

San Francisco – Oakland Bay Bridge
Pile Installation Demonstration Project

Phase I Archaeological Survey Report – Maritime Archaeology



September 1999

EA 012081

Caltrans Contract 04A0148

Task Order 175.10.15

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SHPO # FHWA 980717A

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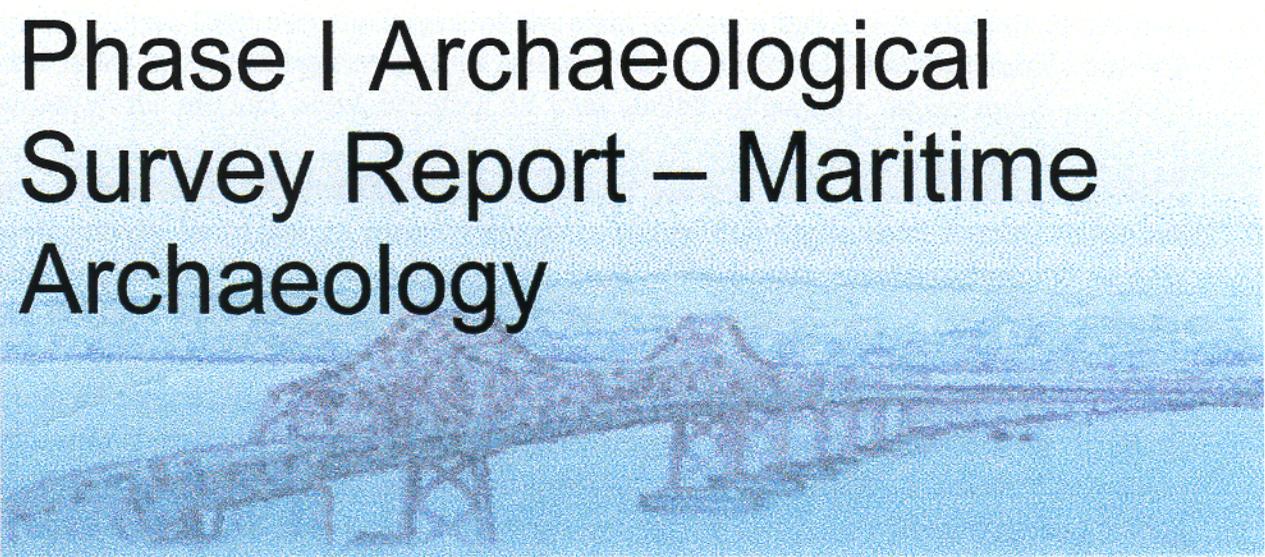
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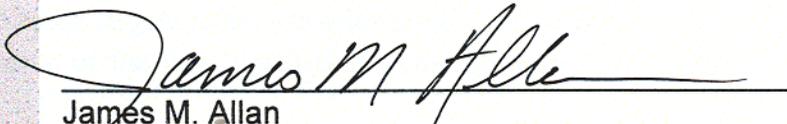
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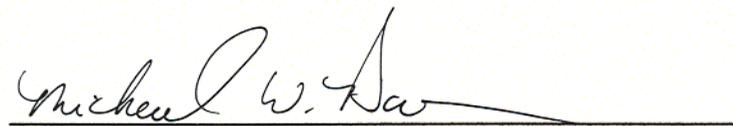


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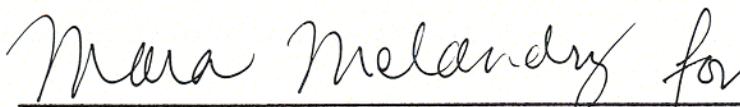
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SUMMARY OF FINDINGS

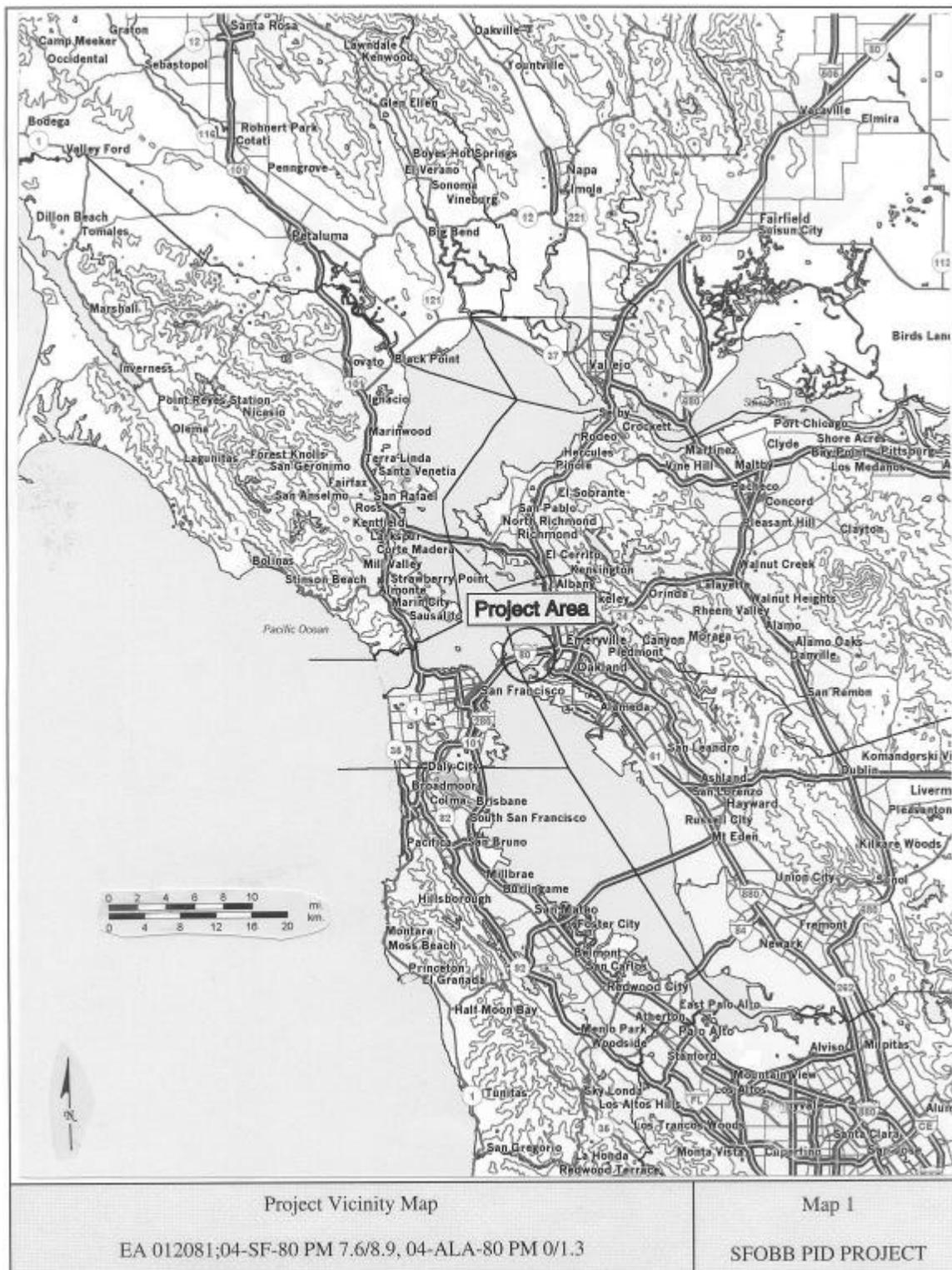
In April 1999, archaeologists from William Self Associates (WSA) conducted a remote sensing survey of the underwater archaeological Area of Potential Effect (APE) for the San Francisco-Oakland Bay Bridge Pile Installation Demonstration Project (PIDP). Analysis of the side scan sonar and sub-bottom profile data identified 8 targets within the PIDP APE.

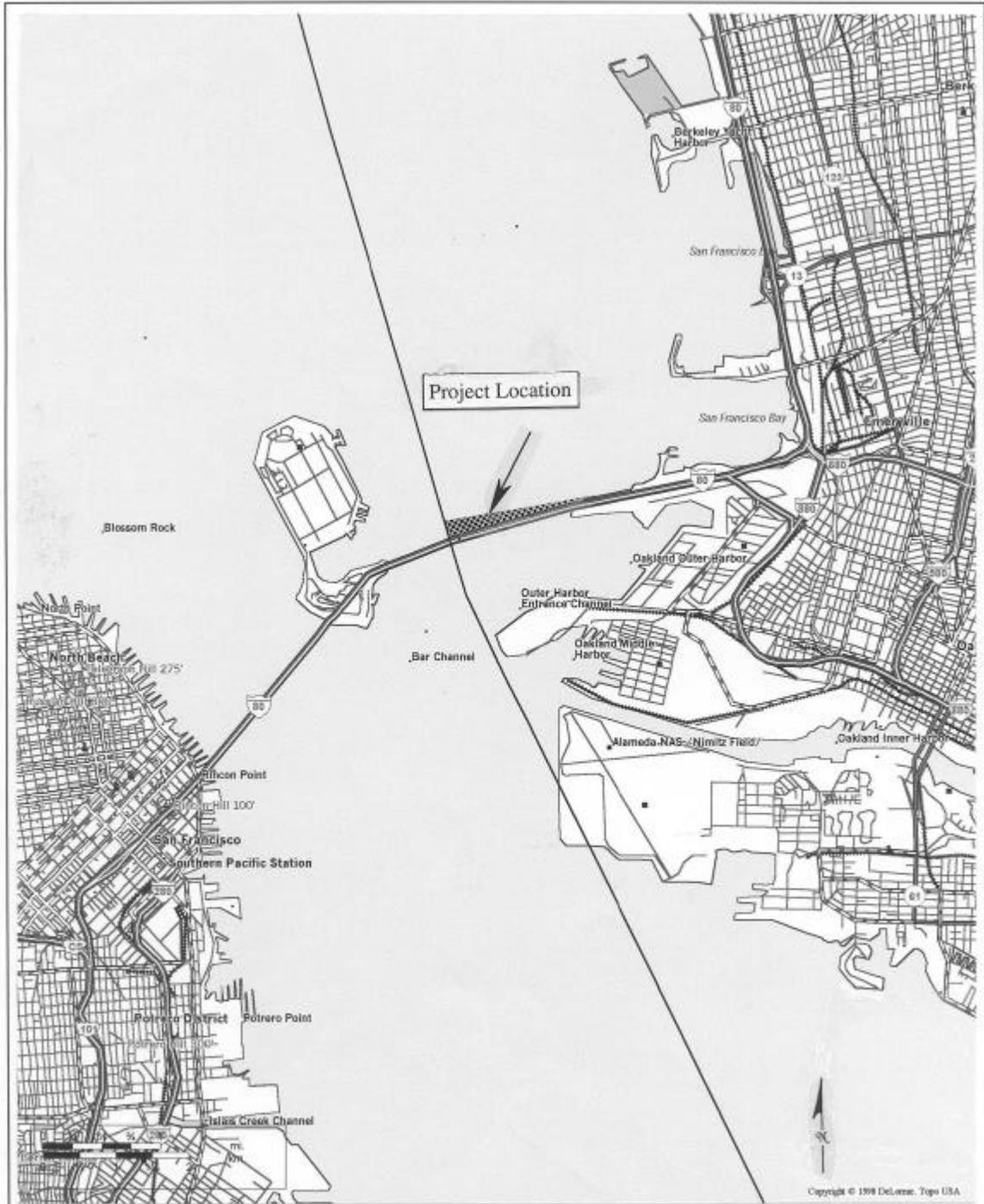
A second remote sensing survey, using a state-of-the-art, high-resolution sonar system, was conducted in June 1999 over the largest of the eight targets in the APE. Analysis of the data collected in the second survey revealed the presence of four additional, discrete targets within the boundaries of the original target, bringing the total number of acoustic targets to 12.

