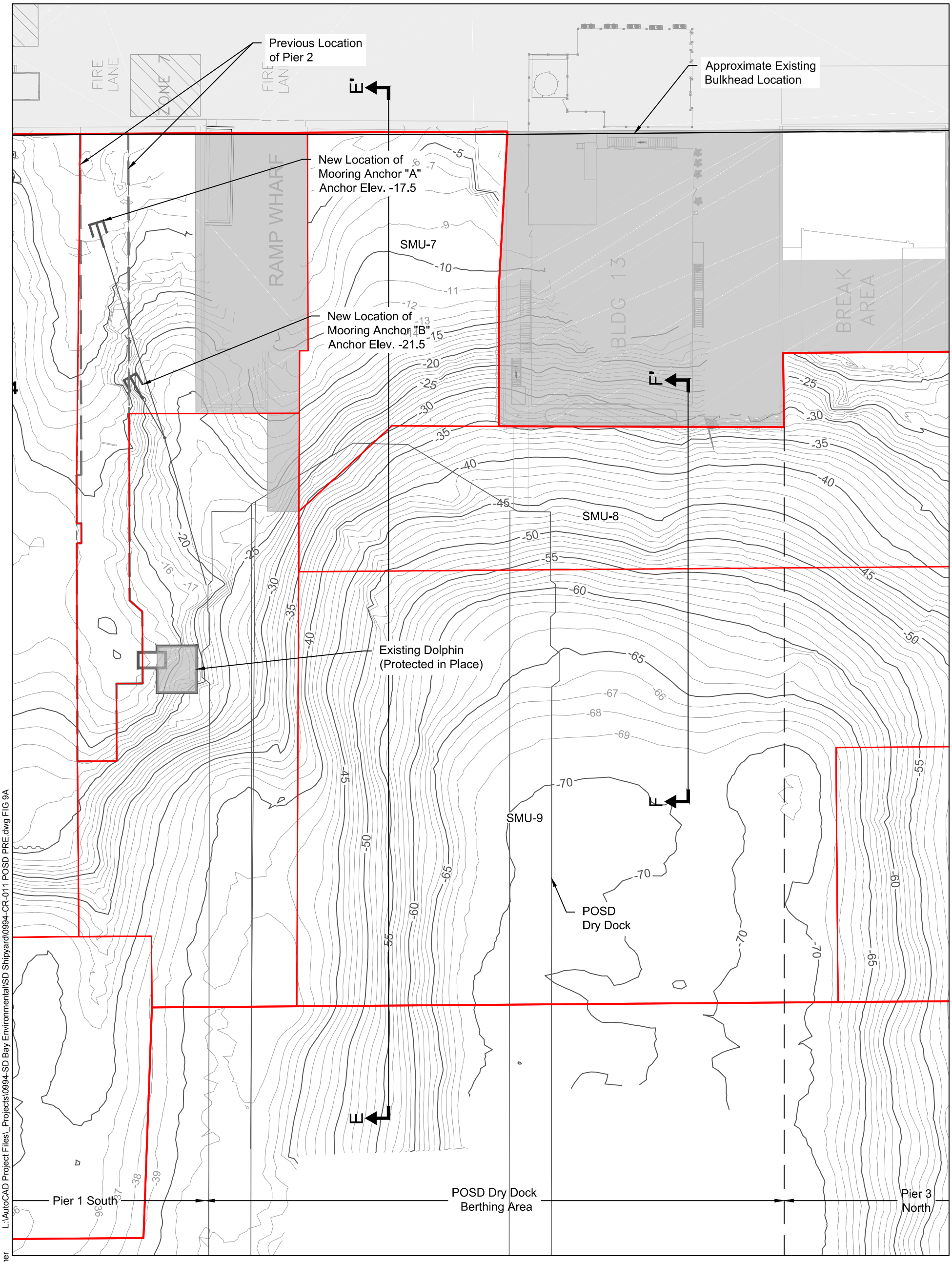


Figure 9a
POSD Dry Dock Berthing Area: Pre-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard

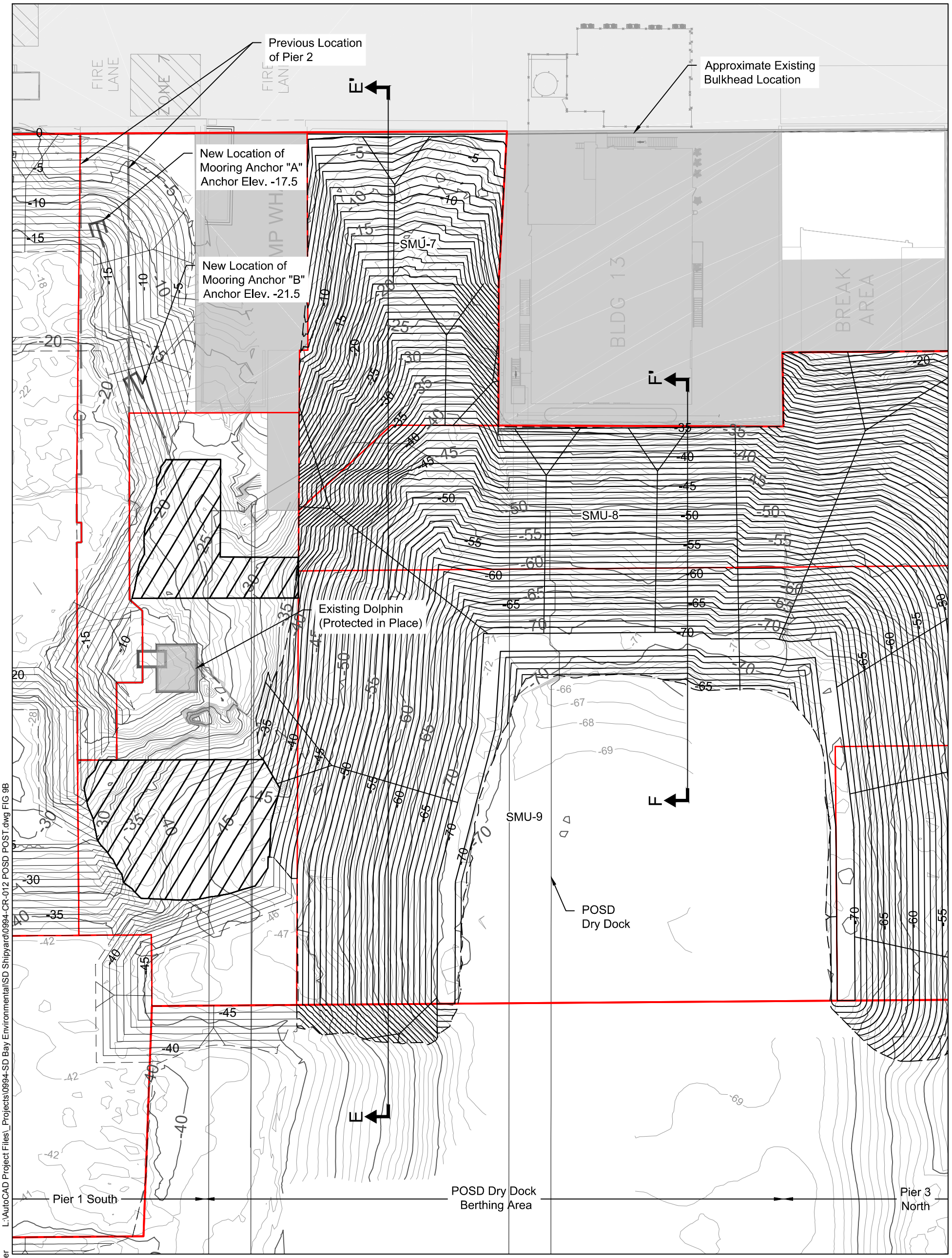
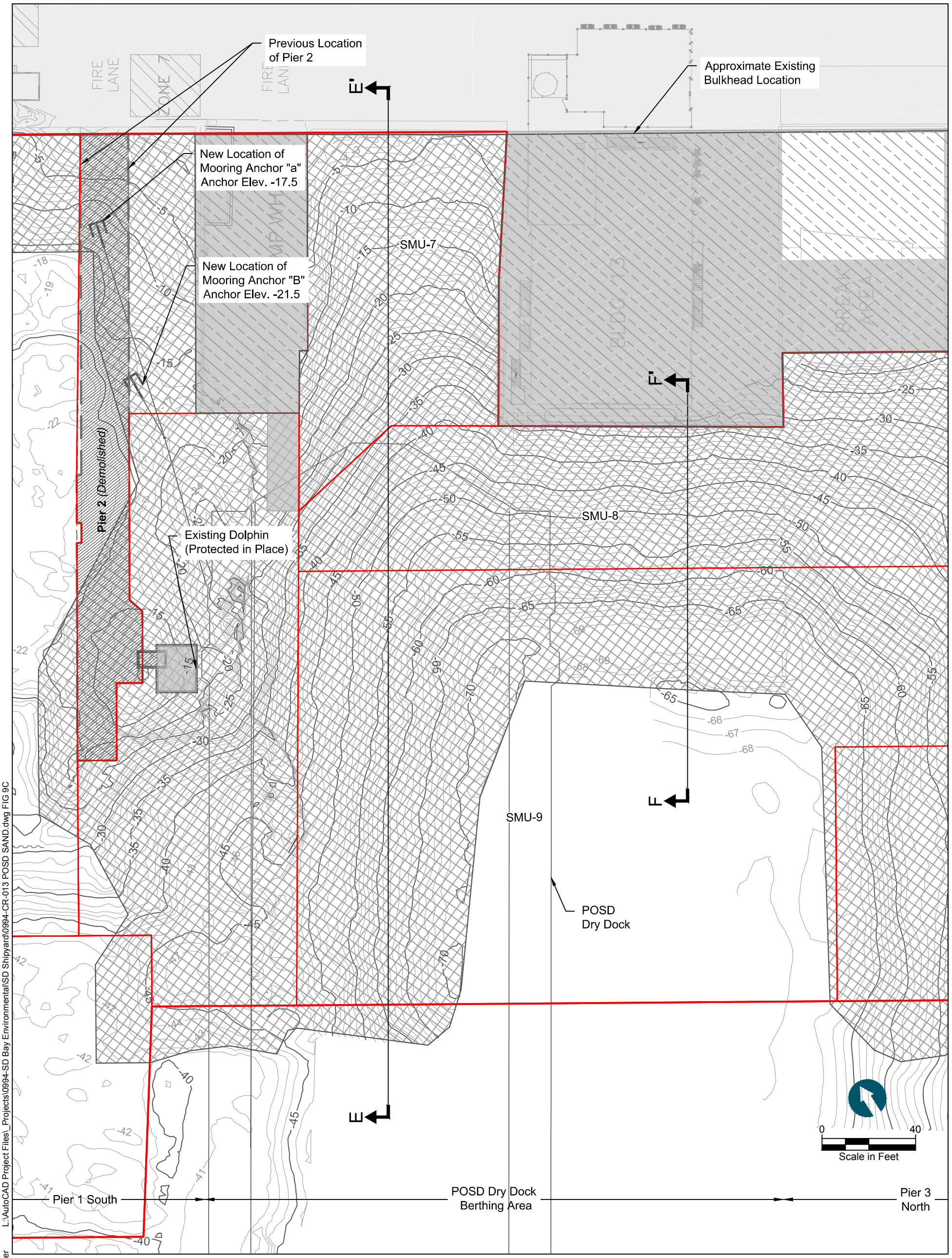


Figure 9b
POSD Dry Dock Berthing Area: Post-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-013 POSD SAND.dwg FIG 9C
Jun 02, 2016 3:29pm mpratschner

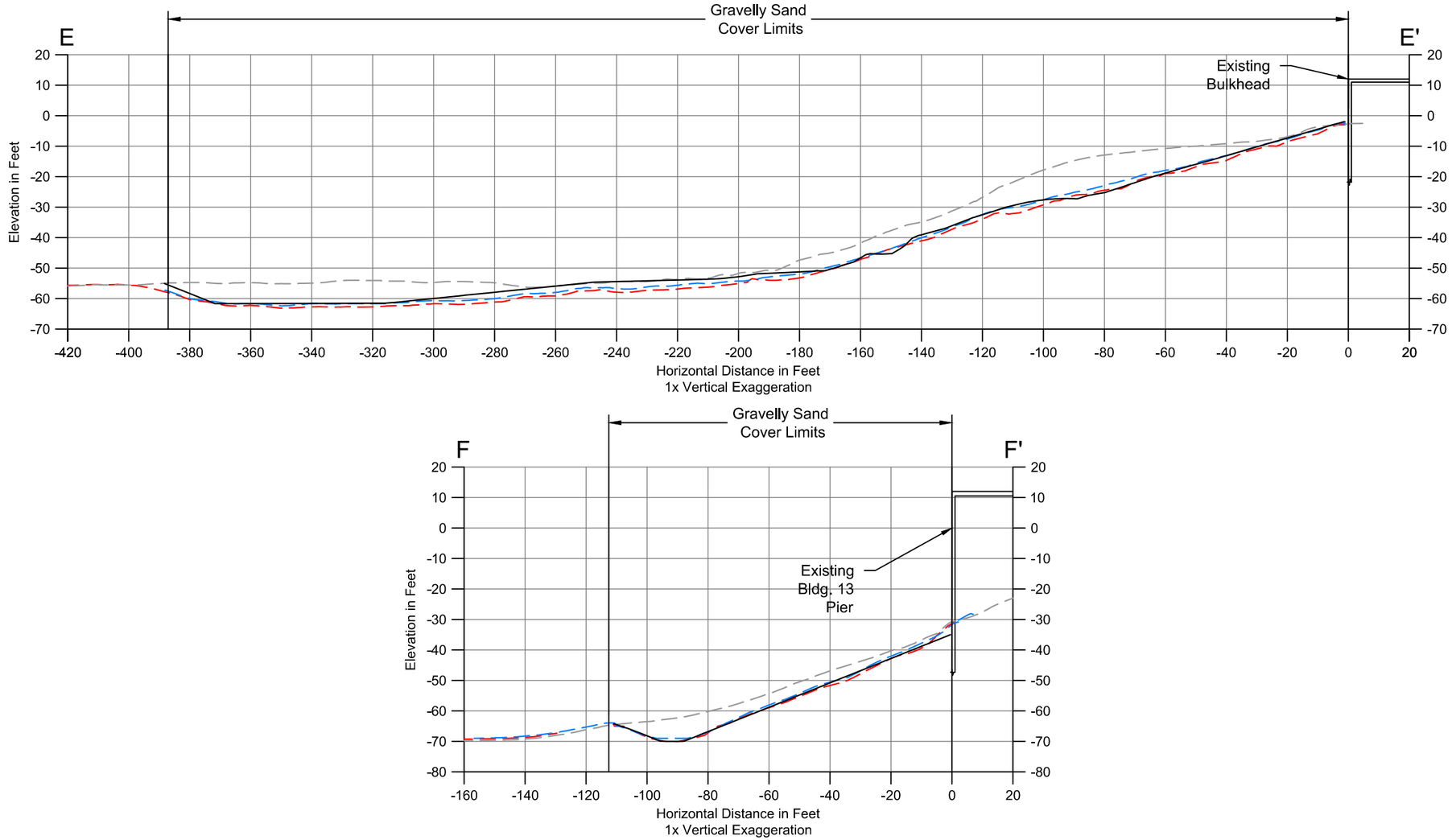
SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

- Gravelly Sand Cover
- Sand Cover
- SMU Boundary
- -25 Post-sand Placement Bathymetric Contours

ANCHOR QEA

Figure 9c
POSD Dry Dock Berthing Area: Post-sand Cover Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