Using a combination of archival research, remote sensing, and diver investigation, WSA archaeologists evaluated the 12 acoustic targets in the APE during ground truthing operations conducted during June, July, and August 1999. Five of the targets were determined to be non-cultural in origin and were eliminated from further consideration.

A portion of one historic archaeological site, the remains of the Key System ferry terminal and pier, lies within the APE. Although the Key System may be historically significant, the scattered, disarticulated remains of the pier and terminal that lie within the APE are considered to be non-contributing elements, as they lack the requisite integrity of design, workmanship, and feeling necessary for consideration of significance. No other archaeological sites are located within the boundaries of the PIDP APE.

On the basis of archival research, data collected during remote sensing surveys of the APE and archaeological investigation of each target, it is the conclusion of William Self Associates that none of the acoustic targets identified within the APE need to be considered in further planning or implementation of the Pile Installation Demonstration Project.





Project Location Map
 EA 012081;04-SF-80 PM 7.6/8.9, 04-ALA-80 PM 0/1.3

Map 2
 SFOBB PID PROJECT

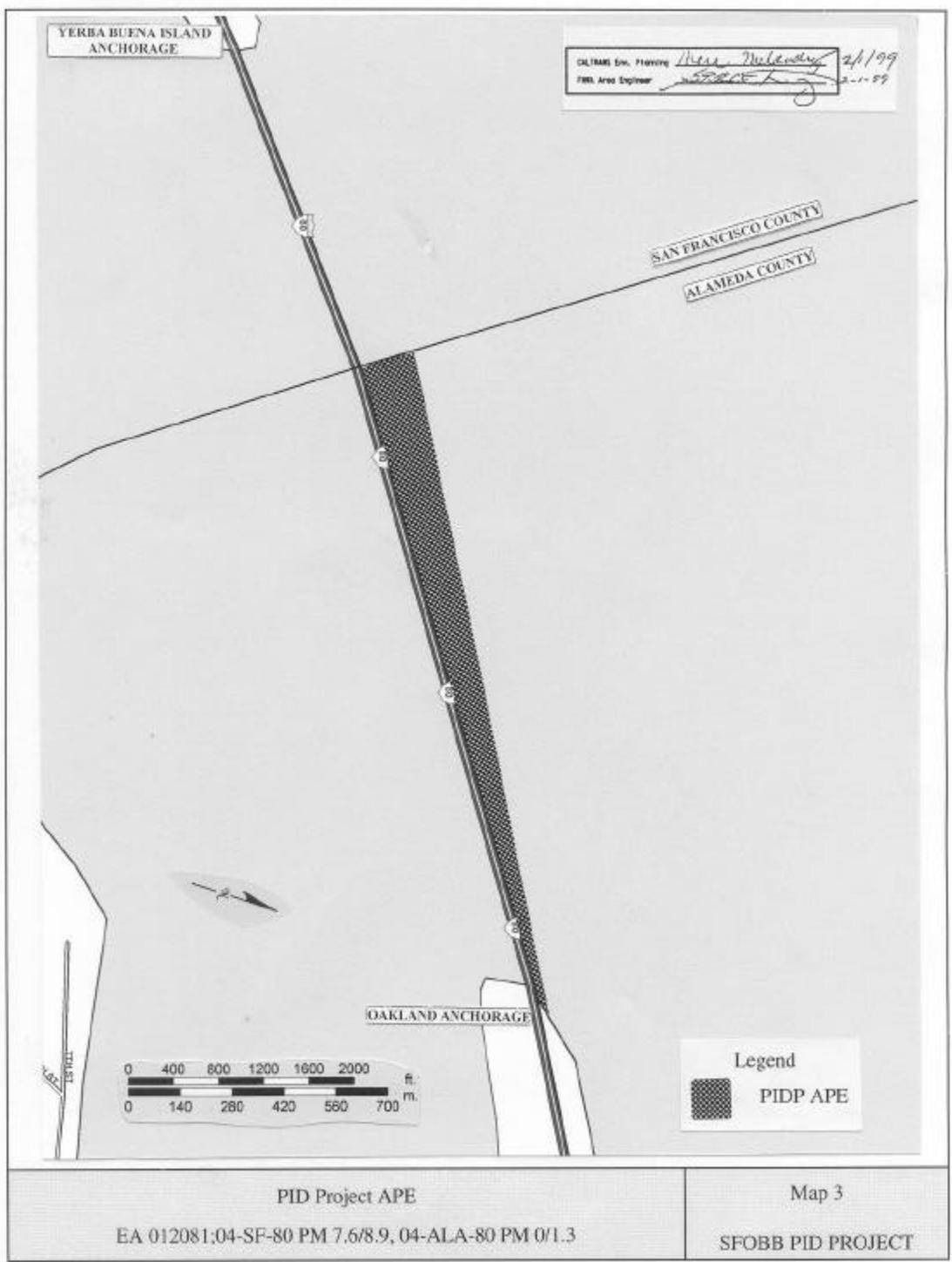


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1.0 INTRODUCTION

In April 1999, following an extensive literature and records search, William Self Associates (WSA) conducted an archaeological remote sensing survey within the boundaries of the SFOBB Underwater Archaeology Area of Potential Effect (APE) for the Pile Installation Demonstration Project (PIDP) to identify the location of potentially significant submerged cultural resources (refer to Map 3). The side scan sonar and sub-bottom profile survey identified eight targets within or near the APE. Analysis of data gathered in a subsequent remote sensing survey revealed the presence of four more targets within that APE, bringing the total number of acoustic targets identified within the APE to 12.

After analyzing the location, shape, surficial expression, size, and acoustic shadows of these targets, five were determined to be either non-cultural in origin or were duplicate images of the same target observed on adjacent survey transects. These were eliminated from further consideration. Ground-truthing was necessary in order to determine the specific nature of the remaining seven targets that could not be identified through data analysis (Figure 1, Appendix A). Although the analysis was sufficient to determine the seven targets were not the remains of intact ship structure, it was not possible on the basis of analysis alone to determine whether the targets were portions of marine machinery (boilers, condensers, steam pipes, drive trains, etc.) or components of ship structure (rudders, masts, ballast piles, etc.).

This report focuses on the interpretation of the remote sensing data and the results of ground truthing operations for the seven targets identified within the APE (coordinates for these targets may be found in Appendix B.) Ground truthing operations began on June 30, 1999. Initial target assessment and location information was based on the acoustic data collected in the April 1999 side scan survey.

Target 11 is situated at the northern boundary of the APE (Figure 2). Target 13 is a wide-spread feature comprising the structural remains of the historic Key System pier (Figures 3a-g, 4). A portion of the feature is scattered on the north side of the existing span and lies within the boundaries of the APE (refer to Figure 1). As discussed below, four more targets (13-1 through 13-4) were identified within the debris field of target 13 during remote sensing operations associated with the ground truthing effort. Target 19 lies adjacent to target 13, near the middle of the APE's western boundary (Figure 5).

Staff of William Self Associates and Caltrans conducted field research and preparation of this report. James M. Allan, Senior Associate of WSA, conducted the archaeological and archival research for the project and is the principal author of this report. Mr. Allan is a Ph.D (ABD) in Anthropology whose area of expertise is in maritime archaeology. Mr. Allan has over 12 years

experience in the field and has over 10 years experience in California archaeology. Aaron Golbus, a WSA Associate Archaeologist, assisted in the remote sensing survey and ground truthing operations. Mr. Golbus holds an M.A in Maritime Studies and has over five years experience in the field of maritime archaeology. Caltrans archaeologist Jack Hunter assisted in the remote sensing and ground truthing operations. Mr. Hunter has over 20 years experience in maritime archaeology, holds a B.A. in Anthropology, and is completing an M.A in Environmental Studies. Jason Reimers, a WSA Associate Archaeologist, also assisted in the ground truthing operations. Mr. Reimers holds a B.A. degree in Anthropology and has over three years experience in California archaeology. Mr. Allan, Mr. Hunter, and Caltrans Archaeology Manager Janet L. Pape conducted the records, literature, and archival research in local repositories and in the National Archives and in the Library of Congress, Washington D.C. Ms. Pape holds an M.A. degree in Cultural Resources Management and has over 18 years experience in California archaeology.

2.0 PROJECT LOCATION AND DESCRIPTION

The PIDP is a field-testing program designed to evaluate the technical requirements and methodological approach necessary to successfully drive the steel pipe piles to be used as the foundation for the SFOBB main span east pier and skyway structures. In the PIDP, three 328-foot long piles will be driven into the San Francisco Bay bottom sediments at two locations, both on the north side of the existing alignment of the San Francisco-Oakland Bay Bridge's (SFOBB) eastern span (Caltrans 1999). The PIDP APE is triangular in shape, defined on the south by the bridge's existing east span and on the north by a line that originates at the east anchorage and intersects the Alameda-San Francisco county line at a point 137 meters (450 feet) north of the bridge's existing east span. The county line forms the western boundary of the APE (refer to Maps 1-3).

3.0 SOURCES CONSULTED

In preparation for field research, archival research was conducted at numerous repositories in California and in Washington, D.C. Records and literature pertaining to an area within an 800-meter (one-half mile) radius of the APE were consulted in order to determine the likelihood that submerged cultural resources were present within or near the project's APE. The files of the Northwest Information Center of the California Historical Resources File System at Sonoma State University were examined, as were the National Register of Historic Places (Sept. 1, 1999), the California Inventory of Historic Resources (1976), and the register of California Historical Landmarks (1996). In addition, records and literature archived at the University of California's Bancroft Library, the California History Room of the San Francisco Public Library, the California Historical Society, the Oakland History Room of the Oakland Public Library and the J. Porter

Shaw Library of the San Francisco Maritime National Historic Park were also examined. The database of California shipwrecks maintained by the California State Lands Commission was consulted, as were nineteenth century ships' records and wreck reports maintained by the San Francisco Collector of Customs and later, by the U.S. Life-Saving Service and U.S. Coast Guard. The latter records, along with numerous historic maps, were examined in both the San Bruno, California, Regional Repository of the National Archives as well as the National Archives in Washington, D.C. Bathymetric and historic survey records stored in the archives of the National Oceanographic and Atmospheric Administration in Washington, D.C. were examined, as were historic newspaper files maintained by the Library of Congress.

Three historic shipwrecks are reported to have sunk in the waters around or near Yerba Buena Island (PAR 1997:21). These have been identified as the *Utica*, a Havre packet reportedly burned and sunk near Goat (Yerba Buena) Island in 1850; the *Norman*, also known as the *C. Nichols*, a schooner that stranded on the Berkeley shore in 1879, and the *San Carlos*, reportedly wrecked in 1797 off "Yorba Buena." Archival research also identified a fourth wreck, the *Crown Prince of Hanover* that may lie in the waters in or near the APE. On the basis of the records and documents examined during the records and literature search, neither these nor other shipwrecks, nor other types of cultural material were specifically identified within the boundaries of the APE.

4.0 BACKGROUND

4.1 Environment

The APE for the PIDP is situated in San Francisco Bay between the Bay's eastern shore and the east side of Yerba Buena Island (refer to Map 2). The Bay itself occupies a late Pliocene trough that was subject to repeated flooding during the interglacial periods of the Pleistocene. The trough extends to the south, where it forms the Santa Clara and San Benito valleys, and to the north where it forms the Petaluma, Sonoma, and Napa valleys. Prior to about 10,000 years ago, the Sacramento River flowed through the deep gorge that is the Golden Gate and across what is today the submerged continental shelf. The river eventually met the ocean some 25 kilometers (15 miles) to the west of today's modern shoreline. Between 10,000 and 8,000 years ago, rising sea levels caused by the melting of continental glaciers began to flood the trough, eventually creating the San Pablo and San Francisco bays (Moratto 1984:220-221).

The geologic history of the Bay suggests that human adaptation to its environs began less than 8000 years ago and that any evidence of the earliest settlements around the Bay lie deeply buried under Bay sediments. Rising water levels in the Bay may also account for shifts through time in the exploitation of particular food resources which, in turn, were affected by changes in microclimates and biotic communities resulting from the rising sea levels (Bickel 1978).

The modern climate of the area is characterized by annual precipitation that varies from 50 to 100 centimeters (20 to 40 inches), with precipitation concentrated in the fall, winter, and spring months. This climate is much like that found in the Mediterranean: mild, rainy winters, and dry, warm summers. After the first rain at the end of October or early November, the vegetation covering the hills surrounding the Bay becomes green and remains green, but not growing, until late February, when the grasses begin to grow rapidly. By early May, these have usually changed to a dry golden color and remain that way until fall (Brown 1985). Due to the cooling effects of the local Bay environment, temperatures in the project area are mild in the summer, usually averaging 55-65° (Moratto 1984:223). The cold water of the Bay also creates frequent fog, and relative humidity remains high most of the time (Schoenherr 1992:627)

4.2 History

The discovery of gold in the Sierra Nevada in 1849 produced a major population increase in the northern half of California as immigrants poured into the territory seeking gold or the opportunities inherent in producing goods or services for miners. Prior to the gold rush, San Francisco - then known as Yerba Buena - was a sleepy hamlet situated on the shores of Yerba Buena Cove. With the discovery of gold and the sudden influx of thousands of optimistic gold seekers, a city of canvas and wood sprang up around the cove and on the sand dunes and hills that surrounded it.

To accommodate the burgeoning population, the city spread out in all directions - including into the waters of Yerba Buena Cove, which had defined the eastern boundary of the early settlement. Street alignments were projected into the waters of the cove and pilings were driven along the alignments to define "water lots" which were later filled and built upon. Construction of docks and wharves along the waterline began shortly after the first influx of gold seekers reached the shores of Yerba Buena Cove. By 1850, a substantial arrangement of wharves projected across the shallow waters of the cove. The wharves and the businesses built upon them serviced the booming maritime trade spawned by the unprecedented population growth associated with the gold-rush.

Over the next 50 years, transportation links were established between San Francisco and the communities that had sprung up around the Bay. By the mid-1870s, four ferry lines crossed the Bay between San Francisco and the east shore, linking what had become known as California's Queen City with the cities of Alameda and Oakland, the latter dubbed the "Bride of the Bay" in response to San Francisco's moniker. In excess of 8,000 passengers were ferried back and forth across the Bay (Lloyd 1999 [1876]: 387-391). Ferry steamers likewise linked San Francisco with San Rafael, Sausalito, and San Quentin. By 1890, nearly 364,000 people (57% of the state's total) lived in the principal cities that ringed the Bay - San Francisco, Oakland, Alameda, and Berkeley (Demoro 1985:12)

The transbay transportation system eventually came under the near-monopolistic control of the Southern Pacific Railroad Company, which combined a fleet of ferryboats with its steam-powered trains. In 1903, Francis Marion "Borax" Smith opened the San Francisco, Oakland, and San Jose Railway as a direct competitor to the Southern Pacific. The various lines of the railroad which serviced Oakland, Piedmont, and Berkeley, terminated in a trestle and pier that extended into San Francisco Bay nearly 5 kilometers (approximately three miles) from the east shore, reaching nearly to Yerba Buena Island (Walker 1978:5). The pier and the elaborate terminal that stood at its head were major feats of engineering and construction (Photos 1, 2, 3). Although Smith eventually lost control of the railroad company (and his borax fortune as well), the line operated until 1939. Known informally as the Key System for many years, the railroad's name was officially changed to the Key System Transit Company in 1923 (Walker 1978:5).

On May 6, 1933, a spectacular fire destroyed the terminal at the head of the Key System's pier, the ferryboat *Peralta*, 40 railroad cars, and 500 yards of the pier itself. (Oakland Tribune May 7, 1933). The burned hulk of the *Peralta* was rebuilt and became the ferry *Kalakala*, entering into service on Puget Sound in 1935 (Demoro 1985:75). The burned railroad cars were removed from the damaged pier and a temporary structure soon replaced the burned terminal. It was used until 1939, when the pier was abandoned in favor of the rail service then using the newly constructed San Francisco-Oakland Bay Bridge to ferry passengers back and forth from San Francisco to the East Bay. In 1946, the Key System was sold to National City Lines and in 1960 was absorbed by the Alameda-Contra Costa County Transit District (Oakland Tribune, October 27, 1963; Walker 1978:5).

5.0 FIELD METHODS

The swift currents and extremely high levels of turbidity encountered in the water column precluded ground truthing operations with cameras mounted on a remotely-operated-vehicle (ROV). The same constraints also prevented exclusive reliance on target observation and evaluation by diving maritime archaeologists. Instead, a two-phase approach combining both hands-on evaluation by archaeologists and use of high resolution sonar was implemented to evaluate the seven acoustic targets in the APE.

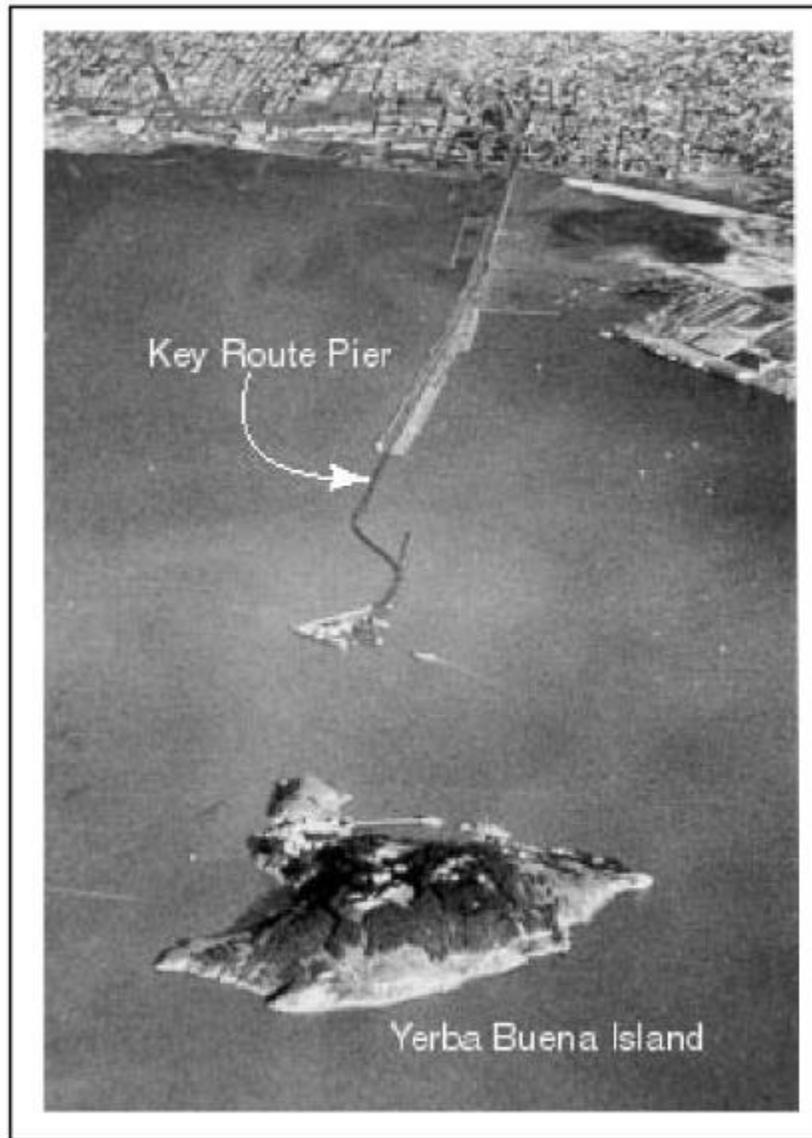


Photo: Pacific Aerial Surveys
Image courtesy of Jack Hunter, Caltrans

Key System Mole, Nov. 18, 1930. View East

Photo 1

Photos 2 & 3 Head of Key System's Pier



Terminal, Head of Pier; Oct. 22, 1935. View West. Note SFOBB to North.



Terminal, Head of Pier; Oct 23, 1934. View East. Note SFOBB Under Construction.