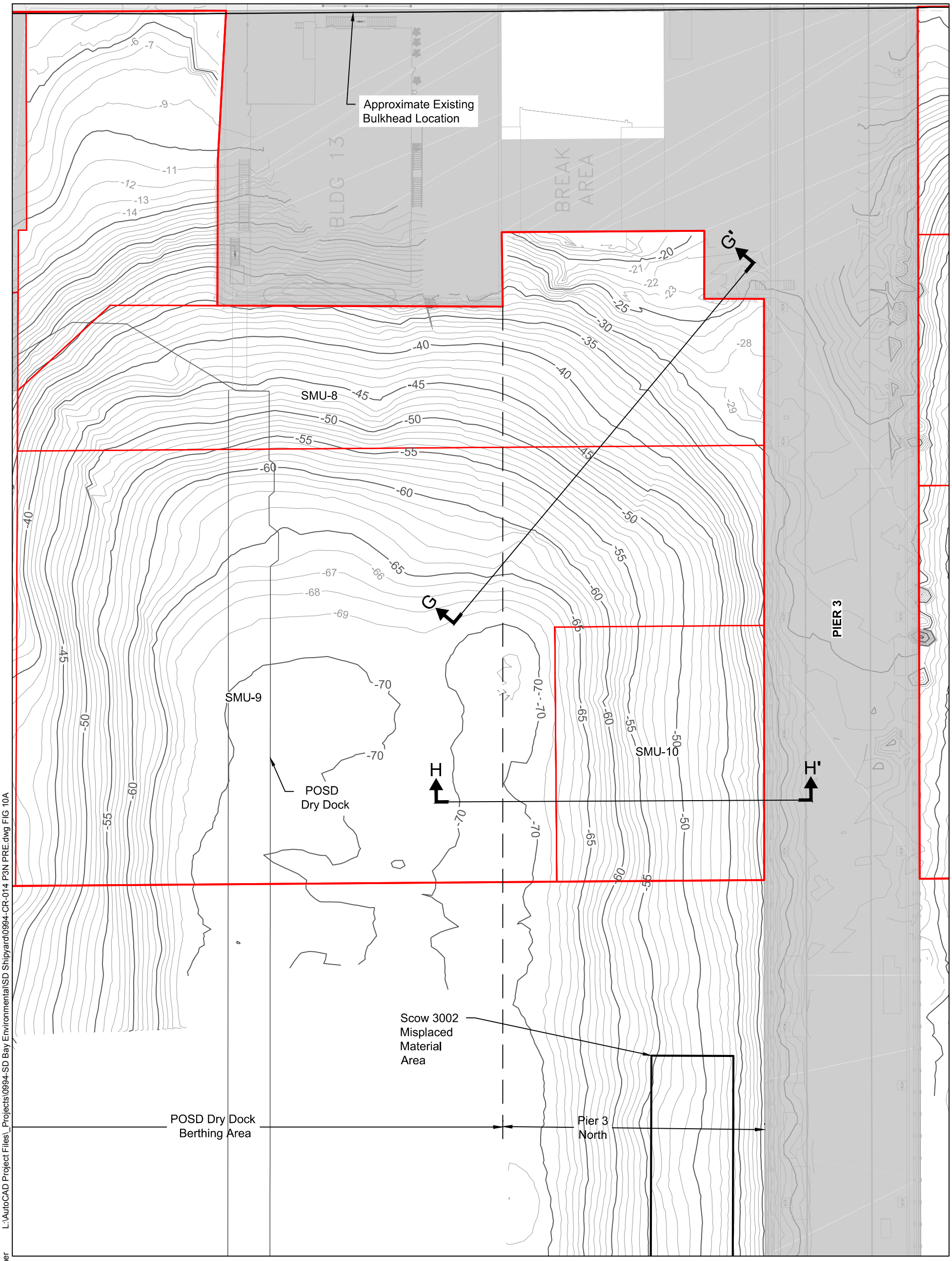
- Pre-construction Baseline Survey
- Required Dredge Line
- Post-dredge Survey
- Post-sand Placement Survey

0 40
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-013 POSD SAND.dwg FIG 9D
Jun 03, 2016 8:52am mpratschner

ANCHOR QEA

Figure 9d
POSD Dry Dock Berthing Area: Cross Sections
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

-40 — Pre-dredge Bathymetric Contours

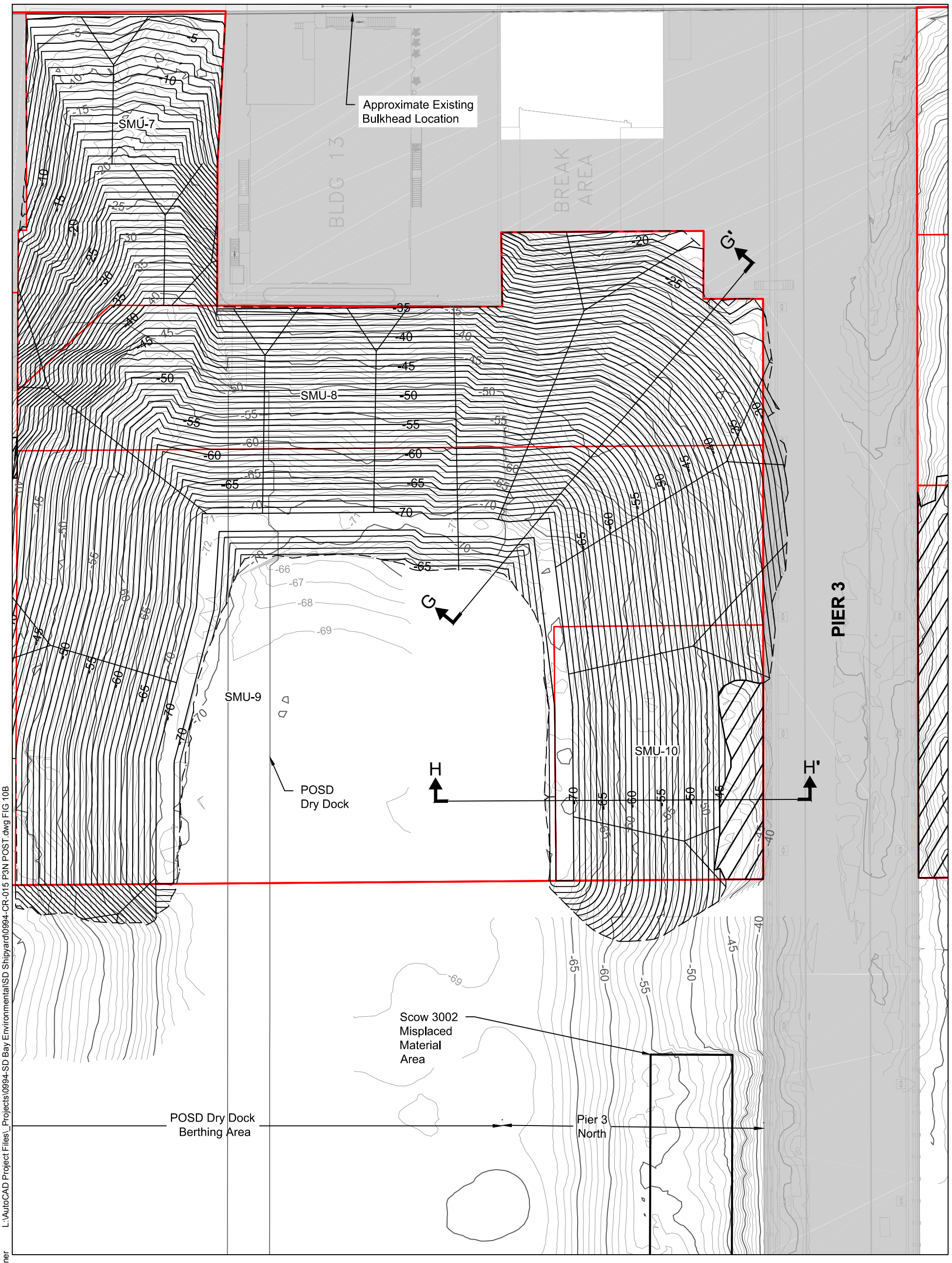
SMU Boundary

0 40
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-014 P3N PRE.dwg FIG 10A
Jun 02, 2016 4:01pm mpratschner

ANCHOR QEA

Figure 10a
Pier 3 North: Pre-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

-10 — Post-dredge Bathymetric Contours

-20 — Dredge Design Contours

SMU Boundary

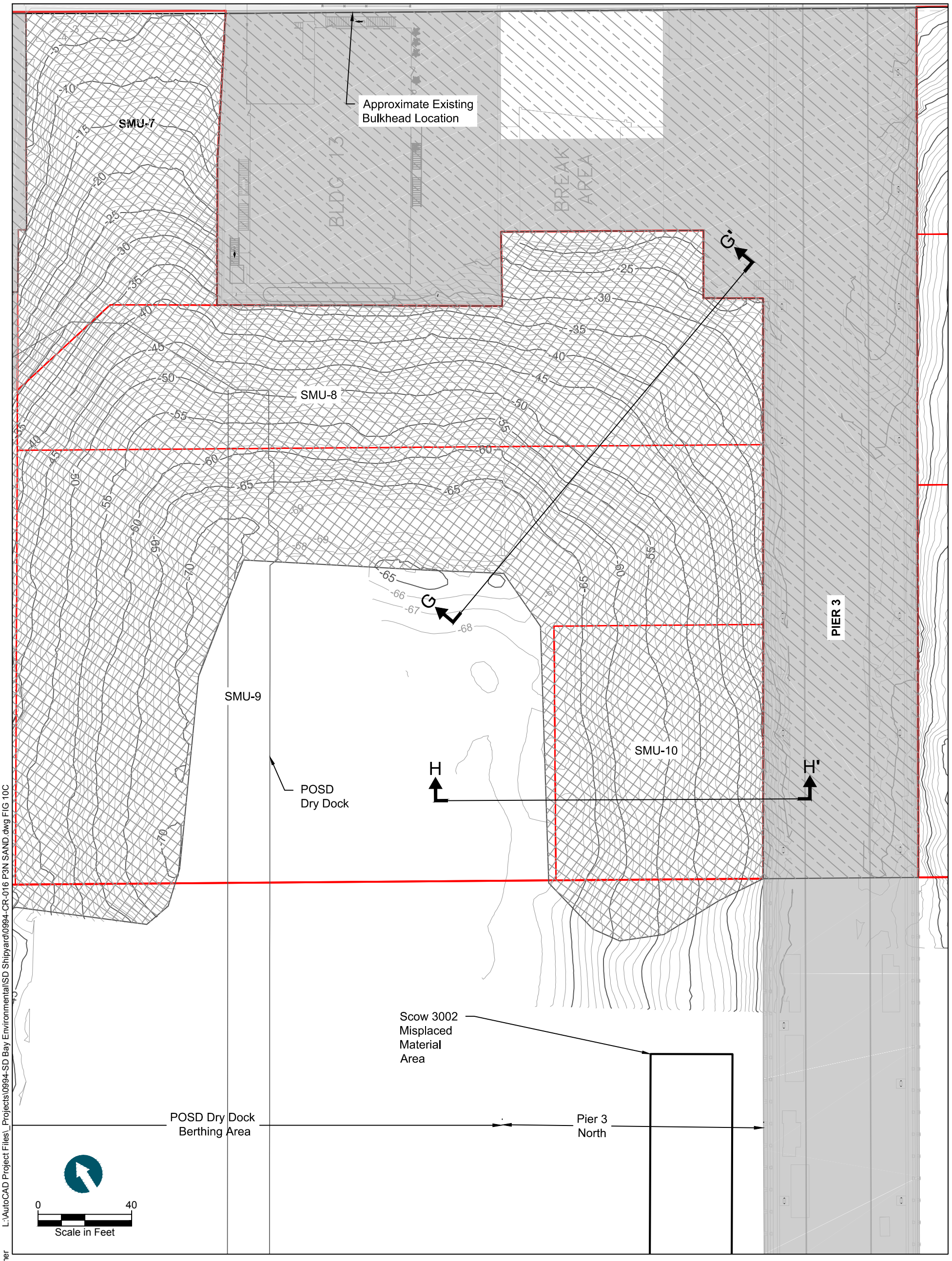
3-foot Cuts

0 40
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-015 P3N POST.dwg FIG 10B
Jun 02, 2016 4:13pm mpratschner

ANCHOR QEA

Figure 10b
Pier 3 North: Post-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-016 P3N SAND.dwg FIG 10C
Jun 02, 2016 4:27pm mpratschner

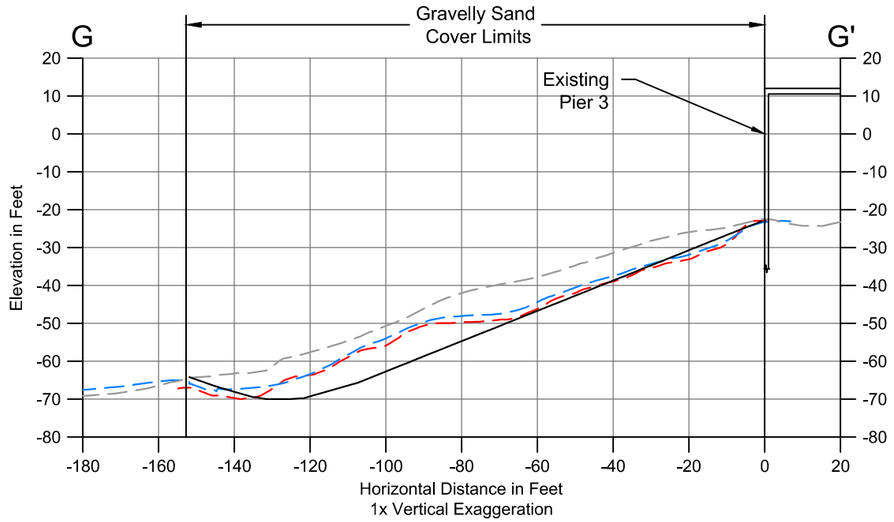
SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

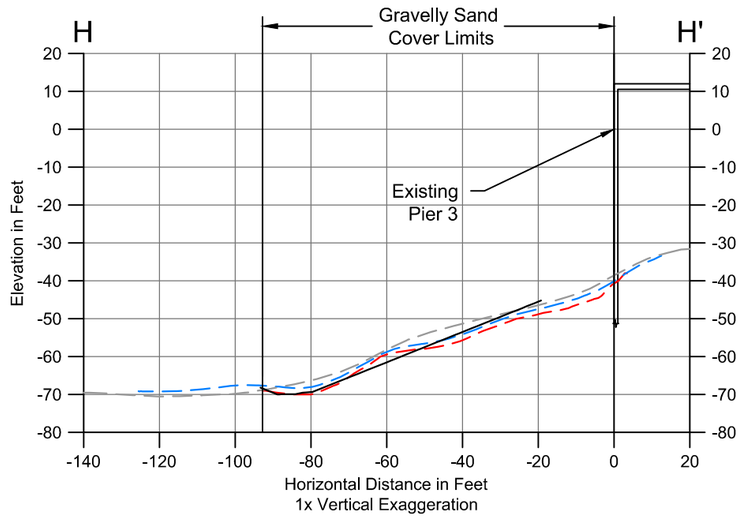
LEGEND:

- Gravelly Sand Cover
- Sand Cover
- SMU Boundary
- -25 Post-sand Placement Bathymetric Contours

ANCHOR QEA

Figure 10c
Pier 3 North: Post-sand Cover Bathymetry
San Diego Shipyard Sediment Site - North Shipyard





SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

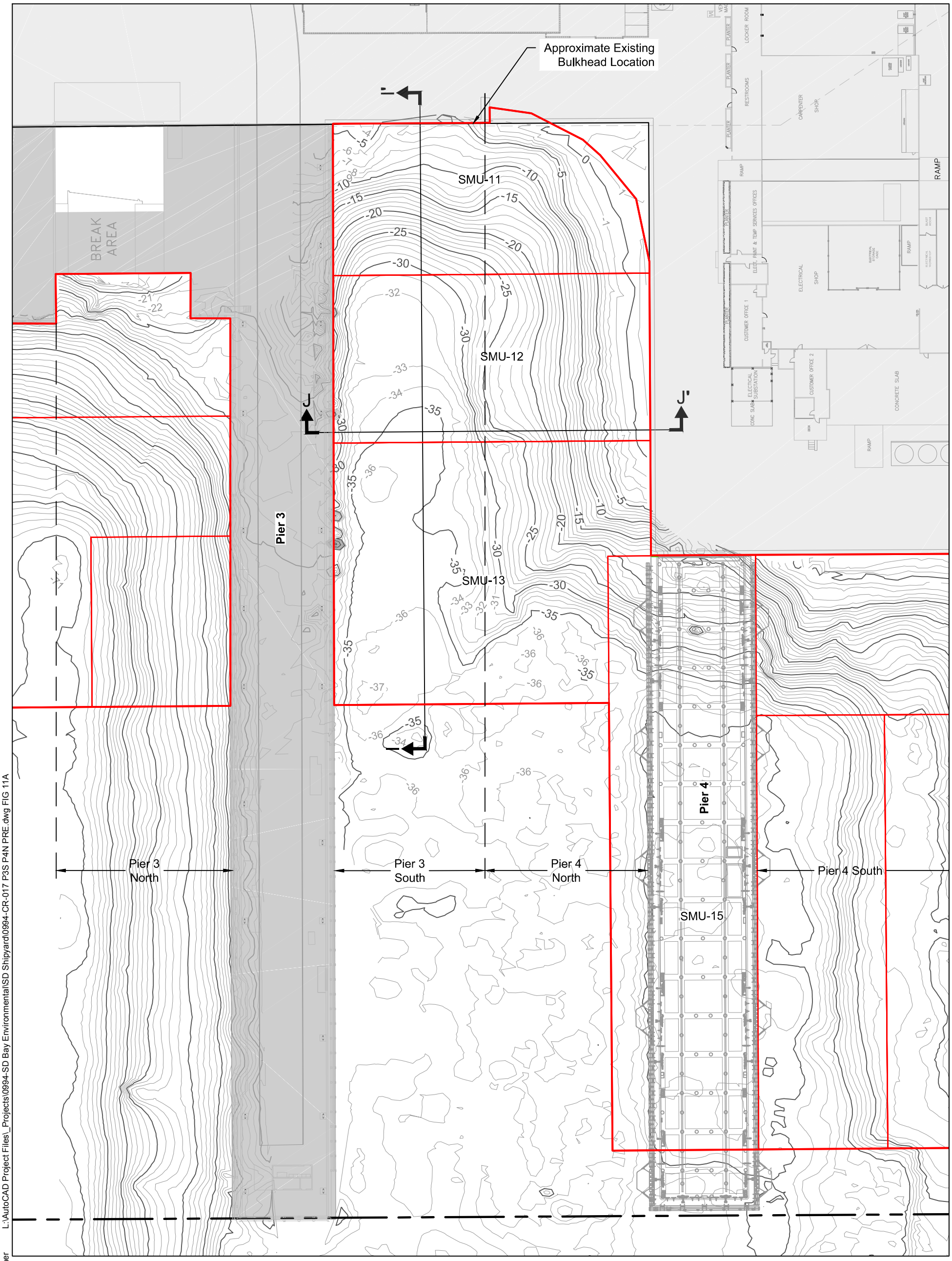
- Pre-construction Baseline Survey
- Required Dredge Line
- Post-dredge Survey
- Post-sand Placement Survey

0 40
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-016 P3N SAND.dwg FIG 10D
Jun 03, 2016 8:55am mpratschner

ANCHOR QEA

Figure 10d
Pier 3 North: Cross Sections
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

-40 — Pre-dredge Bathymetric Contours

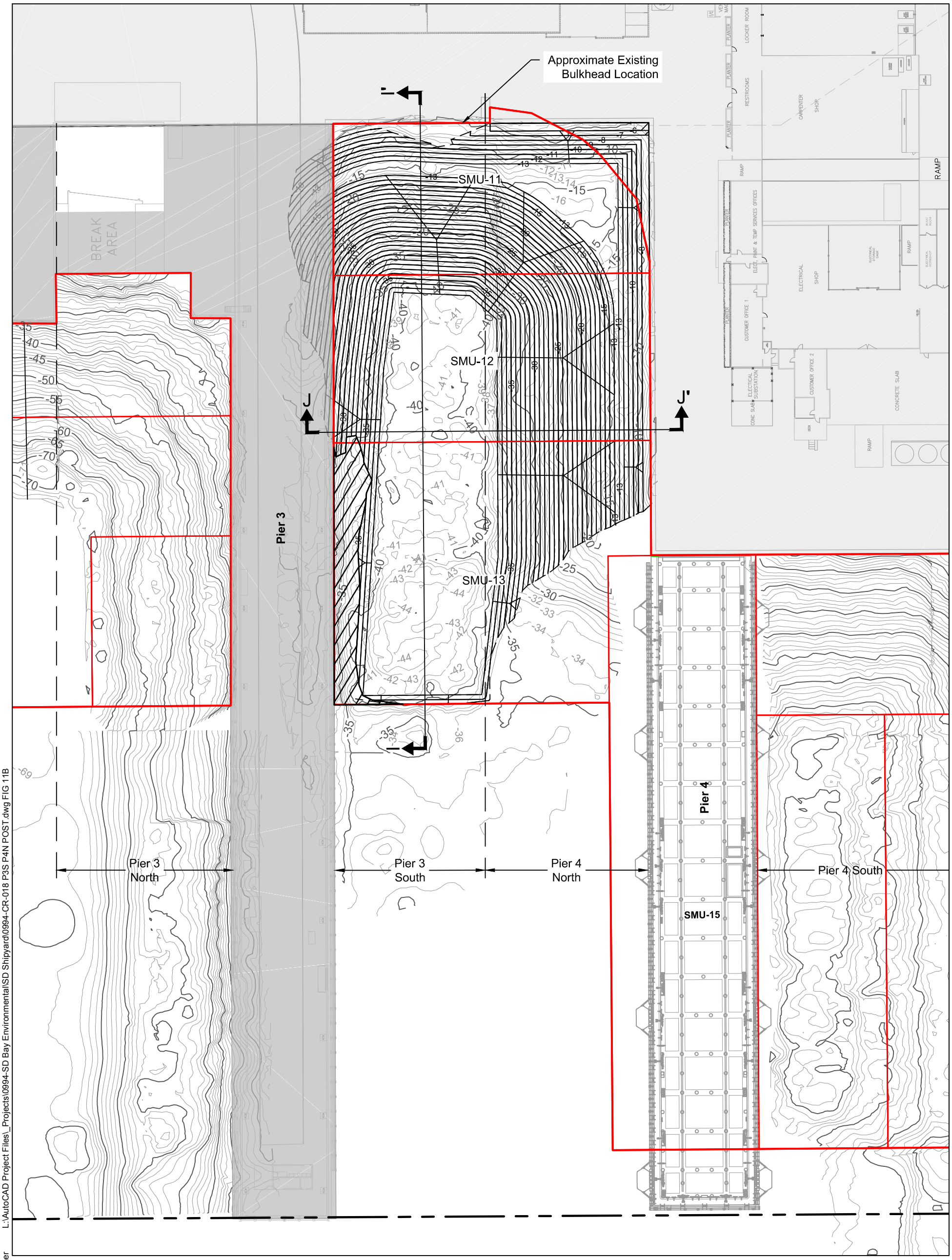
SMU Boundary

0 60
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-017 P3S P4N PRE.dwg FIG 11A
Jun 02, 2016 4:38pm mpratschner

ANCHOR QEA

Figure 11a
Pier 3 South and Pier 4 North: Pre-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

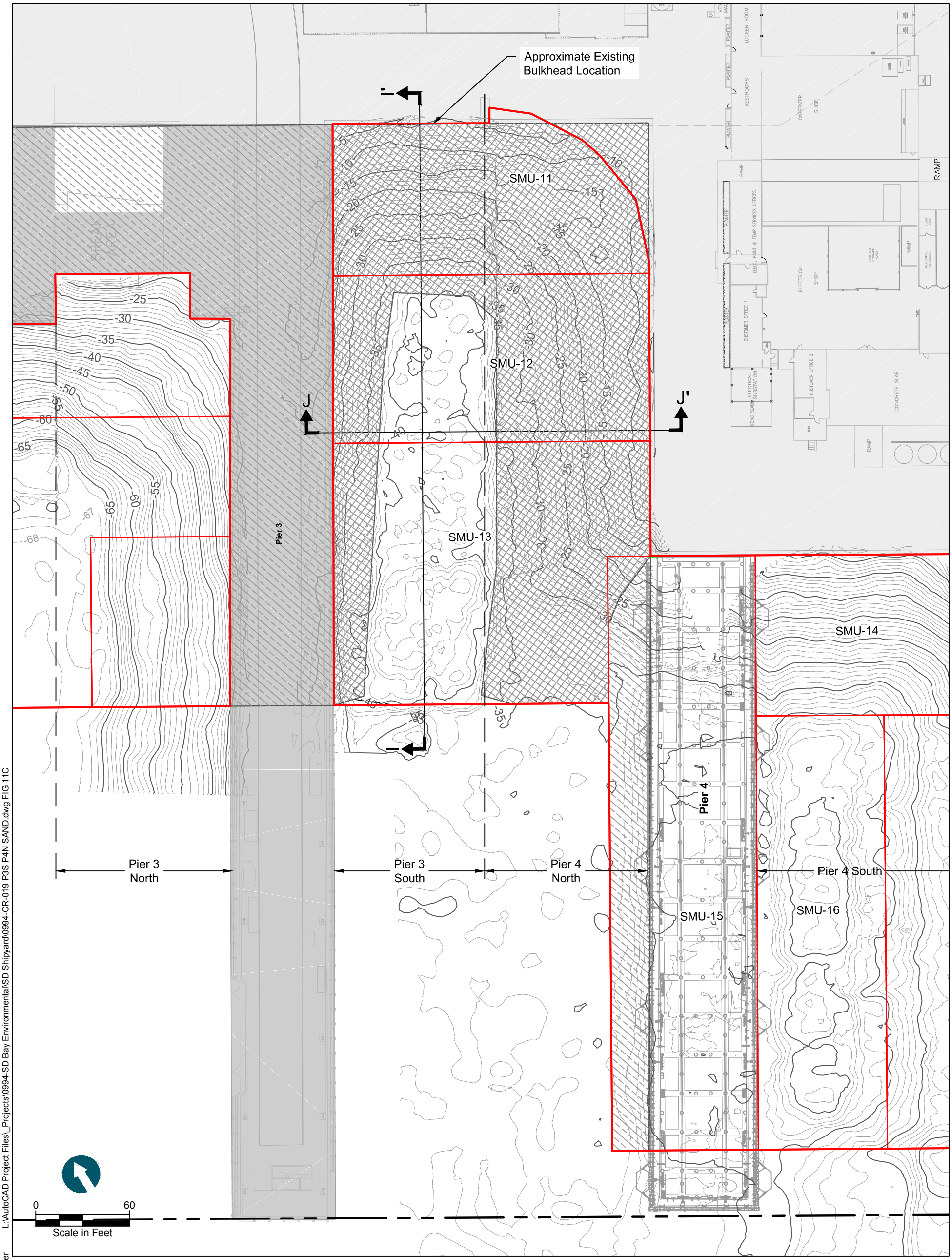
LEGEND:

- -10 — Post-dredge Bathymetric Contours
- -20 — Dredge Design Contours
- SMU Boundary
- 3-foot Cuts

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-018 P3S P4N POST.dwg FIG 11B
Jun 03, 2016 7:46am mpratschner

ANCHOR QEA

Figure 11b
Pier 3 South and Pier 4 North: Post-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-019 P3S P4N SAND.dwg FIG 11C
Jun 03, 2016 7:55am mpratschner

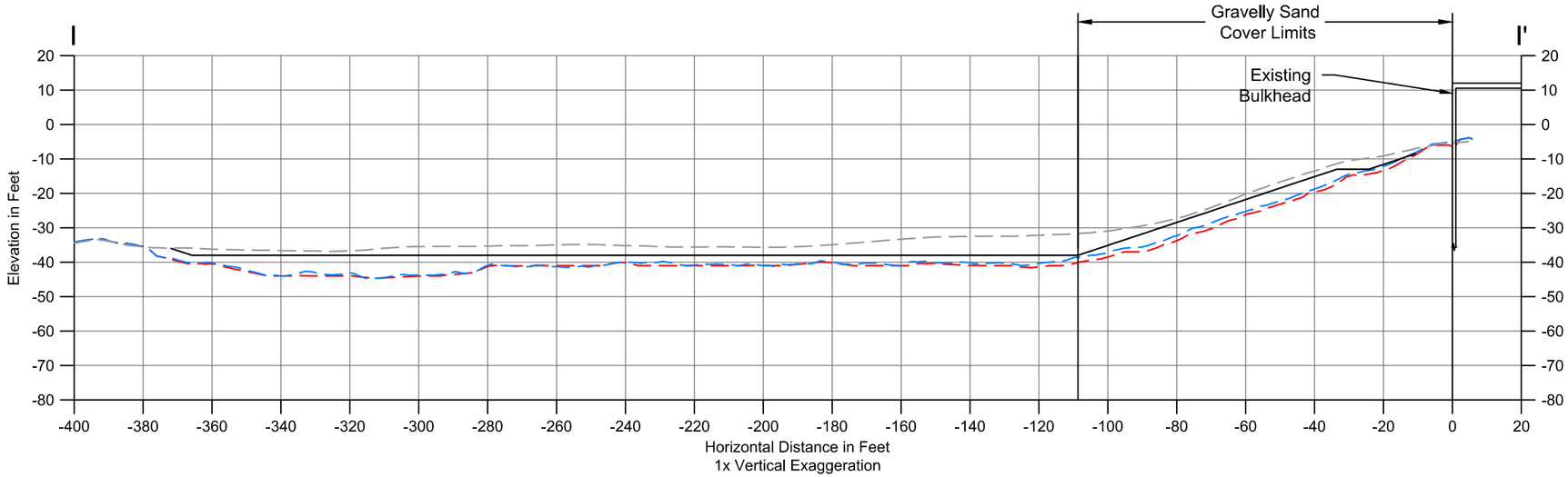
SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

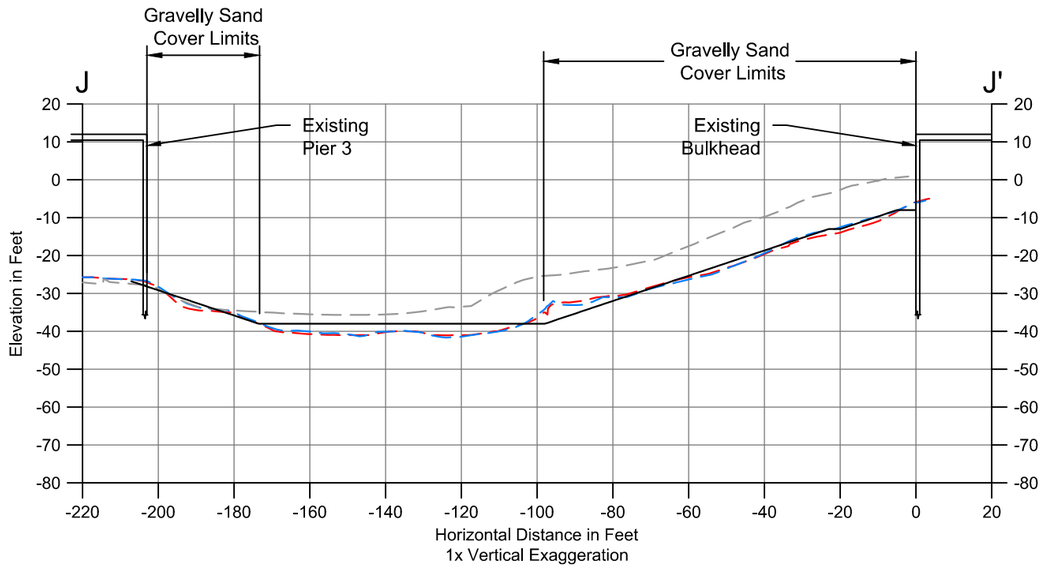
LEGEND:

- Gravelly Sand Cover
- Sand Cover
- SMU Boundary
- -25 Post-sand Placement Bathymetric Contours

ANCHOR QEA

Figure 11c
Pier 3 South and Pier 4 North: Post-sand Cover Bathymetry
San Diego Shipyard Sediment Site - North Shipyard





SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

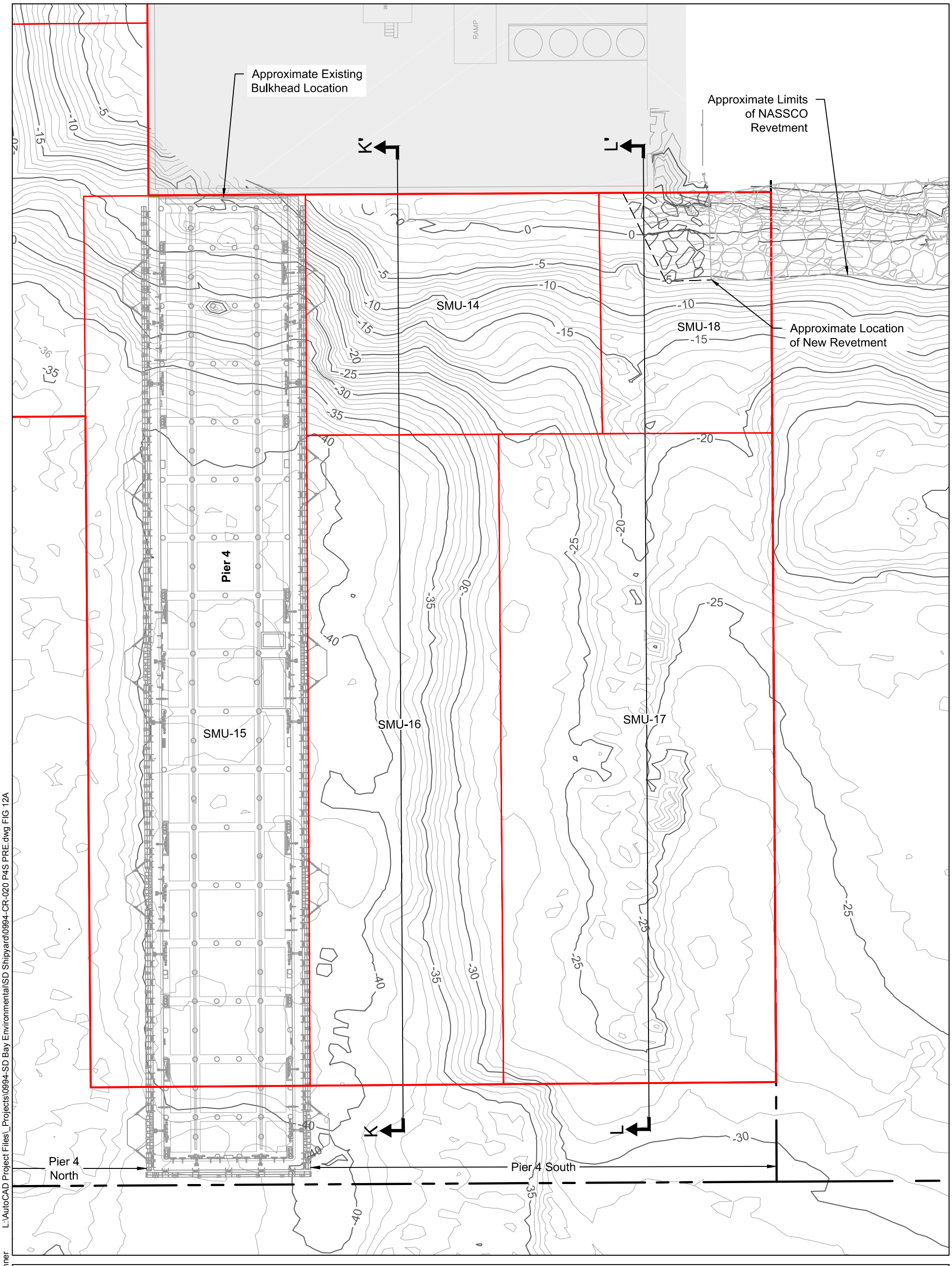
LEGEND:

- Pre-Construction Baseline Survey
- Required Dredge Line
- Post-Dredge Survey
- Post-Sand Placement Survey

0 40
Scale in Feet

ANCHOR QEA

Figure 11d
Pier 3 South and Pier 4 North: Cross Sections
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

-40 — Pre-dredge Bathymetric Contours

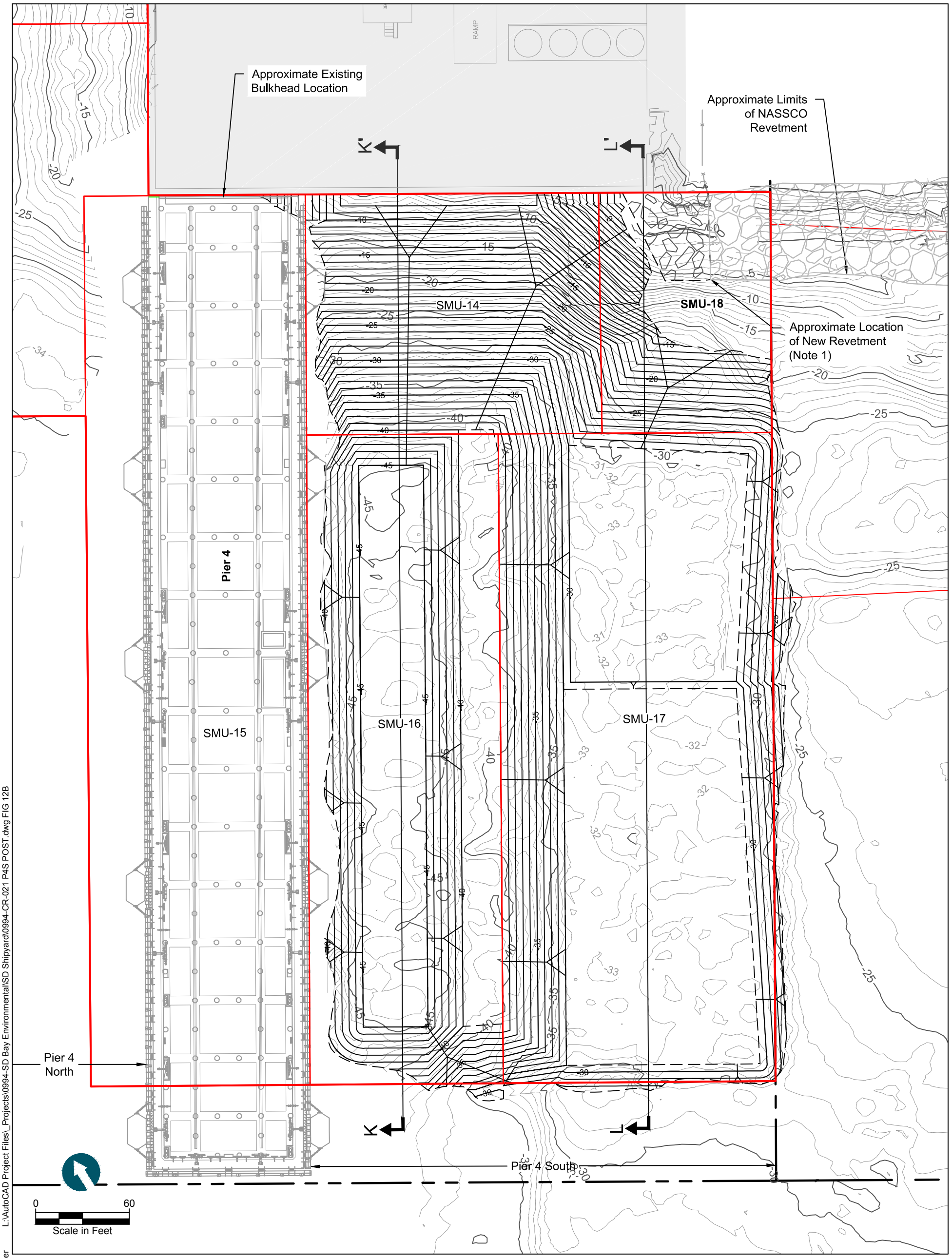
SMU Boundary

0 40
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-020 P4S PRE.dwg FIG 12A
Jun 03, 2016 9:16am mpratschner

ANCHOR QEA

Figure 12a
Pier 4 South: Pre-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

-15 — Post-dredge Bathymetric Contours

-25 — Dredge Design Contours

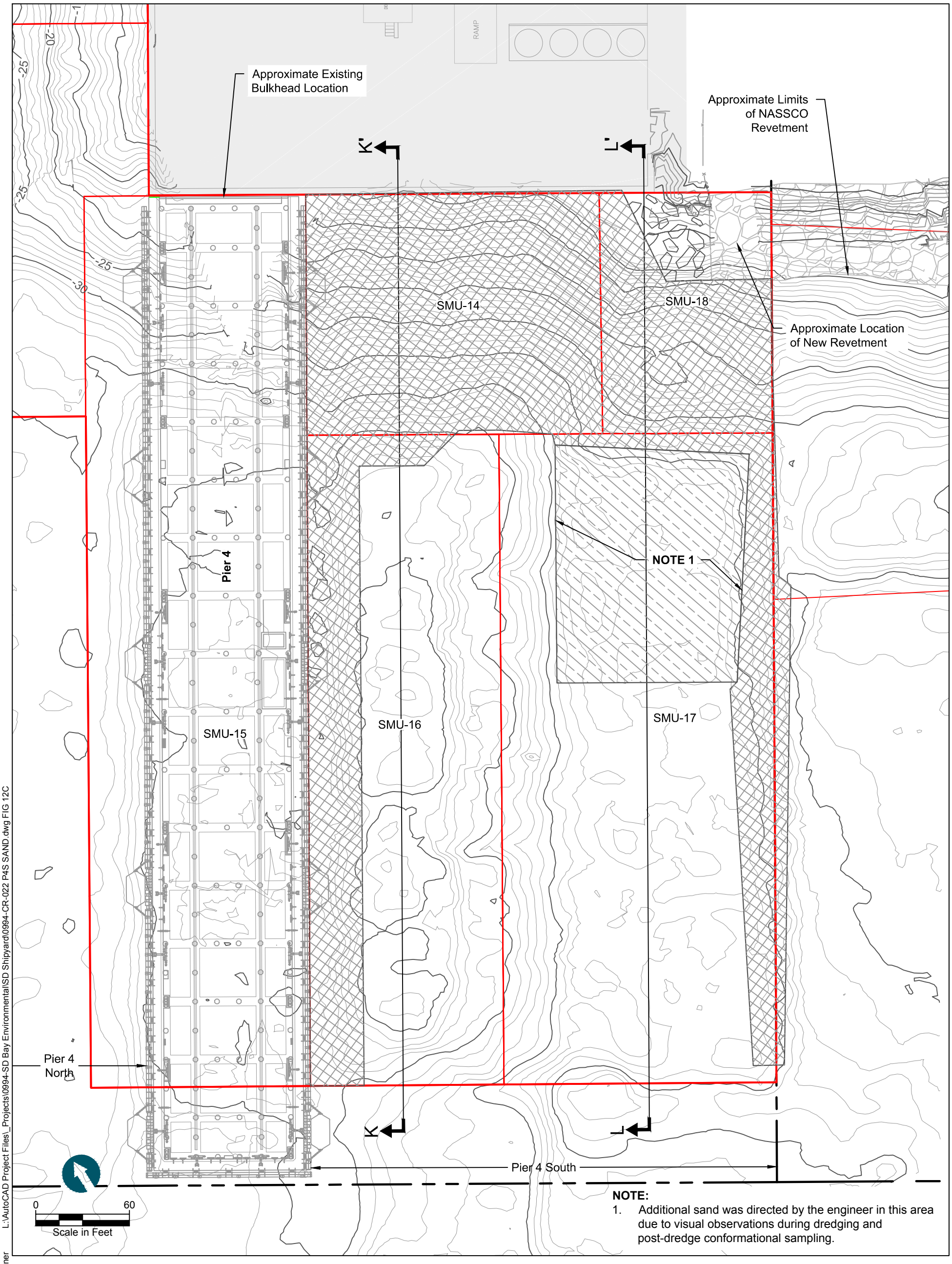
SMU Boundary

NOTE:

1. Dredge design in this location was modified to protect the existing revetment on the adjacent NASSCO property.

ANCHOR QEA

Figure 12b
Pier 4 South: Post-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



NOTE:

1. Additional sand was directed by the engineer in this area due to visual observations during dredging and post-dredge conformational sampling.