In the preliminary remote sensing survey conducted in April 1999, both a side scan sonar and sub-bottom profiler were employed. The side scan sonar operated at a frequency of 100 kHz, the typical cycle rate employed in such surveys, since it provides a good balance between survey swath width and image resolution (refer to Figures 2-5).¹ For ground truthing operations however, a state-of-the-art, high resolution Marine Sonics side scan sonar system, using a 600 kHz transducer, was selected. A sonar operating at the 600 kHz frequency provides an optimal, near-photographic image of the target being investigated. Although its image resolution is very good, such high frequency transducers are not normally used in archaeological sonar surveys because the coverage of its beam in the vertical plane is typically too short, requiring very narrow, and therefore numerous, survey transects. Since the locations of the targets selected for ground truthing were known, however, the width of survey transects was not an issue and the full capability of the higher resolution was realized during ground truthing.²

In particular, use of the high resolution sonar on target 13 (the remains of the Key System pier) provided target images sufficiently clear to allow for assessments of spatial arrangement, integrity and significance as defined by the National Register of Historic Places (NHRP) criteria. Because of the broad spatial extent of the target, and the swift currents, high turbidity, and zero visibility that are the typical water conditions found in the Bay, diving on target 13 to obtain the necessary assessment data was not practical. Using the 600 kHz side scan sonar system was the most effective and efficient approach to evaluating the target.

On June 30, 1999, using the 600 kHz system, maritime archaeologists conducted a side scan sonar survey of target 13. The sonar equipment was deployed from the 26-foot survey vessel *Betty Jo*, owned and operated by Sea Surveyor of Benicia, California. Differential global positioning information was used in the vessel's on-board navigational computer to control the survey. Twenty-two transects separated by intervals of 20 meters were surveyed over the target area (Figure 6). The sonar range was set to a swath width of 20 meters, providing a 100% overlap of the target area. Archaeologists operated the sonar system and directed the survey. It was in the subsequent analysis of this remote sensing data that four more acoustic targets (targets 13-1 through 13-4) were identified in the debris field of target 13.

¹ In the sonar images in Appendix A, the double line represents the path of the sonar sensor, which "views" both sides of the trackline.

¹ Technical failure of one of the two channels on the 600 kHz sonar "fish" nonetheless required more intensive survey transects than would normally be required.

The two-phase ground truthing operations for the remaining seven targets and the four newly identified targets within the boundaries of target 13 commenced on July 14, 1999. Unavoidable logistical constraints made it necessary to substitute a 300 kHz system for the 600 kHz system used in the June 30 survey of target 13. Although the resolution was slightly lower, image clarity was still far superior to that acquired from the 100 kHz system used in the April 1999 survey. Ground truthing operations began with sonar acquisition of a particular target location. As mentioned above these targets were those whose nature could not be identified on the basis of data analysis alone. Their shape, size, and surficial expression were sufficiently enigmatic to preclude dismissing them as non-diagnostic debris. Because these targets were not clearly defined, maritime archaeologists conducted scuba dives to assess the targets. In these instances, a buoy line, heavily weighted to overcome the drift effects introduced by the strong tidal currents, was dropped on the coordinates of a target location. The sonar was then redeployed to determine the relative locations of the buoy anchor and the target. Based on that determination, the diver was directed by two-way communications through the zero visibility water conditions to the target location. In compliance with OSHA regulations, a tender on the diving platform controlled a tether to the diver, who was also equipped with the two-way communication system. A standby diver was outfitted on the dive platform during all diving operations, as required.

6.0 FINDINGS AND CONCLUSIONS

6.1 Findings

Target Assessment

Target 11: In the 100 kHz side scan sonar survey conducted in April 1999, a target was observed in approximately the same location on three different survey lines. The two-meter diameter target is situated in the APE and appears to represent a pair of circular objects in a small cluster (refer to Figure 2). During ground truthing operations, the target was re-acquired with the 300 kHz sonar and several passes were made over it using the 50 meter, 20 meter, and 10 meter range scales (Figure 7). The target appears to be a linear object, approximately 1.5 meters (5-feet) in length, oriented in a north-south direction and resting in a circular depression approximately two meters (6-feet) in diameter. At the western edge of the depression, the harder bottom sediments appear to be slightly mounded, which is a typical result of the tidal scouring that creates a depression around objects embedded in the bottom. To the west of the low mound, a second circular depression, more faintly defined is also evident. The location and configuration of the two depressions is consistent with the target observed in the April survey, but the specific nature of the linear object could not be determined from analysis of the side scan image alone. Consequently, a maritime archaeologist conducted a scuba dive on the target.

As described above, a buoy was dropped at the target location and its proximity to the target was confirmed with the sonar. Following buoy deployment and recovery of the sonar, diving operations commenced. Typical zero visibility water conditions were encountered, so target evaluation was conducted solely by touch. The target, which was found resting in a depression, appeared to be a concrete or stone block measuring approximately 10 by 30 centimeters (4 by 12 inches) with an estimated length approaching 4-meters (12 feet). After evaluating the target, the diver conducted a circle sweep of the area surrounding the buoy anchor. The search pattern covered an area within a 9-meter (30-foot) radius of the buoy anchor. No other cultural material was encountered.

Although visual assessment was not possible, acoustic examination and tactile evaluation of the target suggested it is a singular piece of debris, the composition and shape of which was not discernable. It does not appear to be associated with any other cultural material in the area and nothing in any of the archival information gathered for the project gives any indication as to what it might be. From the evaluation that was possible, it does not appear to be either temporally or culturally diagnostic, or capable of meeting any of the significance criteria established for NRHP evaluation. Target 11 has therefore been eliminated as a cultural resource requiring further consideration.

Target 13: In May 1933, fire destroyed the Key System's passenger ferry *Peralta*, 20 rail cars, and the terminal building that stood at the head of the system's mole,³ which once projected nearly 5 kilometers (more than three miles) into San Francisco Bay (refer to photos 1, 2, & 3). The remains of both the *Peralta* and the railroad cars were removed from the damaged mole and the head of the pier was eventually re-built (Oakland Tribune, May 7 1933:1; Walker 1978:28).

Target 13 is a wide-spread feature comprising the partial, disarticulated remains of either the burned pier, or the remains of a portion of the pier as left following its dismantling after abandonment in 1939. As depicted in Figures 3a-g and the sonar mosaic in Figure 4, a portion of the feature is scattered on the north side of the existing span and lies within the boundaries of the APE (refer to Figure 1). As described above, the broad spatial extent of the feature, swift currents, and zero visibility water conditions found in the target area served to make impossible anything other than an acoustic assessment of the feature as a whole. Because the images acquired with the 100 kHz system in April 1999 were not adequate for this assessment (refer to Figures 3a-g, & 4), the Marine Sonics 600 kHz, high resolution sonar system was used in June to intensively re-survey the feature.

³ A mole is an earthen or stone wall constructed in the sea, used as a breakwater and built to enclose or protect an anchorage or a harbor.

Analysis of the images captured in this survey indicate the feature consists almost entirely of disarticulated pilings and lengths of railroad iron scattered over an area approximately 300 x 200 meters (1000 x 650 feet). Pilings range in size from 6 to over 15 meters (20 to 50-feet) in length and many rest crossed, one upon the other (Figures 8-10). The pilings at the eastern side of the feature appear to be upright, still embedded in the bottom sediment. These project approximately 2 meters (7-feet) into the water column (Figure 11). The feature is largely concentrated directly beneath and south of the existing bridge alignment. As indicated in Figure 1, a scattered, less-concentrated portion of the feature also lies on the north side of the bridge, within the boundaries of the APE (Figures 12-15). Taken as whole, the feature comprising target 13 does not meet the test of significance as measured against the NRHP Criteria for Evaluation.

Although the Key System itself may be historically significant, the scattered, disarticulated remains of the pier and terminal that lie within the APE are considered to be non-contributing elements. The remains of the Key System's pier may retain integrity of location, materials and setting, but they lack the integrity of design, workmanship, and feeling that are requisite components of the significance threshold. On the basis of its inability to meet the test of integrity alone, the feature does not meet the NRHP Criteria for Evaluation.

The remains of the pier clearly are associated with events that have made a significant contribution to the broad pattern of our history (criterion a), and are associated with Borax Smith, the system's developer and original owner, and a person significant in our past (criterion b), but they fail to meet criteria c and d. The disarticulated nature of the feature's components and its wide-spread dispersal have destroyed the distinctive characteristics of its type and method of construction that may have met criterion c, and have likewise eliminated the possibility that the feature would yield information important to our history (criterion d).

As mentioned above, in the analysis of the high resolution acoustic data acquired in the June 30 survey of target 13, four distinctive targets were identified within its boundaries that appeared to be unrelated to the remains of the Key System's pier. These were not visible in the data collected in the April 1999 100 kHz survey (refer to Figures 3a-g). The targets lie within the boundaries of the APE and consequently required additional assessment.

Target 13-1 is an aggregate of debris entirely different in appearance from that observed in the debris field associated with the Key System's pier (Figure 16). Its acoustic image suggests it is mounded within an area of approximately 100 square meters (328 square feet), with a surficial expression of as much as 4.5 meters (15-feet). Projecting vertically from the center of the debris field is a beam or pole approximately 60 centimeters (24-inches) in width and 7.7 meters (25-feet) in height. The appearance of this debris field in the acoustic data is markedly different from the

appearance of the remains of the Key System pier. Its location suggests it may be detritus associated with the construction or maintenance of the existing SFOBB East Span, but this could not be determined with certainty on the basis of the sonar data alone. Consequently, a maritime archaeologist conducted a scuba dive to the target. As with all other diving investigations, zero visibility conditions precluded visual assessment of the target, so the examination was conducted by touch.

The central portion of the target is a rectangular concretion projecting through the bottom sediments. Above it, a tangle of 7.5 to 13 centimeter (3 to 5-inch) diameter iron pipes project in various directions. Two of the largest pipes project vertically from the rectangular concretion and turn 90 degrees, one to the north, the other to the south. The pipe trending to the south is bent, undulating up and down along its length. It continues into a second pile of intertwined pipes, steel cable, and wood boards that lead off in several direction. A 20 to 30-centimeter (8 to 12-inch) diameter pipe rests near a solid, cylindrical object approximately 1-meter (3-foot) in diameter. Scattered around the perimeter of the large pile of wood and cable were smaller pieces of wood, cable, and pipe.

Although target 13-1's acoustic image is significantly different from those of the other remains of the Key System's pier, it appears that the conglomeration of pipe, wood, and intertwined cable is more debris from the Key System's pier and the structures that once stood upon it. As discussed below, the debris does not appear to be either temporally or culturally diagnostic, nor is it capable of meeting any of the significance criteria established for NRHP evaluation. Consequently, target 13-1 requires no further consideration.

As depicted in Figure 17, the second target identified within the Key System pier debris field is rectangular in shape and appears to be fabricated from a type of large open-mesh material. Designated as target 13-2, this object is approximately 1.8 meters (6-feet) long and 1.3 meters (4-foot) wide and projects approximately 3.3 meters (11-feet) above the bottom surface. Two rectangular handles appear to protrude from the target's upper end. These appear to be 75 centimeters (30-inches) long and 40 centimeters (16-inches) wide. A cable or rod approximately 8 meters (26-feet) long is attached to the southeast corner of the target. This may be slightly bowed relative to the bottom surface. A long, possibly triangular object, approximately 6 meters (20-feet) in length lies about 1.5 meters (5-feet) from the southwest corner of the target. This linear object appears to project into the water column as much as 1.7 meters (5.5-feet). The configuration of target 13-2 and its proximity to the existing bridge suggest it may be a piece of maintenance equipment, possibly a large basket-like carrier. As with target 13-1, a diving assessment was necessary to determine the exact nature of the target.

Tactile evaluation of the target determined that it is a concrete block, approximately 2-meters (6-

feet) square. Four evenly spaced rows of four steel I-beams project 50 to 60 centimeters (1.5 to 2-foot) from the top surface of the block. Two rows of two steel I-beams project from the two sides of the block that were exposed above the bottom sediments. Numerous strands of thin plastic-coated cable are intertwined and wrapped around the projecting I-beams. A 75-centimeter (2.5-foot) diameter cylindrical object rests approximately 2-meters (6-feet) to the southeast of the block. The material from which it was fabricated could not be determined.

The block may be associated with the structural elements of the Key System pier, but its seemingly relatively modern appearance suggests it is more likely discarded construction debris. Its nature suggests it is neither temporally nor culturally diagnostic. Consequently, target 13-2 need not be considered further.

The acoustic image of target 13-3 suggests an object that is approximately 5.8 meters (19-feet) in length and 25 centimeters (10-inches) thick. Its southern end appears to project above the bottom surface nearly 4.5 meters (15-feet) in a long sweeping arc (Figure 18). Although it appeared to be a length of cable or a bowed piece of metal, its position in the water column and the shadow it projects suggested it might be something more substantial. A diving assessment was determined necessary in order to ascertain its exact nature.

Tactile evaluation of the target determined it to be a length of railroad iron, approximately 8-meters (25-feet) in length. It has been bent and projects above the bottom approximately 3.5-meters (12-feet) in a long, graceful arch. Its western end is buried in the bottom sediments, while the eastern end terminates in a small pile of three or four shorter pieces of bent railroad iron, all of which lie flat on the bottom. Target 13-3 is not considered to be diagnostic and does not meet any of the criteria of significance and need not be considered further.

As depicted in Figure 19, target 13-4 appears to be a singular large, triangular mound of material with sharply-defined edges. It projects approximately 5.6 meters (18-feet) into the water column and covers an area of 42 square meters (140 square feet). It appears to be approximately 7 meters (23-feet) long and 6 meters (20-feet) wide, although the more substantive portion of the mound is closer to 3 meters (10-feet) in width. The mound does not appear to be associated with the light scatter of debris lying approximately 17 meters (55-feet) to the south. The singular, compact nature of this target and its unusual configuration required a diving assessment to determine its exact nature.

In reacquiring the target's location with the 600 kHz sonar system, multiple views of its configuration were taken (Figure 20). Analysis of these images suggested a slightly different arrangement of the target's components. Rather than the sharply-defined, triangular object

observed in the original sonar image (refer to Figure 20), the target appeared to be a conglomeration of long, flat objects - possibly timbers or more railroad iron. A diving assessment of the target was conducted in order to determine its nature and to clarify the ambiguity of the sonar record.

Target 13-4 is an amalgamation of numerous flat, wood planks, approximately 30 centimeters (12-inch) wide, 2 to 3-meters (6 to 10-feet) long, and 4 to 5 centimeters (1.5 to 2-inches) thick. The planks overlap each other and are lying in a north-south orientation. Several planks cross the main portion of the target at various angles. Tidal scour around and beneath the pile is substantial, so that several larger timbers, perhaps 10 centimeters (4-inches) square in size, lie across the depression, effectively suspended above the bottom. Intermixed in the pile of flat planks are several 10 by 20-centimeter (4 by 8-inch) planks, as well as several 20 by 20 centimeter (8 by 8-inch) and 30 by 30 centimeter (12 by 12-inch) square beams, the latter crossing the pile at approximately a 90-degree angle to the general orientation of the other components. Spike holes penetrate the flat planks but no fasteners were located.

Target 13-4 appears to be structural remains of the Key System pier, intermixed with elements of a structure that perhaps once stood on the pier itself. No other cultural material was located in or around the debris constituting the target. Nothing in the debris pile appeared to be either temporally or culturally diagnostic. Consequently, the debris constituting target 13-4 need not be considered further.

Target 19: In the sonar data collected with the 100 kHz system during the April 1999 remote sensing survey, three targets were identified on alternate survey lines and on a perpendicular tie-line transect. The targets appeared to lie in close proximity to each other, and were situated immediately adjacent to the west side of target 13. Subsequent evaluation of the sonar records determined that the images were all of the same target, which was designated as Target 19. Target 19 is situated near the middle of the APE's western boundary (refer to Figure 1). During the ground truthing operations conducted on July 15, 1999, several transects were surveyed over the target's coordinates with the 300 kHz systems, using 50 meter, 20 meter and 10 meter range scales in order to reacquired it.

The sonar images of target 19 depicts a target that is nearly rectangular in shape (Figure 21). It is approximately 2.8 meters (9-feet) long, 1.3 meters (4-feet) wide, and is approximately 1.3 meters (4-feet) in height. It rests in a north-south orientation in a surrounding depression approximately 60 centimeters (24-inches) deep. Its rectangular configuration clearly suggests the target is cultural in origin but the nature of the object could not be determined from analysis of the side scan image alone. Consequently, a scuba dive was conducted on the target.

As described above, a buoy was dropped at the target location and its proximity to the target was confirmed with the sonar. The buoy anchor was dropped within 6 meters (20-feet) of the target location, a degree of accuracy considered quite good given the strength of the tidal current. Following buoy deployment and recovery of the sonar, diving operations commenced. Typical zero visibility water conditions were encountered. As with the evaluation of target 11, assessment of target 19 was conducted solely by touch.

The target appeared to be either a concrete or stone block. A metal pipe protruded from one end of the block and another angled away from one side (Figure 22). Although it could not be determined with certainty, the 7.5 centimeter (3-inch) diameter pipes felt as if they were fabricated of iron. The ends of both pipes and the north end of the block were buried in the bottom sediment, so their overall length could not be determined.

A circle sweep of the surrounding area indicated the block was situated northeast of a large scatter of stones that covered an area of at least 30 square meters (100-square feet). The stones at the northern end of the scatter were too large to be moved by an individual, but decreased in size towards the southern edge. The extent and nature of the scatter suggested the stones may be an exposed portion of the natural geologic substrate. As discussed below, the subsequent geologic analysis of samples recovered from the stone scatter confirmed this interpretation.

Archival research conducted for the project gives no indication of the presence of any cultural material in this area. Although visual assessment was not possible due to the diving conditions, acoustic examination and tactile evaluation of target 19 suggest it is neither temporally nor culturally diagnostic.

Summary of Targets

Target	Size	Description
11	~10 X 30 X 400 cm (4 X 12 X 144 in.)	Concrete or stone block - non-diagnostic.
13	~300 x 200 meters (1000 x 650 feet)	Feature comprising the partial, disarticulated, burned remains of the Key System's pier and terminal.
13-1	~100 square meters (328 square feet) Surficial expression of ~4.5m (15-feet).	Rectangular concretion projecting through the bottom sediments. Above it, iron pipes project in various directions. A second pile of intertwined pipes, steel cable, and wood boards lead off in several direction. Scattered around the perimeter of the large pile of wood and cable are smaller pieces of wood, cable, and pipe.

Target	Size	Description
13-2	~2m (6 ft.) square.	Concrete block with four rows of four steel I-beams projecting 50 to 60 cm (1.5 to 2 ft.) from the top surface. Two rows of two steel I-beams project from the two sides of the block. Numerous strands of thin plastic-coated cable intertwine and wrap around the I-beams. A 75cm (2.5 ft) dia. cylindrical object lies ~ 2m (6 ft.) SE of the block.
13-3	~8m (25 ft.) x 25cm (10 in.)	A piece of railroad iron, ~8m (25 ft.) in length. It has been bent and arches above the bottom approximately 3.5m (12 ft.). Western end is buried in the bottom sediments, eastern end terminates in a small pile of three or four shorter pieces of bent railroad iron, all of which lie flat on the bottom.
13-4	~42m sq.(140 sq. ft.). ~7m (23 ft.) x 6m (20 ft.)	Numerous flat, wood planks, ~30 cm (12 in.) wide, 2-3m (6-10 ft.) long, and 4-5 cm (1.5 - 2in.) thick. Planks overlap each other and are lying in a north-south orientation. Several larger timbers, ~10cm (4 in.) sq. lie across a bottom depression, effectively suspended above the bottom. Intermixed with the flat planks are several 10 x 20cm (4 x 8in.) planks, 20 x 20cm (8 x 8in.) and 30 x 30 cm (12 x 12in.) sq. beams. Target appears to be structural remains of the Key System pier, intermixed with elements of a structure that perhaps once stood on the pier itself.
19	~2.8m (9 ft.) x 1.3 m (4 ft.) x 1.3m (4 ft.) in height	A concrete or stone block resting in a N-S orientation in a 60cm (24 in.) deep depression. A metal pipe protrudes from one end of the block and another angles away from one side.

6.2 Conclusions

Scheduling considerations pertinent to the inception of the PIDP dictated that the ground truthing operations for the seven acoustic targets situated within the APE commence in highly unfavorable diving conditions. The unusually dynamic tidal exchanges that occurred during the three days comprising the first phase of ground truthing operations created very short intervals of slack water, and very swift currents during both the ebb and flood tidal cycles. Consequently, diving opportunities were severely limited, visibility in the water column was reduced to zero, and current velocity seriously impacted the diver's ability to conduct more than cursory target assessments.

Nevertheless, the ground truthing operations conducted on the targets within the APE were successful and sufficient data was gathered to assess their nature and significance. On the basis of

the ground truthing evaluation, none of the seven remote sensing targets identified within the APE appear to meet the NRHP Criteria for Evaluation of significance and need not be considered in further planning for the PIDP. Target 11 is a singular, linear object that is likely either a concrete or stone block, not associated with any other cultural material in the area. It is neither temporally or culturally diagnostic, nor capable of meeting any of the significance criteria established for NRHP evaluation.

Target 13 is the wide spread, scattered remains of the Key System pier. Although it is clearly associated with both events and people important to our regional history, it lacks the requisite integrity of design, workmanship, and feeling necessary for consideration of significance and would be a non-contributing element to any evaluation of the Key System's historical significance. The disarticulated remains of the pier lying within the project's APE will not yield any information important in history that cannot be gathered from other contemporary sources. For the same reasons, the four separately identified targets within its boundaries (targets 13-1 through 13-4) also are considered non-contributing elements and need not be considered further.