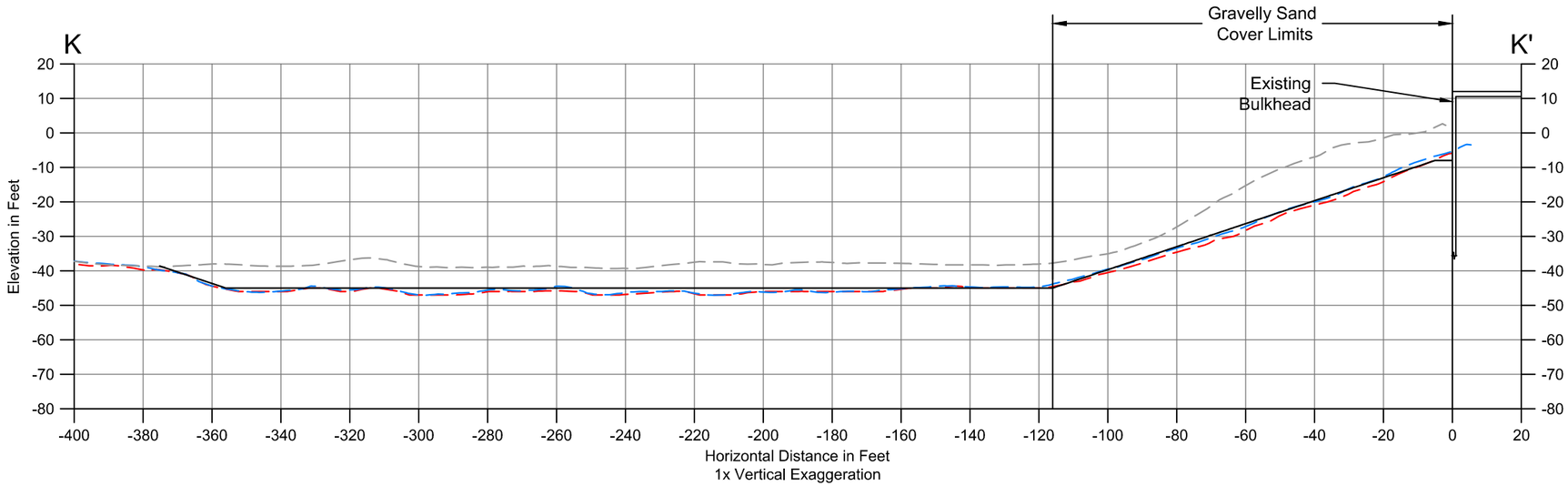
SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

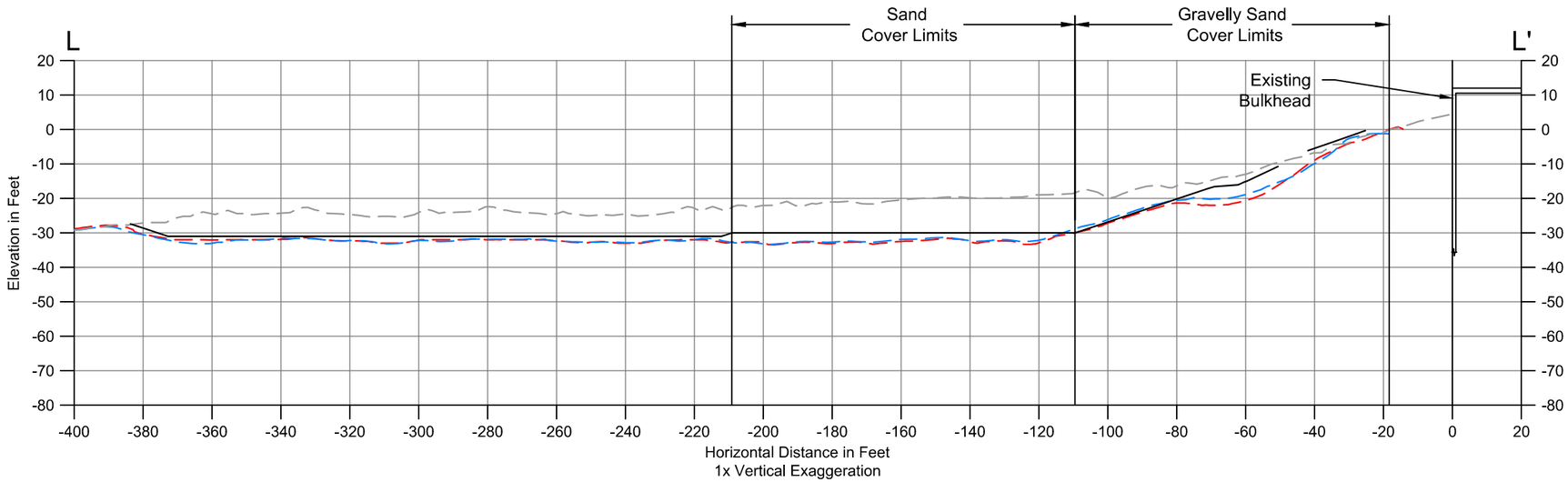
LEGEND:

- Gravelly Sand Cover
- Sand Cover
- SMU Boundary
- -25 Post-sand Placement Bathymetric Contours

ANCHOR QEA

Figure 12c
Pier 4 South: Post-sand Cover Bathymetry
San Diego Shipyard Sediment Site - North Shipyard





SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

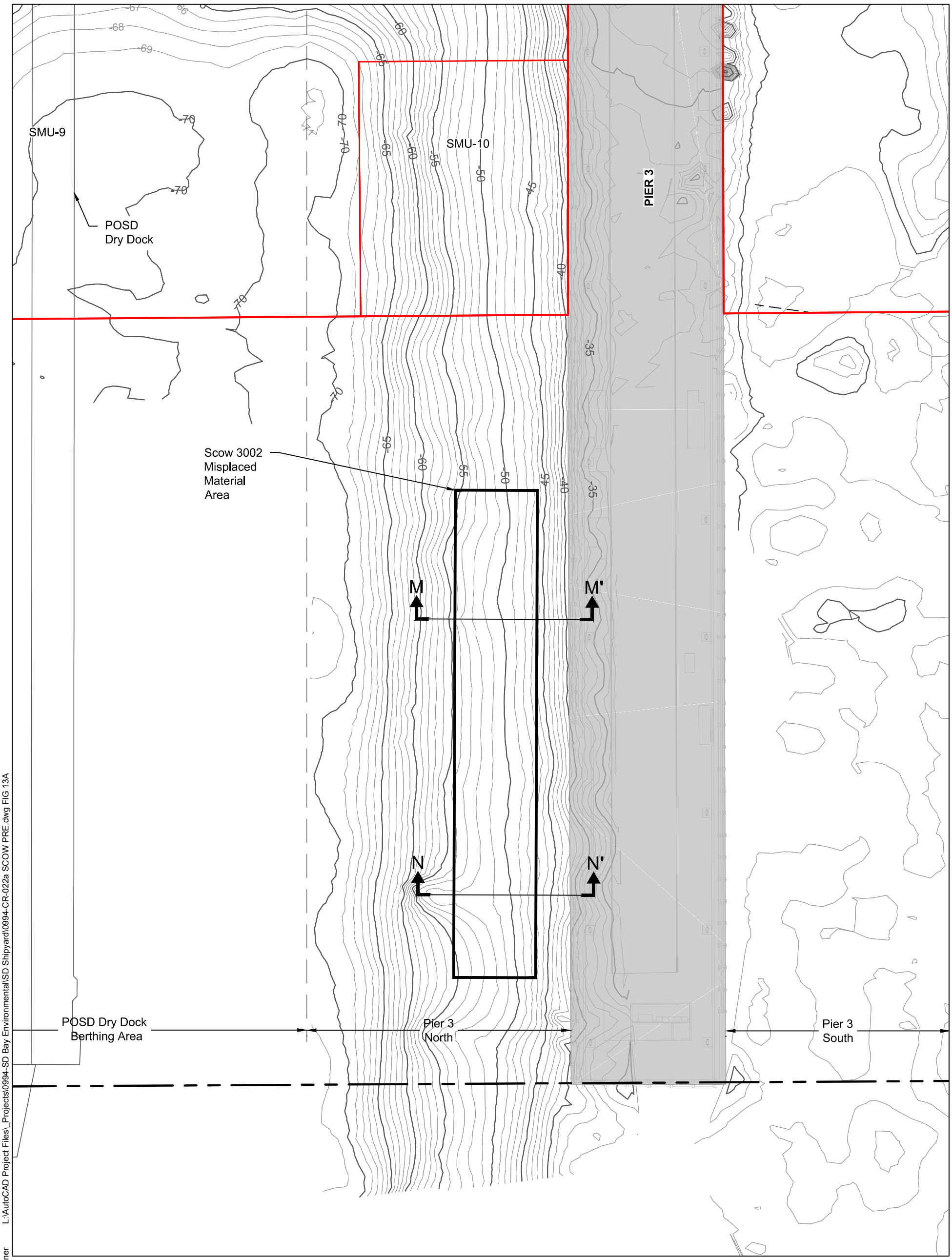
LEGEND:

- Pre-construction Baseline Survey
- Required Dredge Line
- Post-dredge Survey
- Post-sand Placement Survey

0 40
Scale in Feet

ANCHOR QEA

Figure 12d
Pier 4 South: Cross Sections
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Pre-dredge bathymetric data is from eTrac, Inc., multiple dates, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

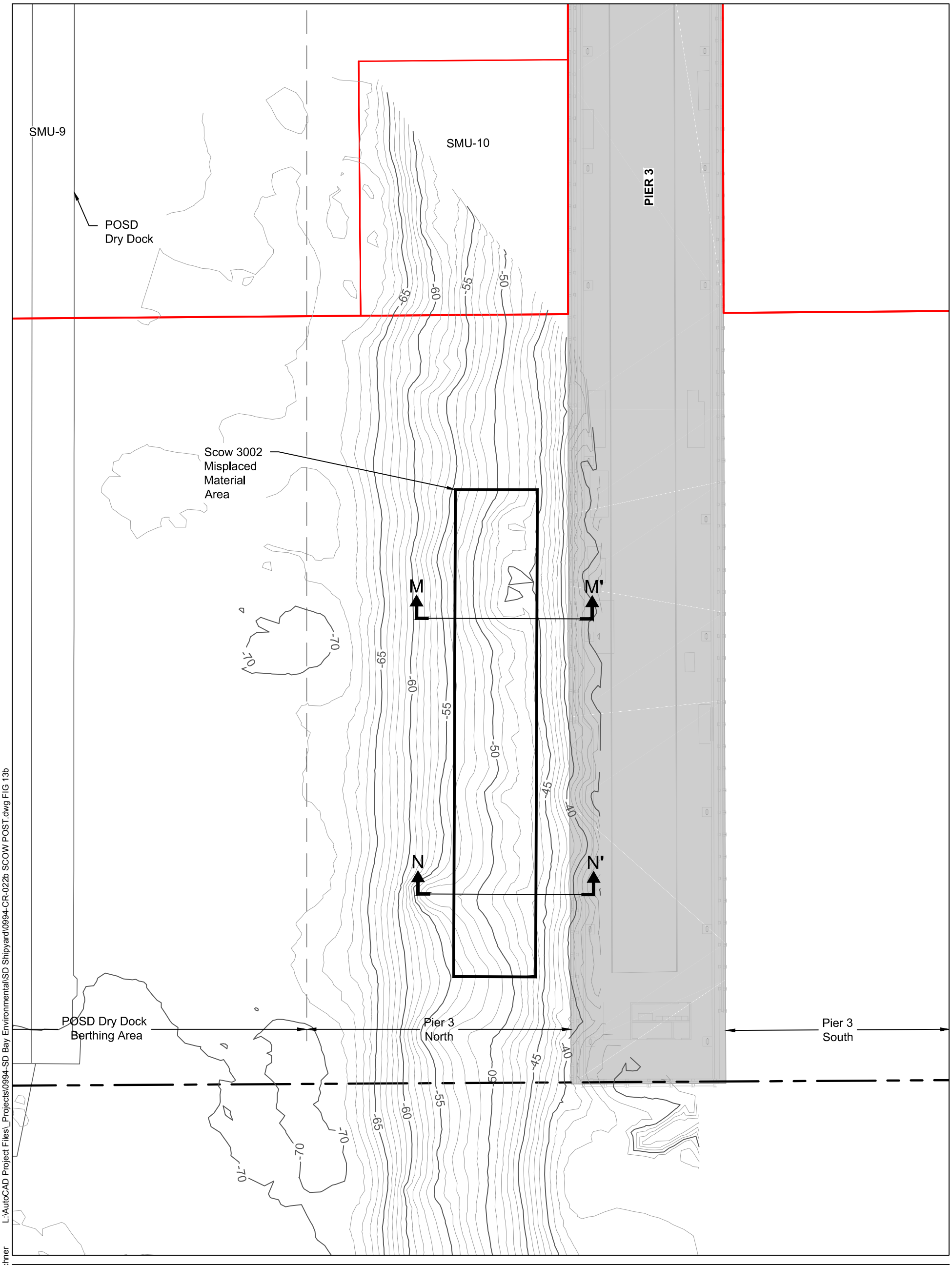
-40 — Pre-spill Bathymetric Contours

SMU Boundary

0 40
Scale in Feet

ANCHOR QEA

Figure 13a
Scow 3002 Misplaced Material Area: Pre-spill Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Post-spill bathymetric data from eTrac, dated July 30, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

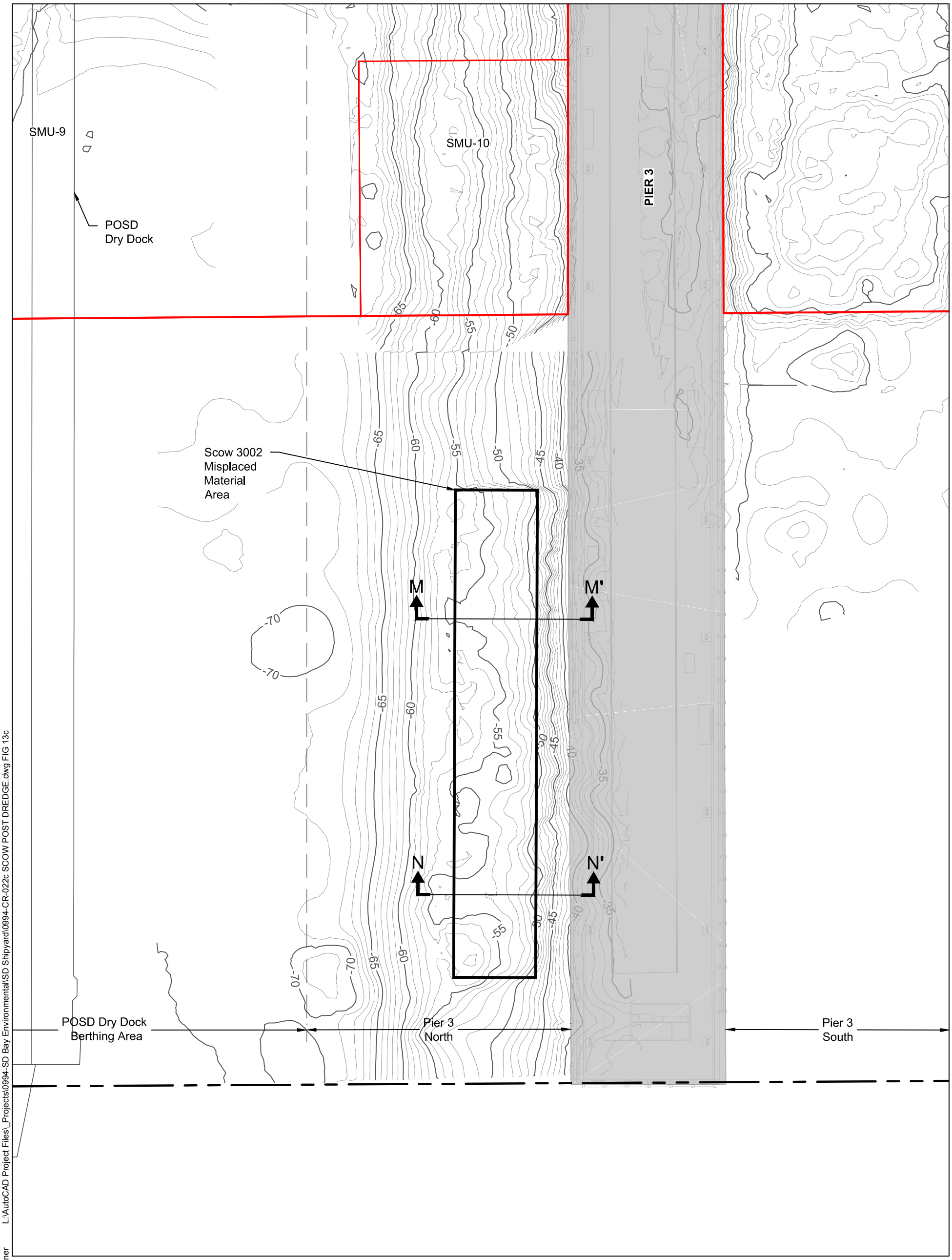
-15 — Post-spill Bathymetric Contours

SMU Boundary

0 40
Scale in Feet

ANCHOR QEA

Figure 13b
Scow 3002 Misplaced Material Area: Post-spill Bathymetry
San Diego Shipyard Sediment Site - North Shipyard



SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Post-dredge bathymetric data from eTrac Inc., September 25, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

LEGEND:

-15 — Post-dredge Bathymetric Contours

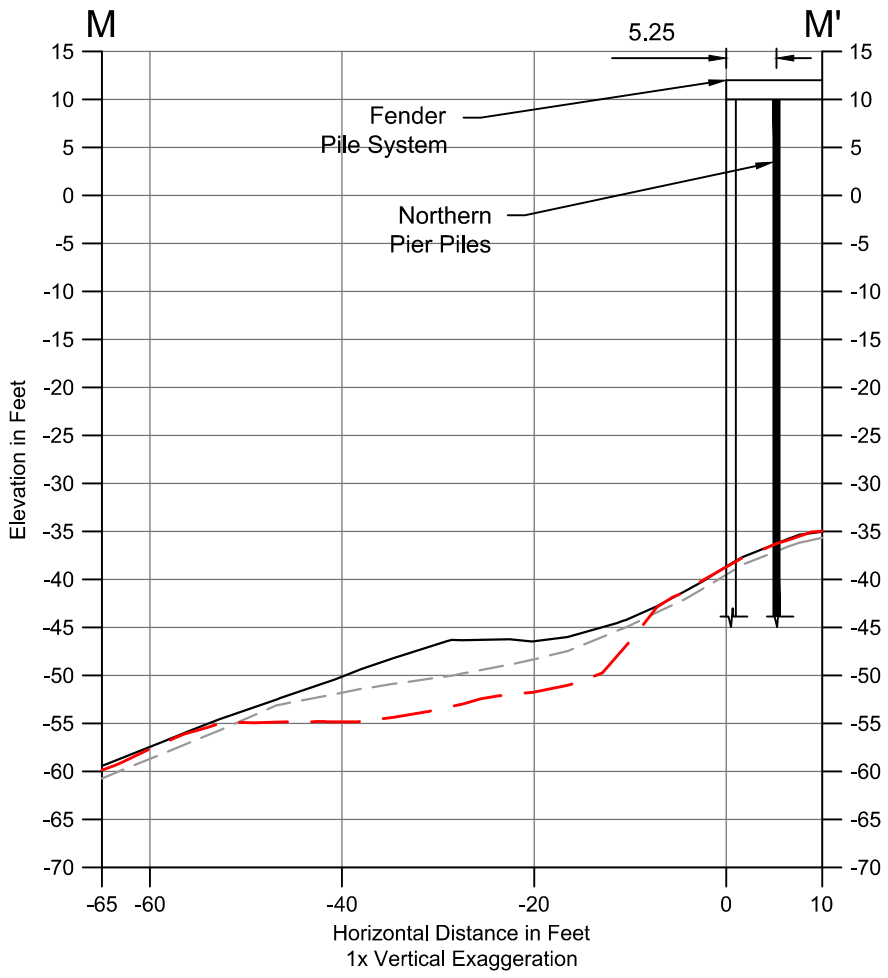
SMU Boundary

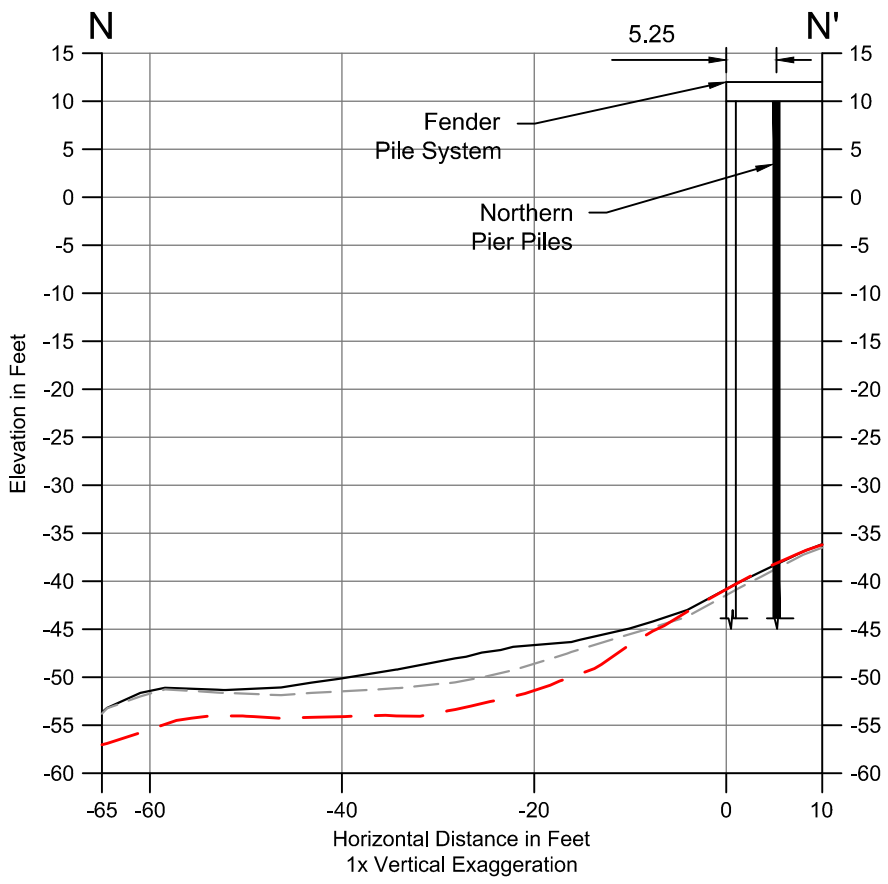
0 40
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-022c SCOW POST DREDGE.dwg FIG 13c
Jun 03, 2016 12:02pm mpratschner

ANCHOR QEA

Figure 13c
Scow 3002 Misplaced Material Area: Post-dredge Bathymetry
San Diego Shipyard Sediment Site - North Shipyard





SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Post-dredge bathymetric data from eTrac Inc., September 25, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

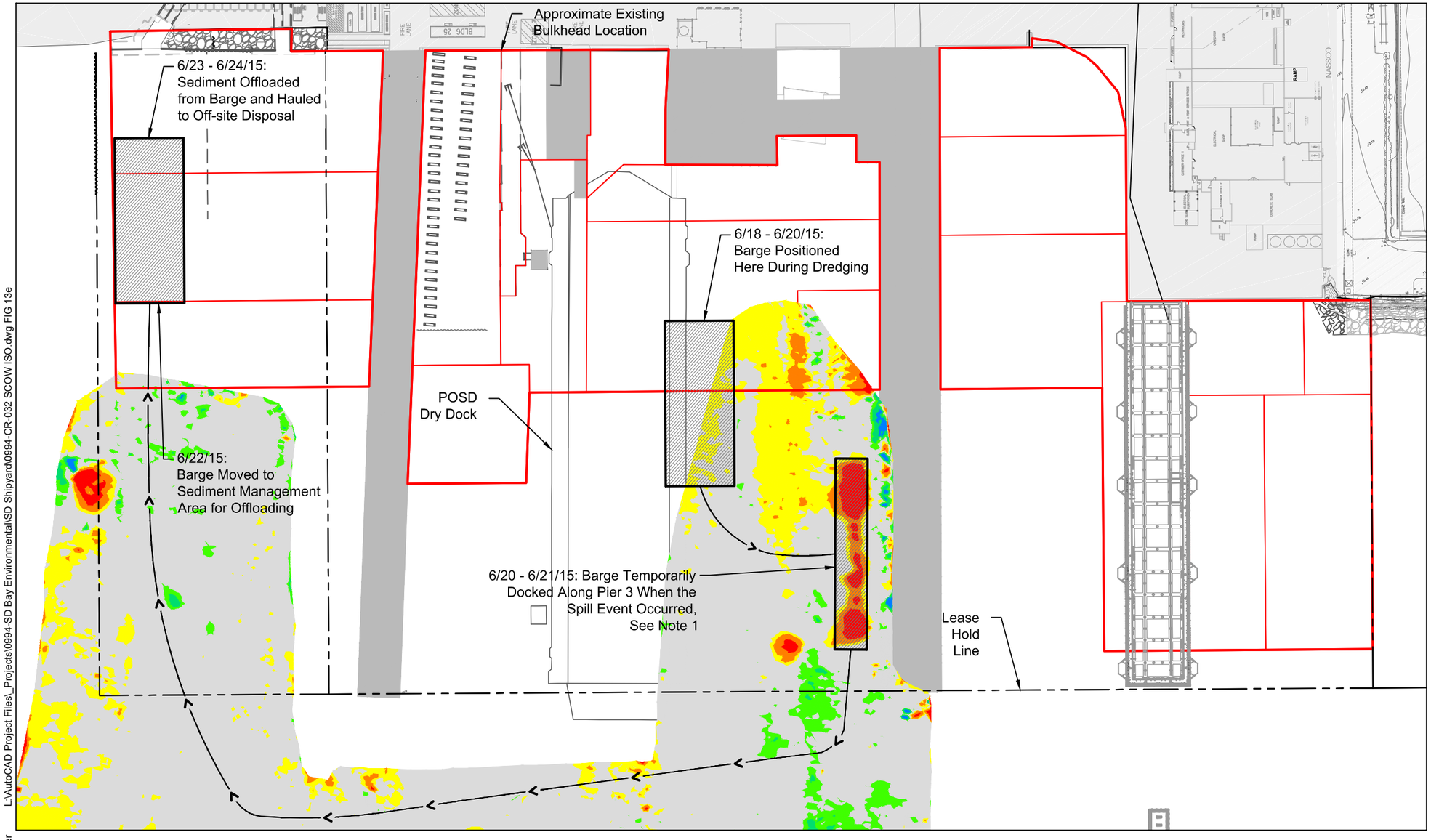
LEGEND:

- Pre-spill Bathymetry
- Post-spill Bathymetry
- Post-dredge Survey

0 40
Scale in Feet

ANCHOR QEA

Figure 13d
Scow 3002 Misplaced Material Area: Cross Sections
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

SMU Boundary

Barge Path

Ranges Where 5/18 Survey is Deeper ↑ / Ranges Where 7/30 Survey is Raised ↓	Comparison of Pre and Post-spill Survey	
	Elevation Difference (ft)	Color
Ranges Where 5/18 Survey is Deeper ↑	-1.0 and Greater	
	-1.0 to -0.5	
	-0.5 to -0.25	
	-0.25 to 0.25	
Ranges Where 7/30 Survey is Raised ↓	0.25 to 0.5	
	0.5 to 1.0	
	1.0 and Greater	

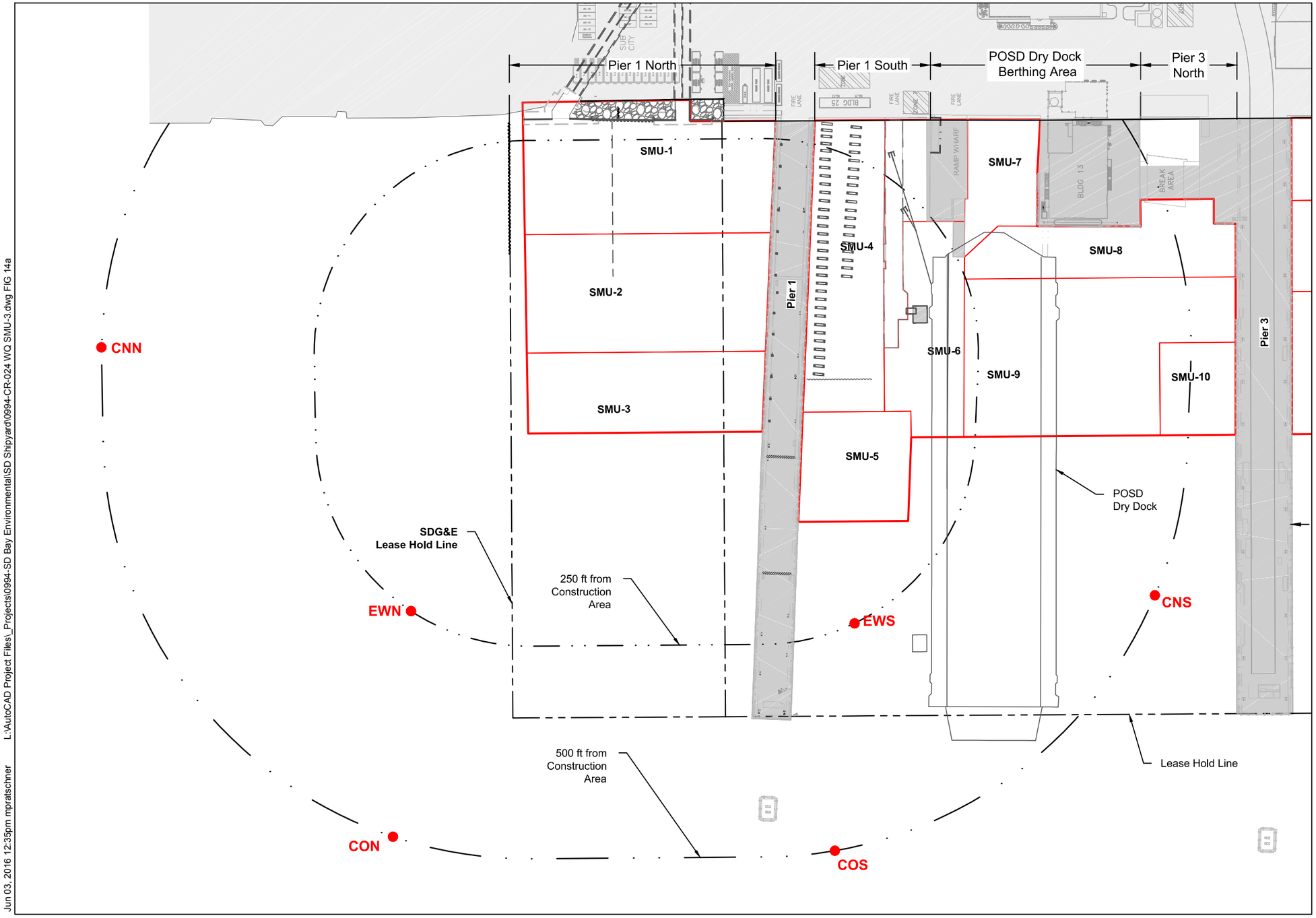
SOURCE: Upland topography from Digital Mapping, Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013. Bathymetric data from eTrac, Inc., surveys dated May 18, and July 30, 2015.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: NOAA Tidal Gauge.
NOTE 1: This rectangle denotes the area over which cleanup actions will take place.