Target 19 is a non-diagnostic irregularly-shaped stone or concrete block with metal pipe protruding from two sides. It does not appear to be culturally or temporally diagnostic and need not be considered further. Samples from the adjacent stone scatter were analyzed and determined to be metamorphosed lithic wacke sandstone, probably from the Franciscan complex that underlie the bottom sediments, and part of the natural geological substrate.⁴

Archival research conducted for the project gives no indication of the presence of any cultural material in this area. Although visual assessment was not possible due to the diving conditions, acoustic examination and tactile evaluation of target 19 suggest it is neither temporally nor culturally diagnostic.

In conclusion, none of the seven acoustic targets identified in the remote sensing surveys of the underwater archaeological APE need to be considered in further planning for the PIDP. As a practical matter, the locations of the objects constituting the targets should probably be avoided simply to eliminate the possibility of attempting to drive a pile through the object. From a cultural resource standpoint, however, none of the objects investigated are capable of meeting the criteria of significance and therefore need not be considered further.

⁴ Lithic analysis was conducted by geologist Jeff Unruh and the staff at the geological engineering firm of William Lettis and Associates, Walnut Creek, California.

It is Caltrans policy to avoid cultural resources whenever possible. If subsurface cultural materials are encountered during construction, it is Caltrans policy that work in that area must halt until a qualified archaeologist can evaluate the nature and significance of the find (Environmental Handbook, Vol. 2, Chapter 1).

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APPENDICES

Appendix A

FIGURES

CULTRANS Env. Planning *Maria Delaney* 2/1/99
FWS Area Engineer *[Signature]* 2-1-99

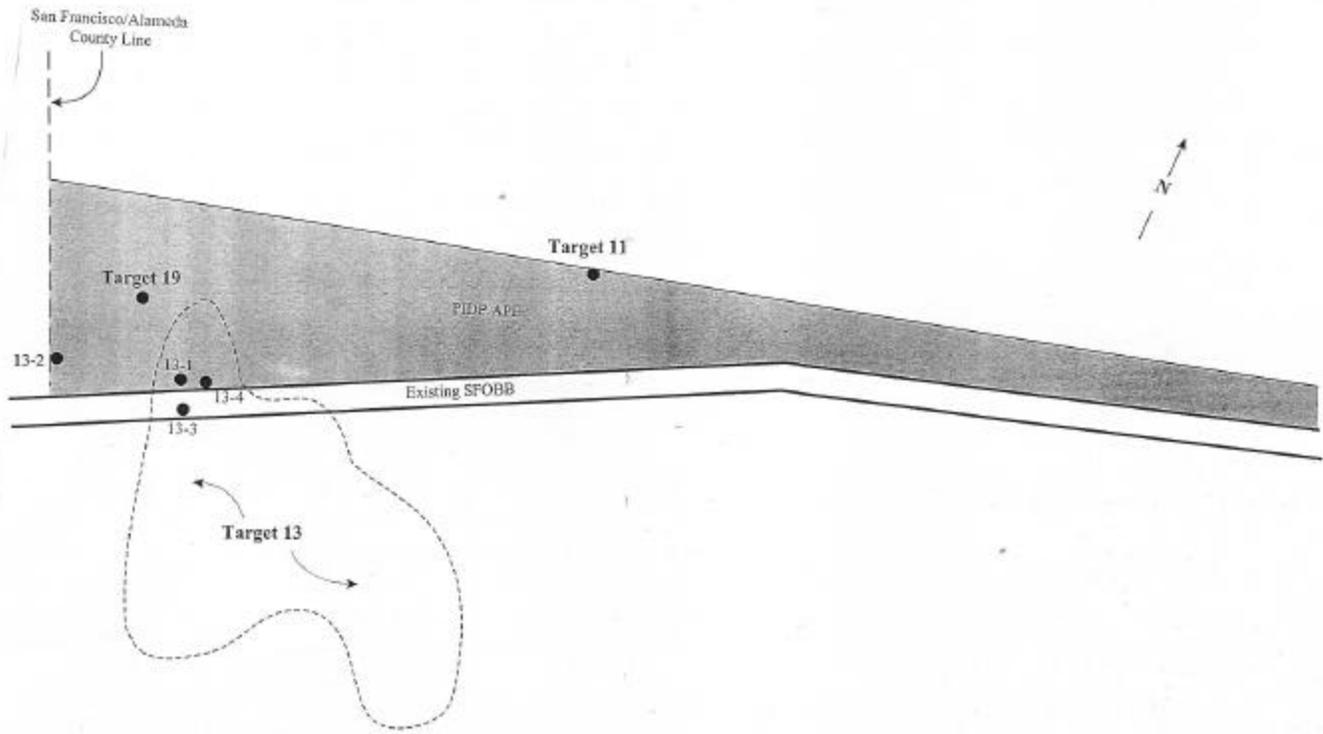
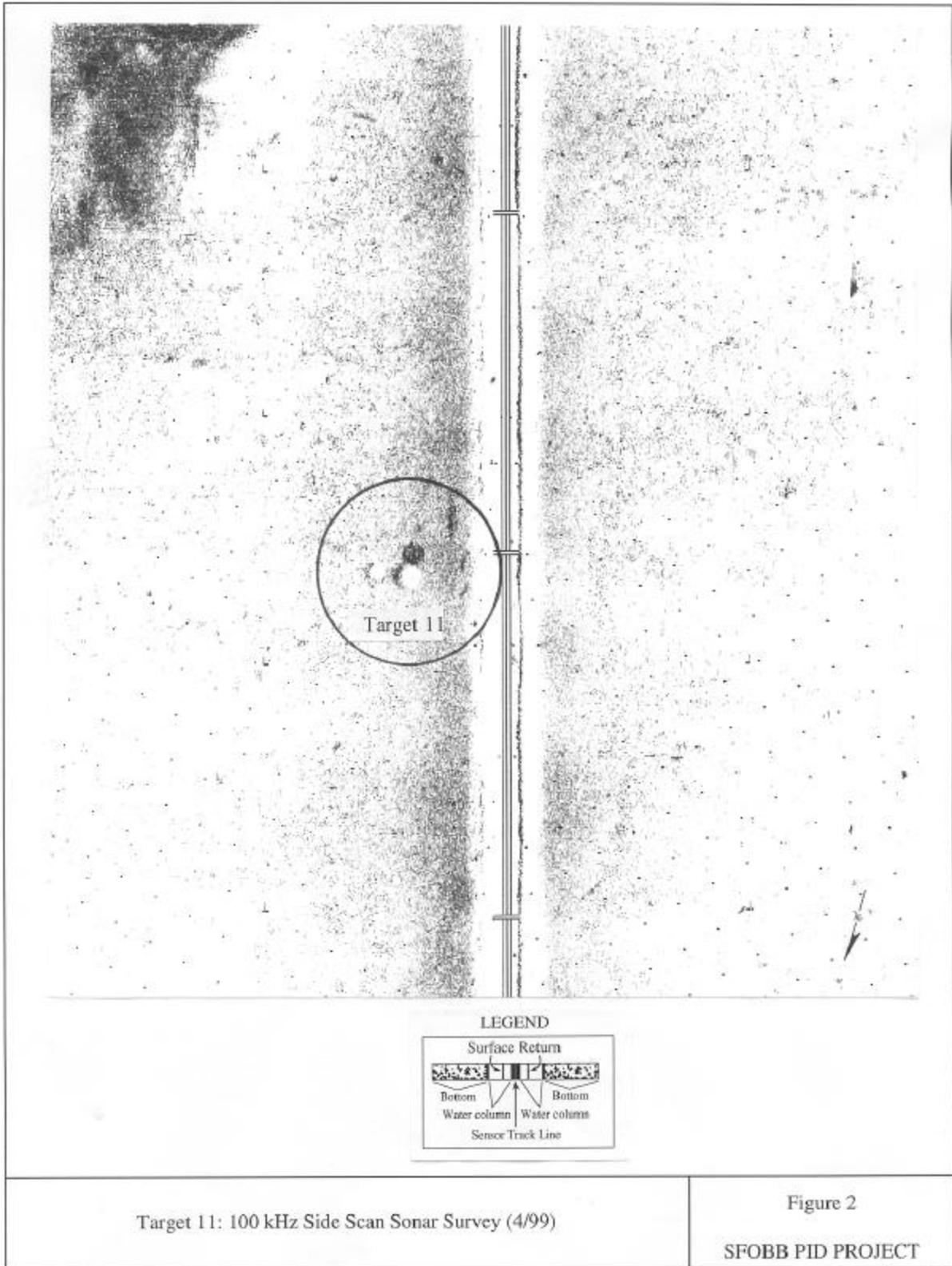
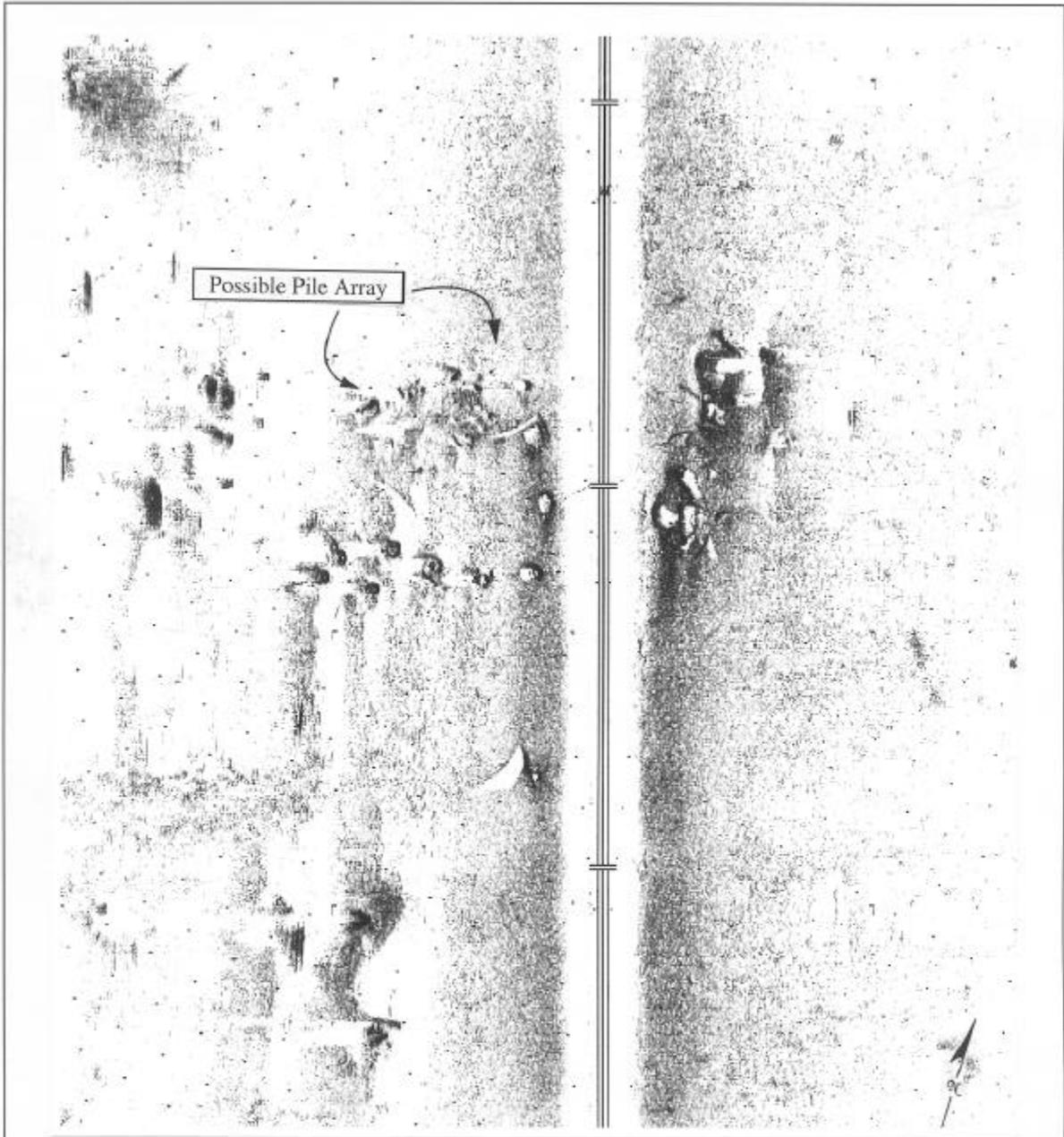


Figure 1
Location of Remote
Sensing Targets in
PIDP APE
SFOBB PID PROJECT

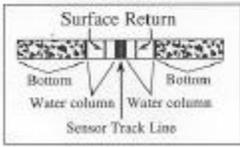


Target 11: 100 kHz Side Scan Sonar Survey (4/99)

Figure 2
SFOBB PID PROJECT

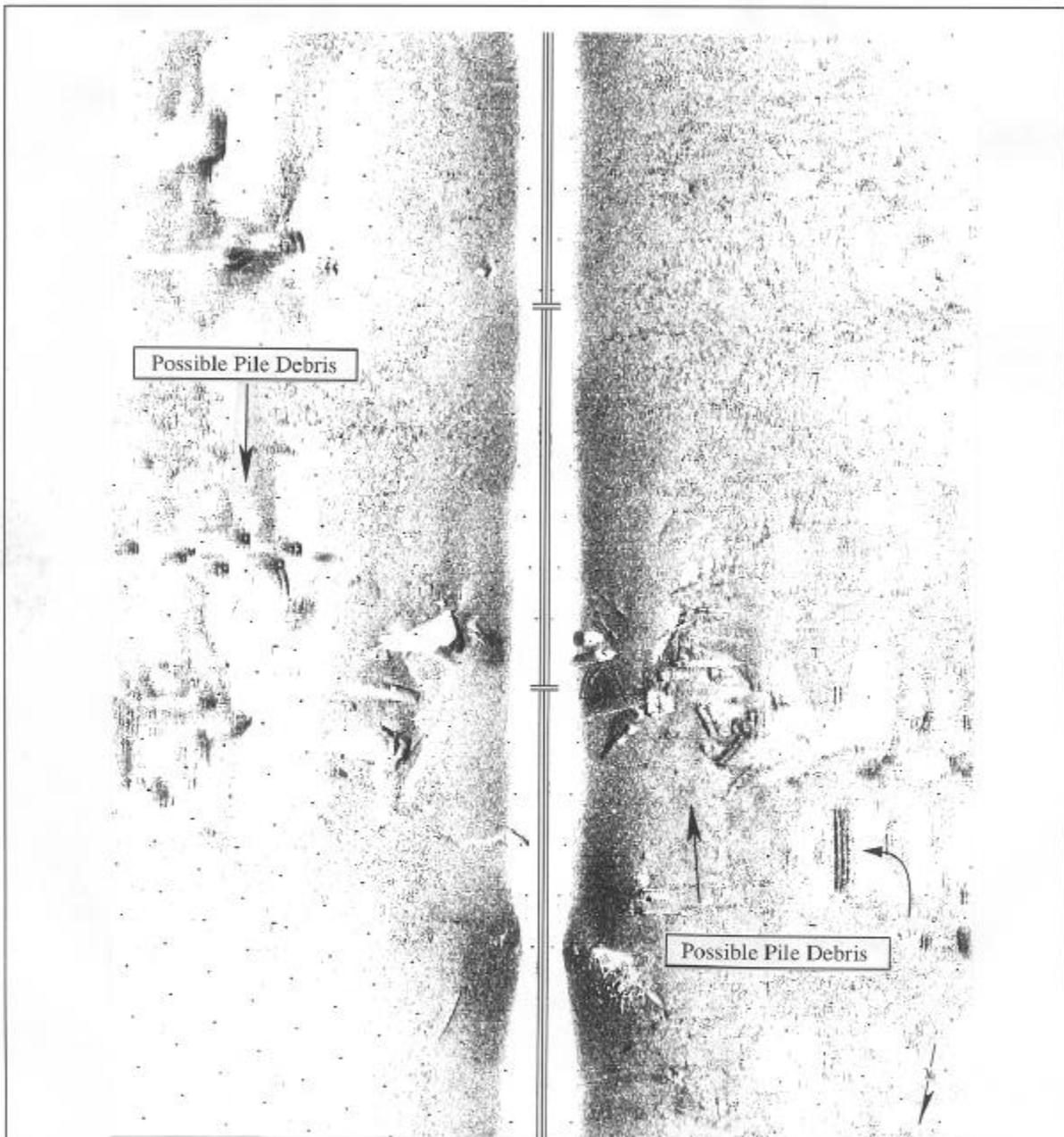


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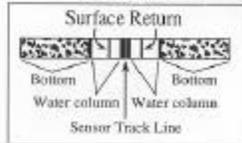


Target 13: 100 kHz Side Scan Sonar Survey (4/99)

Figure 3a
SFOBB PID PROJECT



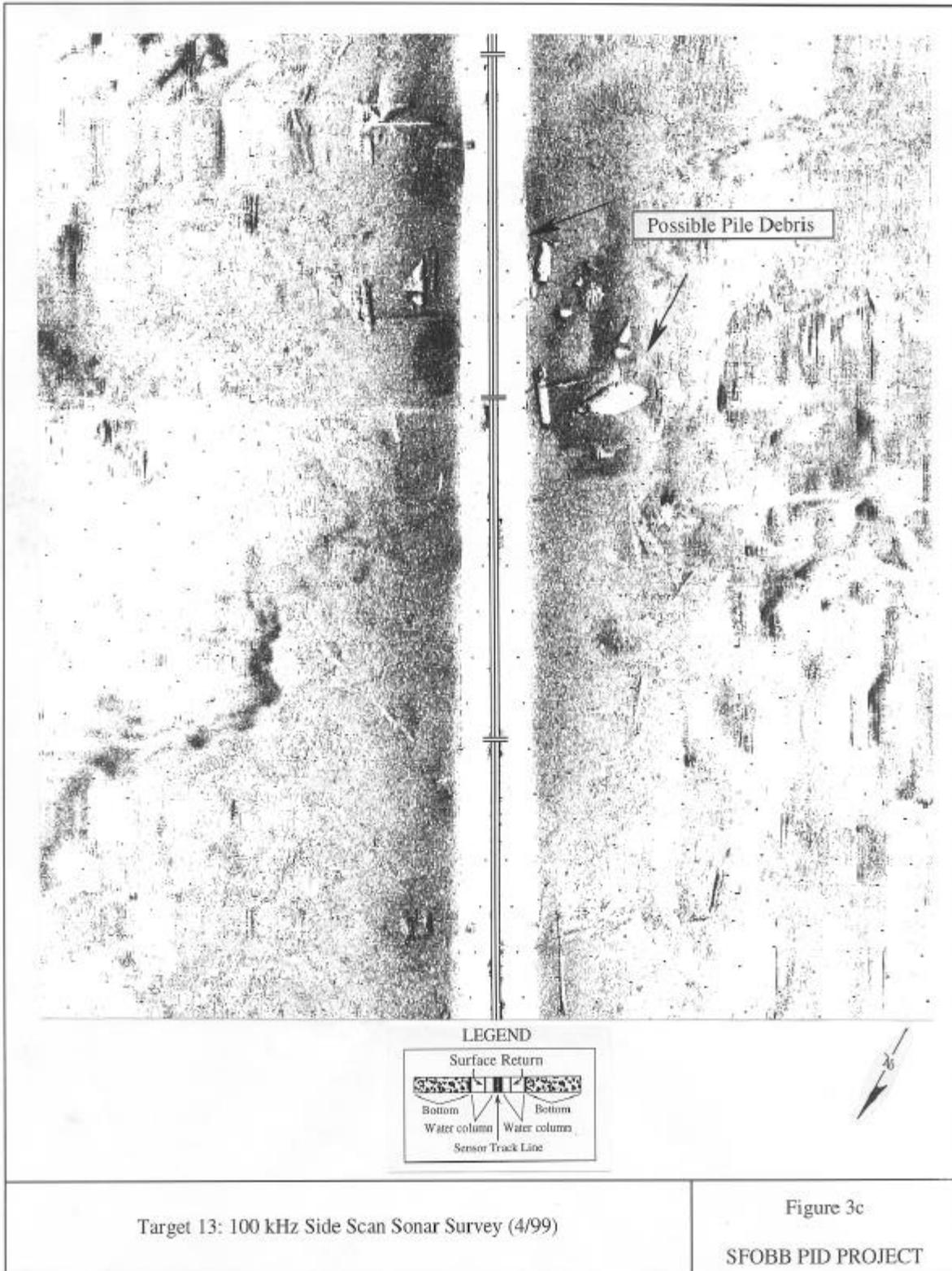
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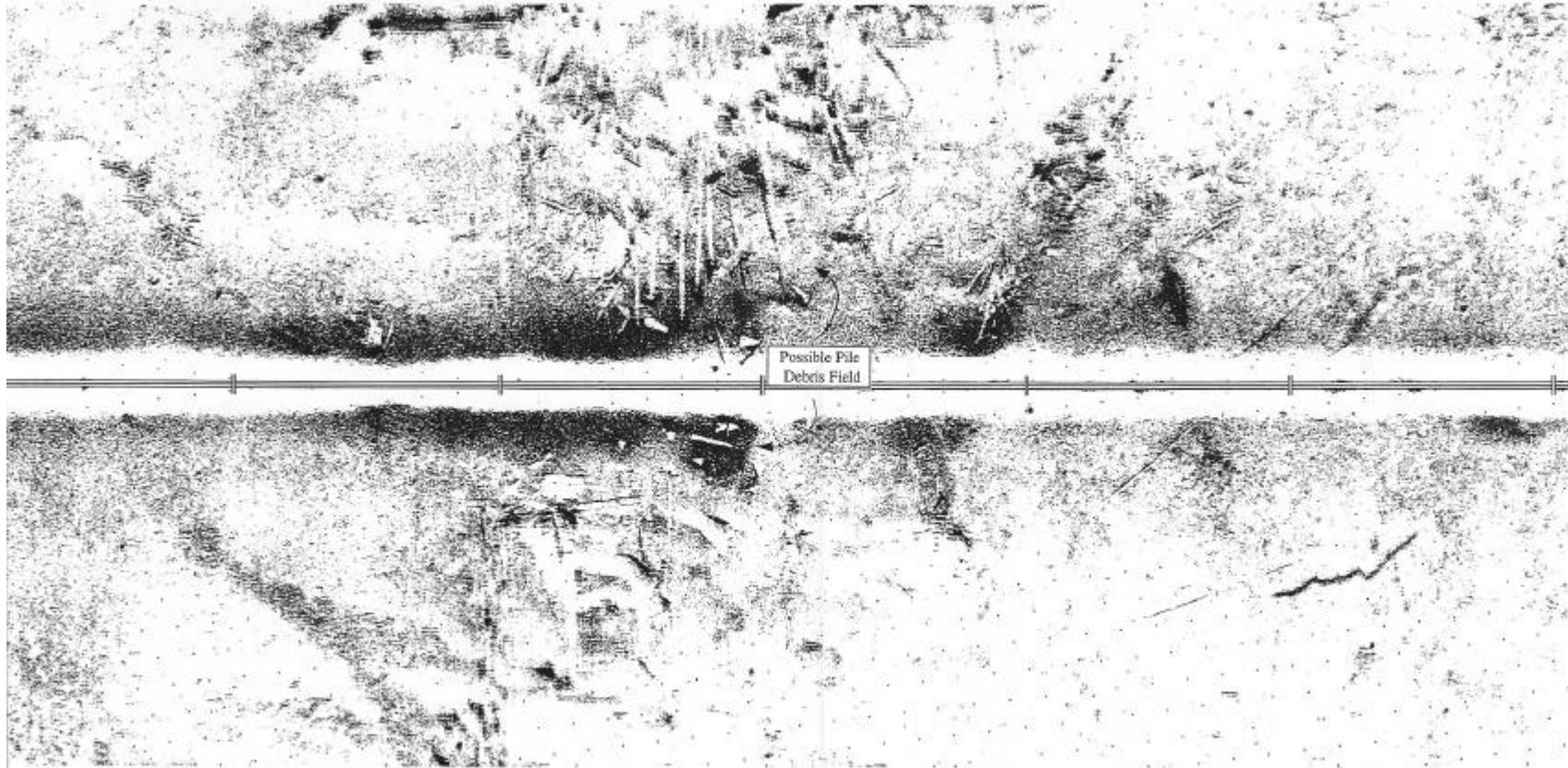
Figure 3b