0 150
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-032 SCOW ISO.dwg FIG 13e
Jul 14, 2016 9:34am mpratschner

ANCHOR QEA

Figure 13e
Scow 3002 Misplaced Material Area: Movement and Positioning of Scow 3002 - Survey Comparison
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

- SMU Boundary
- 250 ft from Construction Area
- 500 ft from Construction Area
- XXX ● Sampling Location
- EWN Early Warning North
- EWS Early Warning South
- CNN Compliance Nearshore North
- CNS Compliance Nearshore South
- CON Compliance Offshore North
- COS Compliance Offshore South

SOURCE: Upland topography from BAE Systems dated March 8, 2013, and supplemented by Environmental Data Solutions survey dated April 18, 2013.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

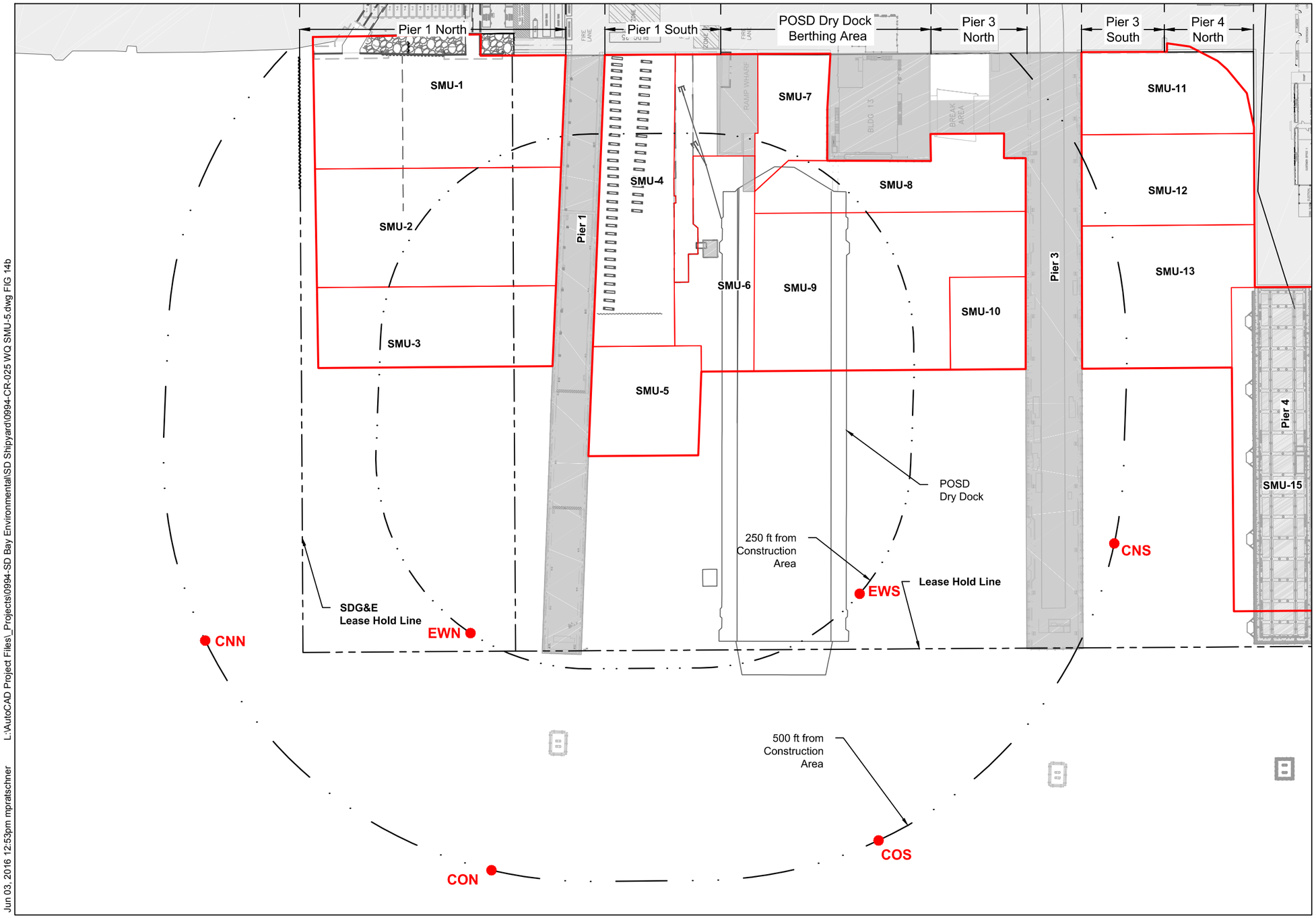
NOTE:
Actual sampling locations determined in the field based on the location of the construction area.

0 120
Scale in Feet

Jun 03, 2016 12:35pm mpratschner L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-024 WQ SMU-3.dwg FIG 14a

ANCHOR QEA

Figure 14a
Example General Layout of Water Quality Sampling Locations in Pier 1 North (SMU-3)
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

- SMU Boundary
- 250 ft from Construction Area
- 500 ft from Construction Area
- XXX ● Sampling Location
- EWN Early Warning North
- EWS Early Warning South
- CNN Compliance Nearshore North
- CNS Compliance Nearshore South
- CON Compliance Offshore North
- COS Compliance Offshore South

SOURCE: Upland topography from BAE Systems dated March 8, 2013, and supplemented by Environmental Data Solutions survey dated April 18, 2013.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

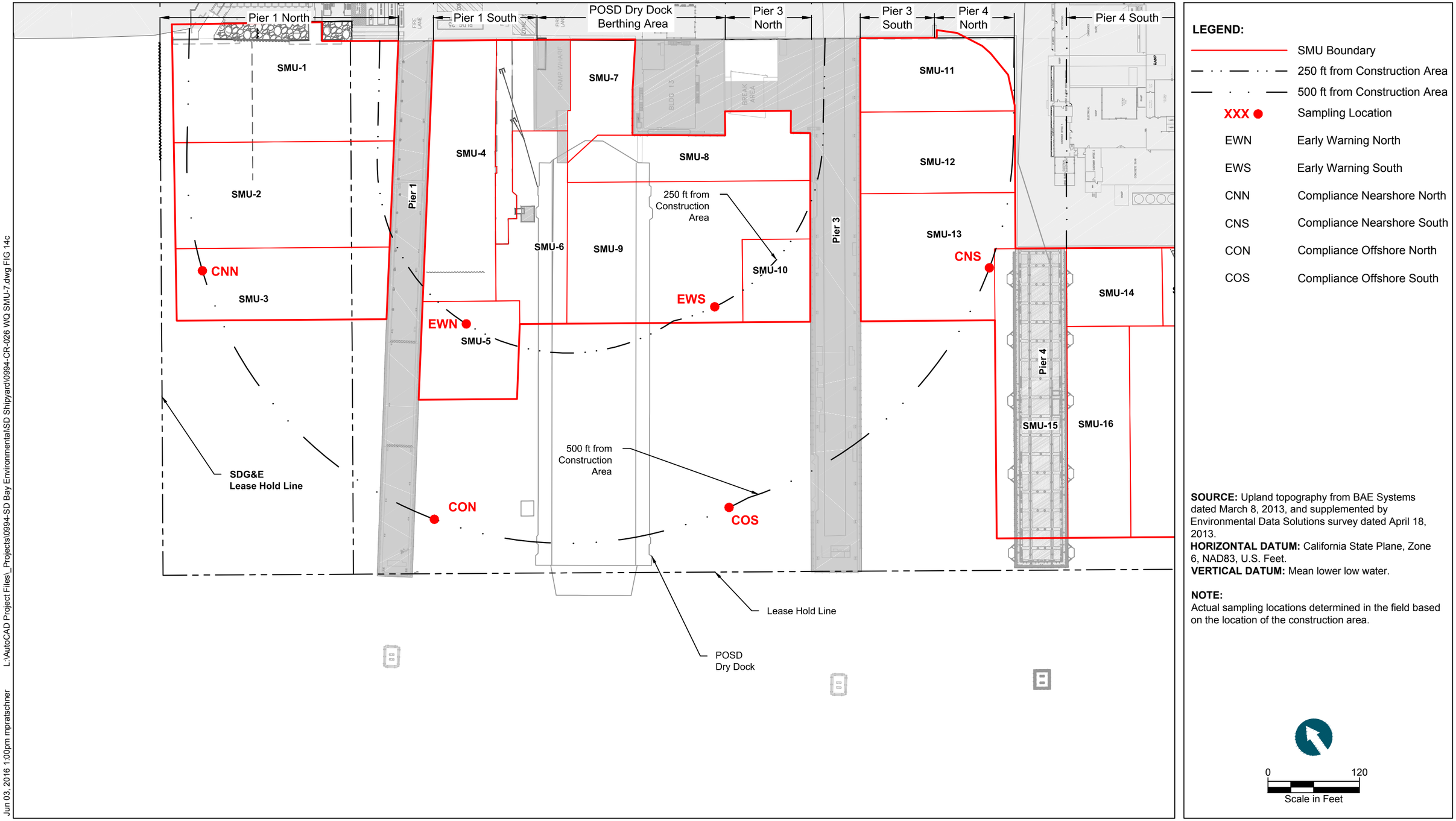
NOTE:
Actual sampling locations determined in the field based on the location of the construction area.

0 120
Scale in Feet

Jun 03, 2016 12:53pm mpratschner L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-025 WQ SMU-5.dwg FIG 14b

ANCHOR QEA

Figure 14b
Example General Layout of Water Quality Sampling Locations in Pier 1 South (SMU-5)
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

- SMU Boundary
- 250 ft from Construction Area
- 500 ft from Construction Area
- XXX ● Sampling Location
- EWN — Early Warning North
- EWS — Early Warning South
- CNN — Compliance Nearshore North
- CNS — Compliance Nearshore South
- CON — Compliance Offshore North
- COS — Compliance Offshore South

SOURCE: Upland topography from BAE Systems dated March 8, 2013, and supplemented by Environmental Data Solutions survey dated April 18, 2013.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

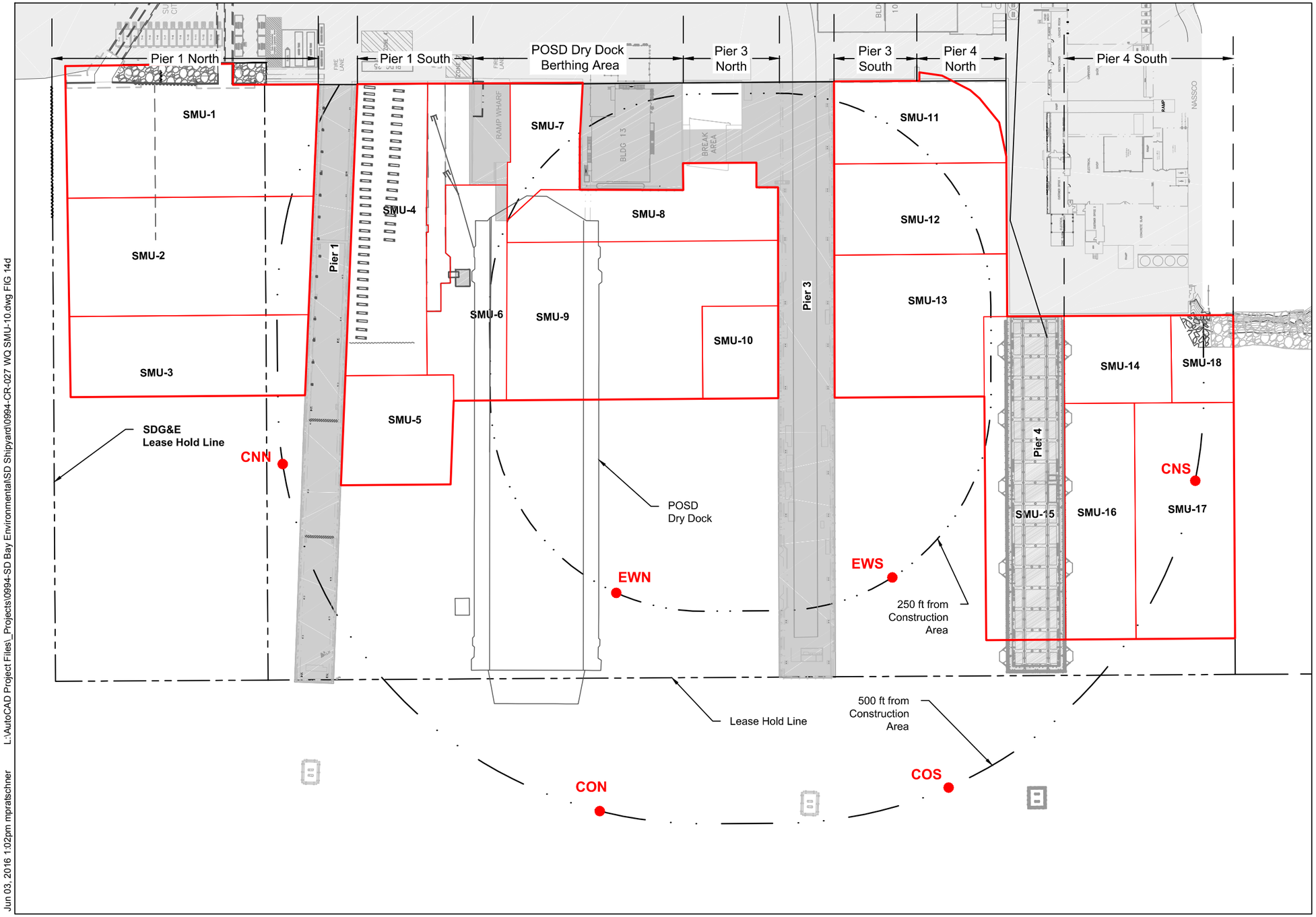
NOTE:
Actual sampling locations determined in the field based on the location of the construction area.

0 120
Scale in Feet

Jun 03, 2016 1:00pm mpratschner L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-026 WQ SMU-7.dwg FIG 14c

ANCHOR QEA

Figure 14c
Example General Layout of Water Quality Sampling Locations in the Pride of San Diego Dry Dock Area (SMU-7)
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

- SMU Boundary
- 250 ft from Construction Area
- 500 ft from Construction Area
- XXX ● Sampling Location
- EWN Early Warning North
- EWS Early Warning South
- CNN Compliance Nearshore North
- CNS Compliance Nearshore South
- CON Compliance Offshore North
- COS Compliance Offshore South

SOURCE: Upland topography from BAE Systems dated March 8, 2013, and supplemented by Environmental Data Solutions survey dated April 18, 2013.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

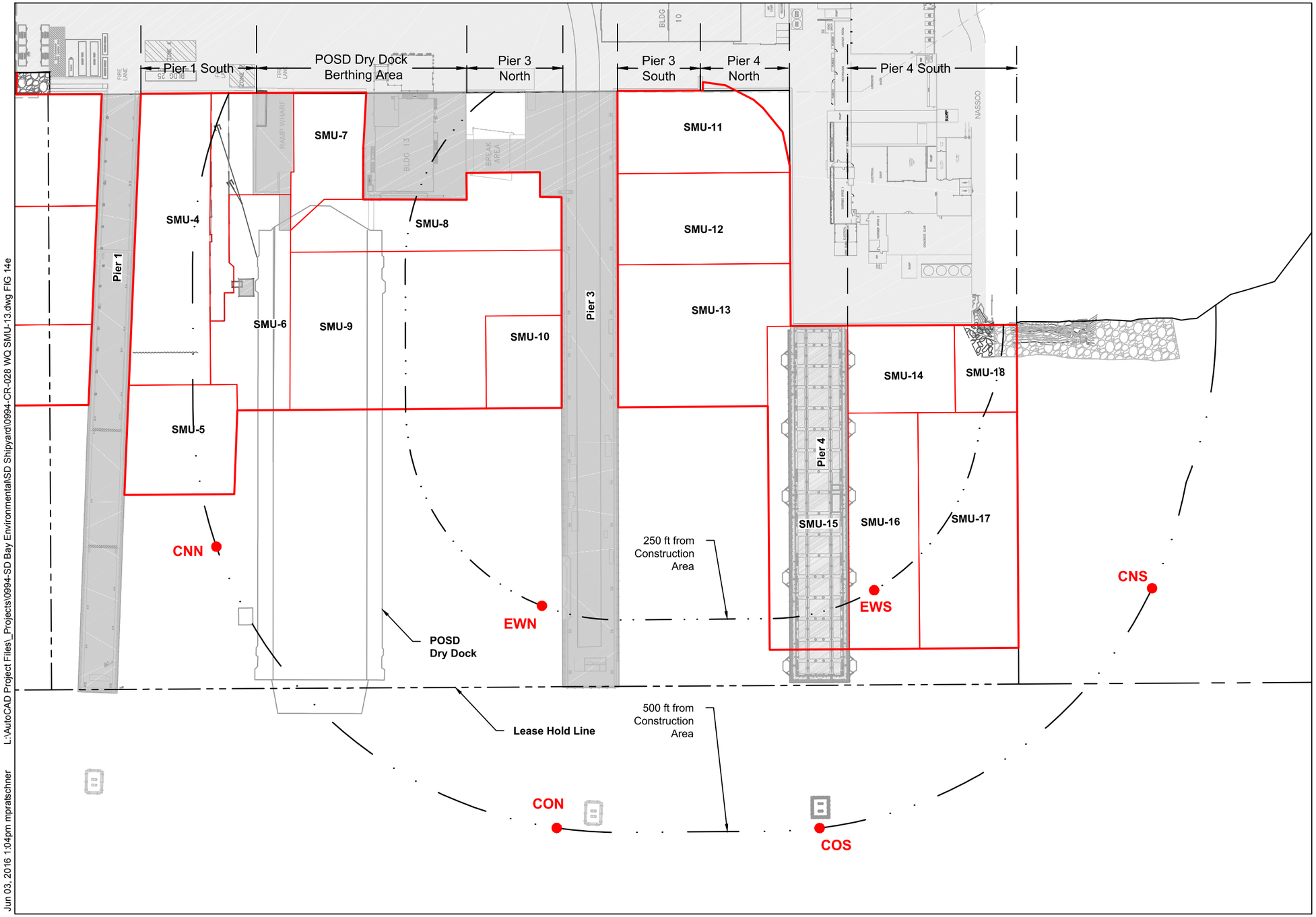
NOTE:
Actual sampling locations determined in the field based on the location of the construction area.

0 120
Scale in Feet

Jun 03, 2016 1:02pm mpratschner L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-027 WQ SMU-10.dwg FIG 14d

ANCHOR QEA

Figure 14d
Example General Layout of Water Quality Sampling Locations in Pier 3 North (SMU-10)
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

- SMU Boundary
- 250 ft from Construction Area
- 500 ft from Construction Area
- XXX ● Sampling Location
- EWN Early Warning North
- EWS Early Warning South
- CNN Compliance Nearshore North
- CNS Compliance Nearshore South
- CON Compliance Offshore North
- COS Compliance Offshore South

SOURCE: Upland topography from BAE Systems dated March 8, 2013, and supplemented by Environmental Data Solutions survey dated April 18, 2013.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

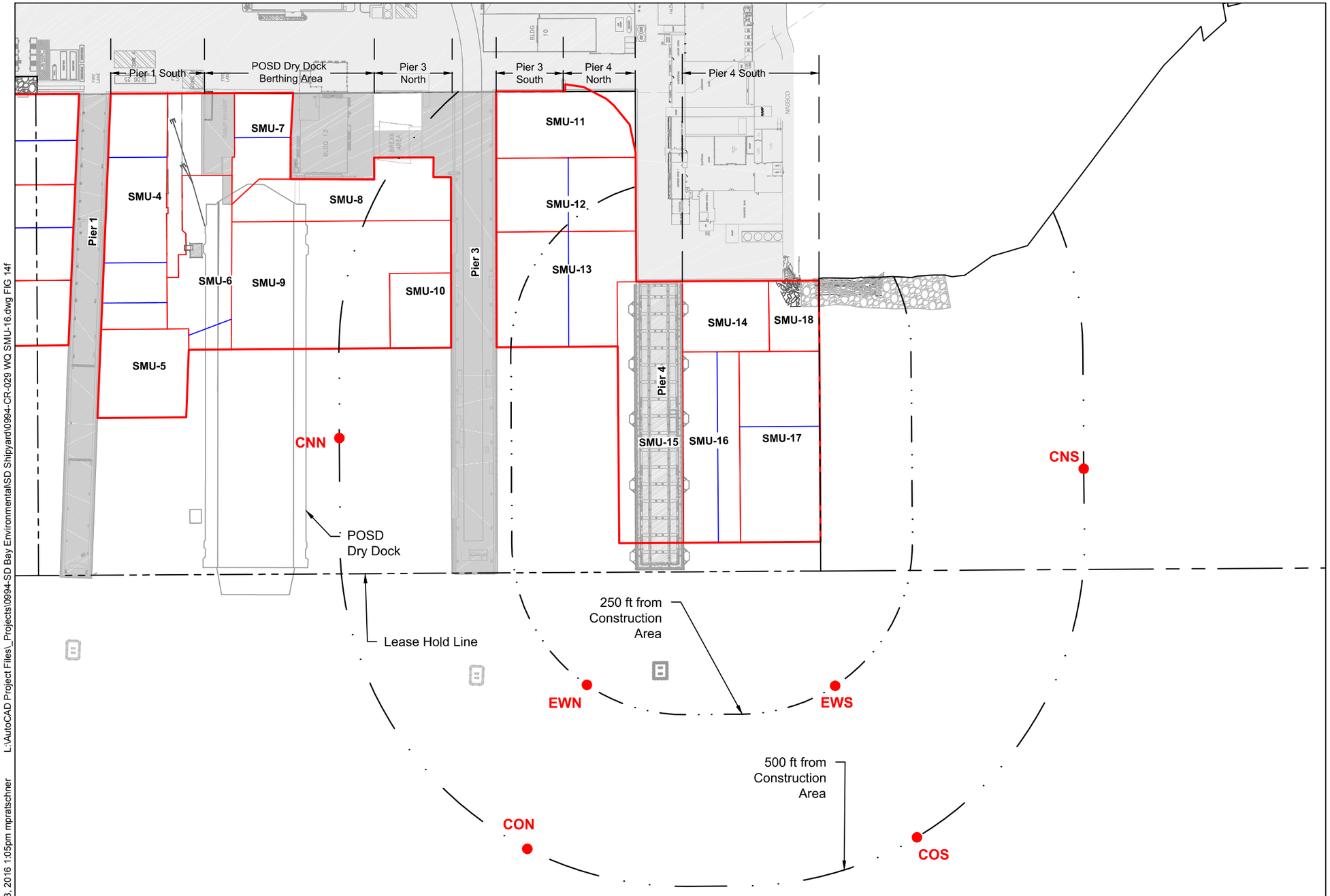
NOTE:
Actual sampling locations determined in the field based on the location of the construction area.

0 120
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-028 WQ SMU-13.dwg FIG 14e
Jun 03, 2016 1:04pm mpratschner

ANCHOR QEA

Figure 14e
Example General Layout of Water Quality Sampling Locations in Pier 3 South and Pier 4 North (SMU-13)
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

- SMU Boundary
- 250 ft from Construction Area
- 500 ft from Construction Area
- XXX ● Sampling Location
- EWN Early Warning North
- EWS Early Warning South
- CNN Compliance Nearshore North
- CNS Compliance Nearshore South
- CON Compliance Offshore North
- COS Compliance Offshore South

SOURCE: Upland topography from BAE Systems dated March 8, 2013, and supplemented by Environmental Data Solutions survey dated April 18, 2013.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

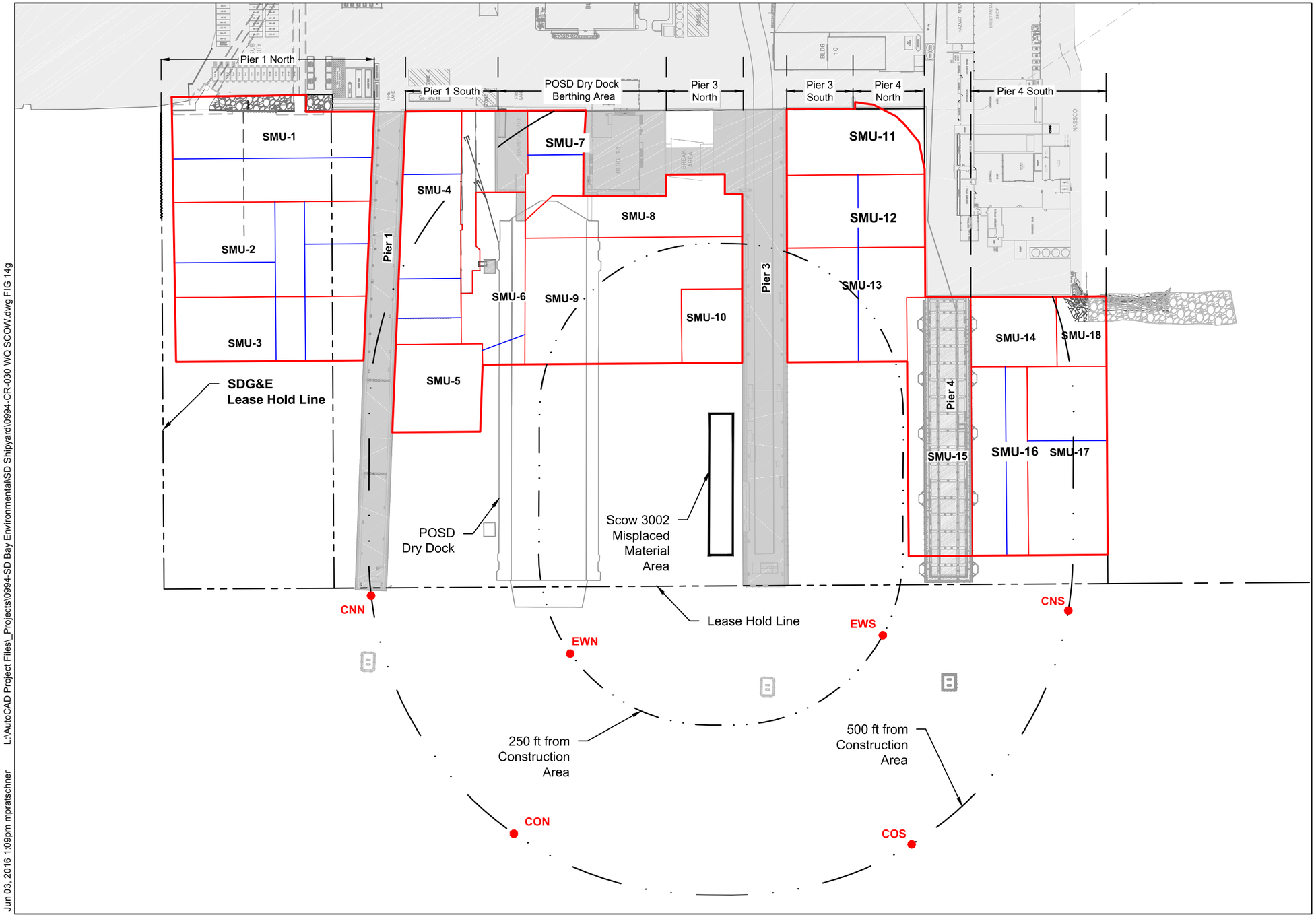
NOTE:
Actual sampling locations determined in the field based on the location of the construction area.

0 150
Scale in Feet

Jun 03, 2016 1:05pm mpratschner L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-029 WQ SMU-16.dwg FIG 14f

ANCHOR QEA

Figure 14f
Example General Layout of Water Quality Sampling Locations in Pier 4 South (SMU-16)
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

- SMU Boundary
- 250 ft from Construction Area
- 500 ft from Construction Area
- XXX ● Sampling Location
- EWN Early Warning North
- EWS Early Warning South
- CNN Compliance Nearshore North
- CNS Compliance Nearshore South
- CON Compliance Offshore North
- COS Compliance Offshore South

SOURCE: Upland topography from BAE Systems dated March 8, 2013, and supplemented by Environmental Data Solutions survey dated April 18, 2013.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.
VERTICAL DATUM: Mean lower low water.

NOTE:
Actual sampling locations determined in the field based on the location of the construction area.

0 150
Scale in Feet

Jun 03, 2016 1:09pm mpratschner L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-030 WQ SCOW.dwg FIG 14g

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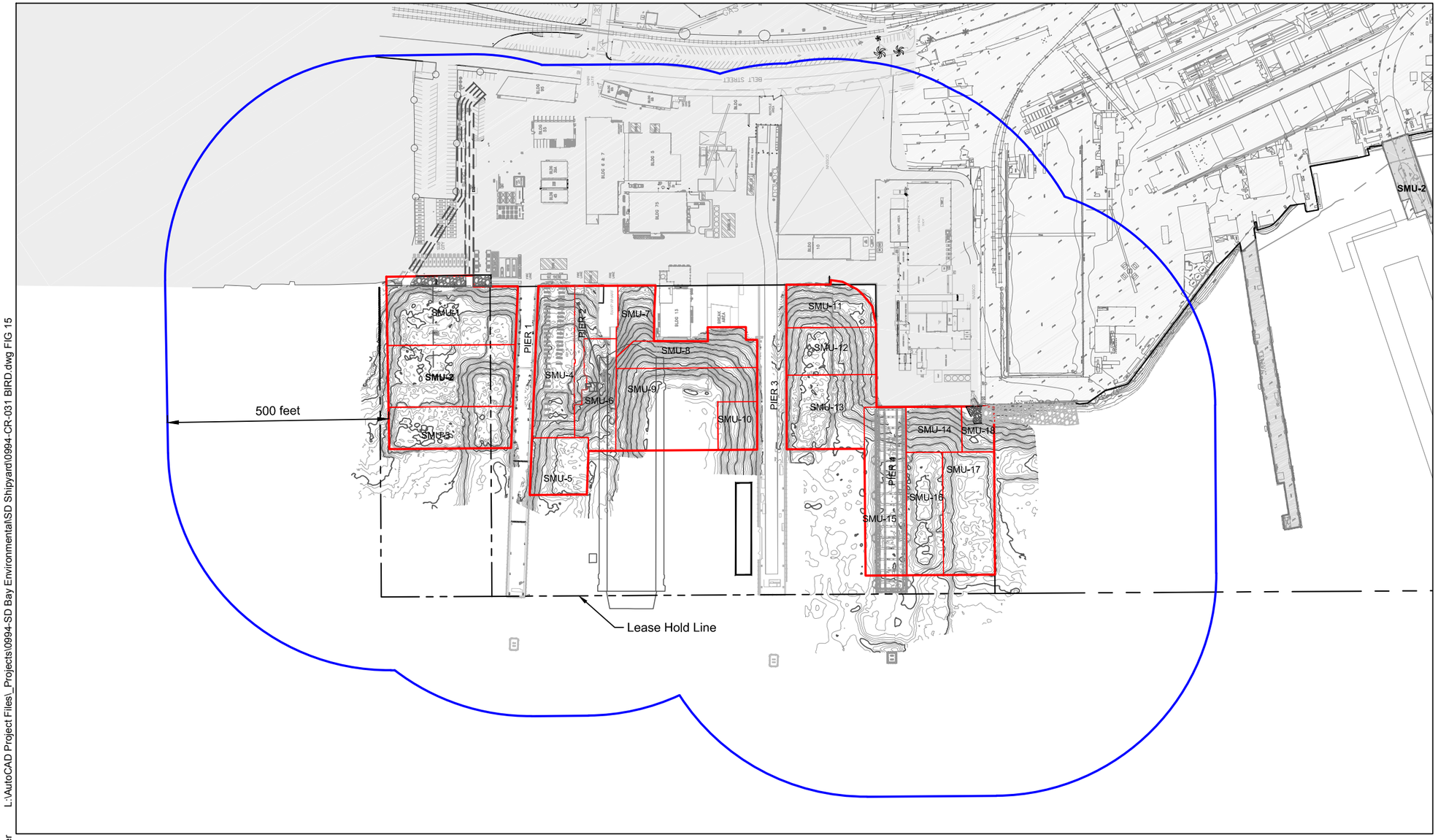
Figure 14g
General Layout of Water Quality Sampling Locations for Scow 3002 Misplaced Material Dredge Area
San Diego Shipyard Sediment Site - North Shipyard



LEGEND:

- Bird Monitoring Area
- SMU Boundary
- Scow 3002 Misplaced Material Area

SOURCE: Upland topography from Digital Mapping Inc., dated September 2009, and supplemented by Environmental Data Solutions survey dated April 13, 2013.
HORIZONTAL DATUM: California State Plane, Zone 6, NAD83, U.S. Feet.

0 150
Scale in Feet

L:\AutoCAD Project Files_Projects\0994-SD Bay Environmental\SD Shipyard\0994-CR-031 BIRD.dwg FIG 15
Jun 03, 2016 1:11pm mpratschner

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Figure 15
Special Status Bird Monitoring Areas
San Diego Shipyard Sediment Site - North Shipyard