SFOBB PID PROJECT



Target 13: 100 kHz Side Scan Sonar Survey (4/99)

Figure 3c
 SFOBB PID PROJECT



Possible Pile
Debris Field

LEGEND

Surface Return

Debris

Water column

Water column

Sensor Track Line



Figure 3d
Target 13: 100 kHz Side
Scan Sonar Survey
SFOBB PID PROJECT

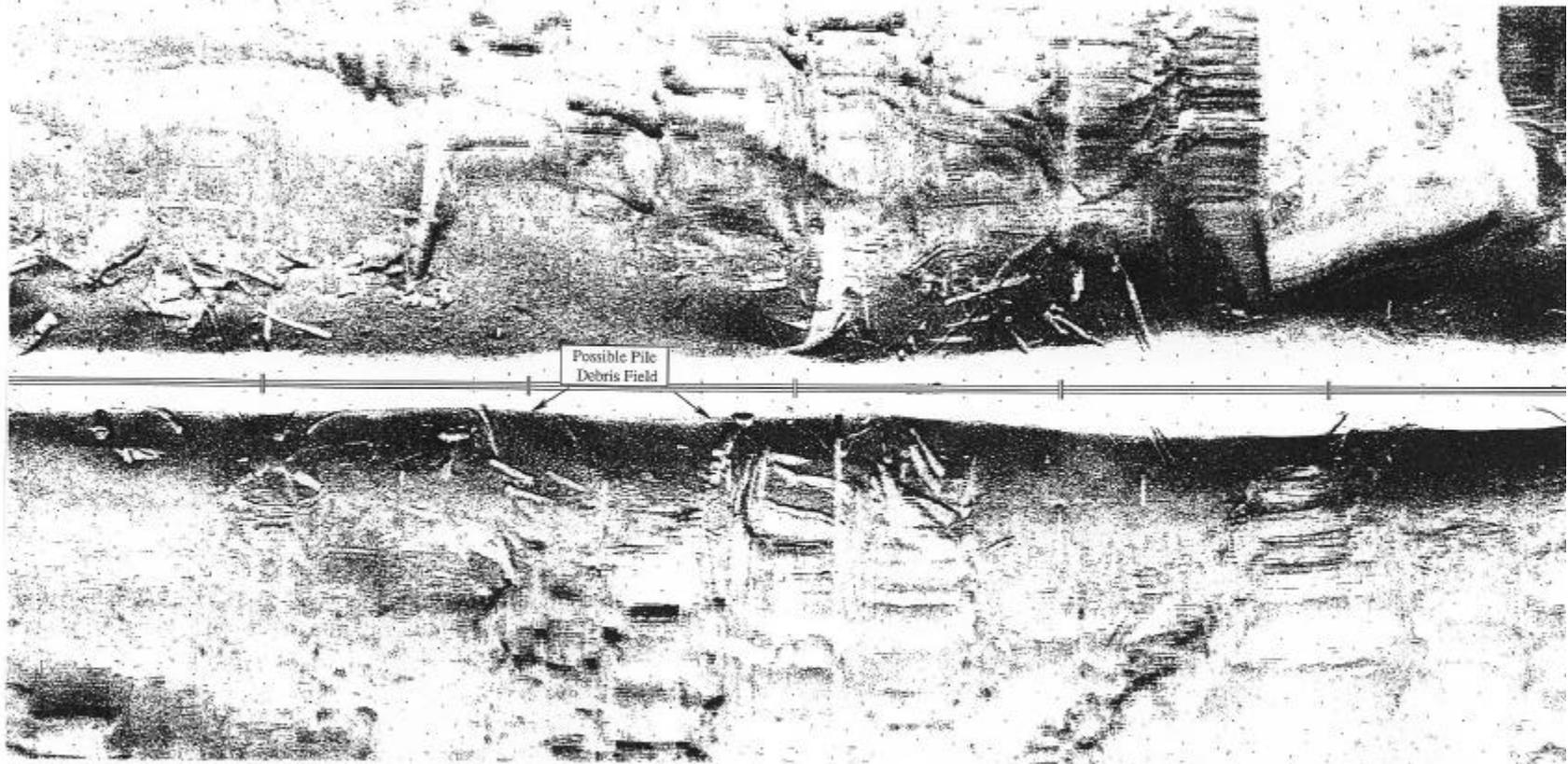
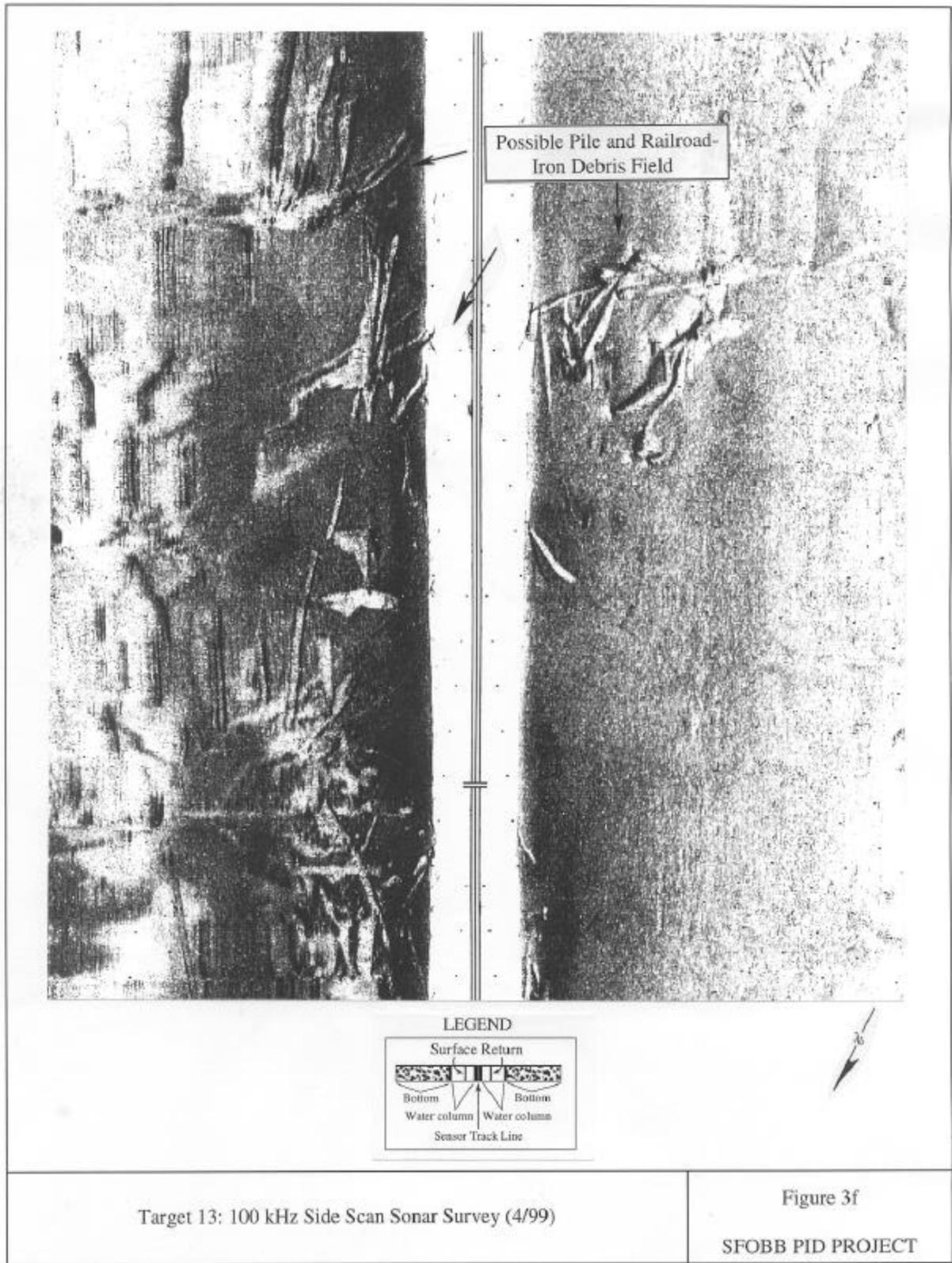
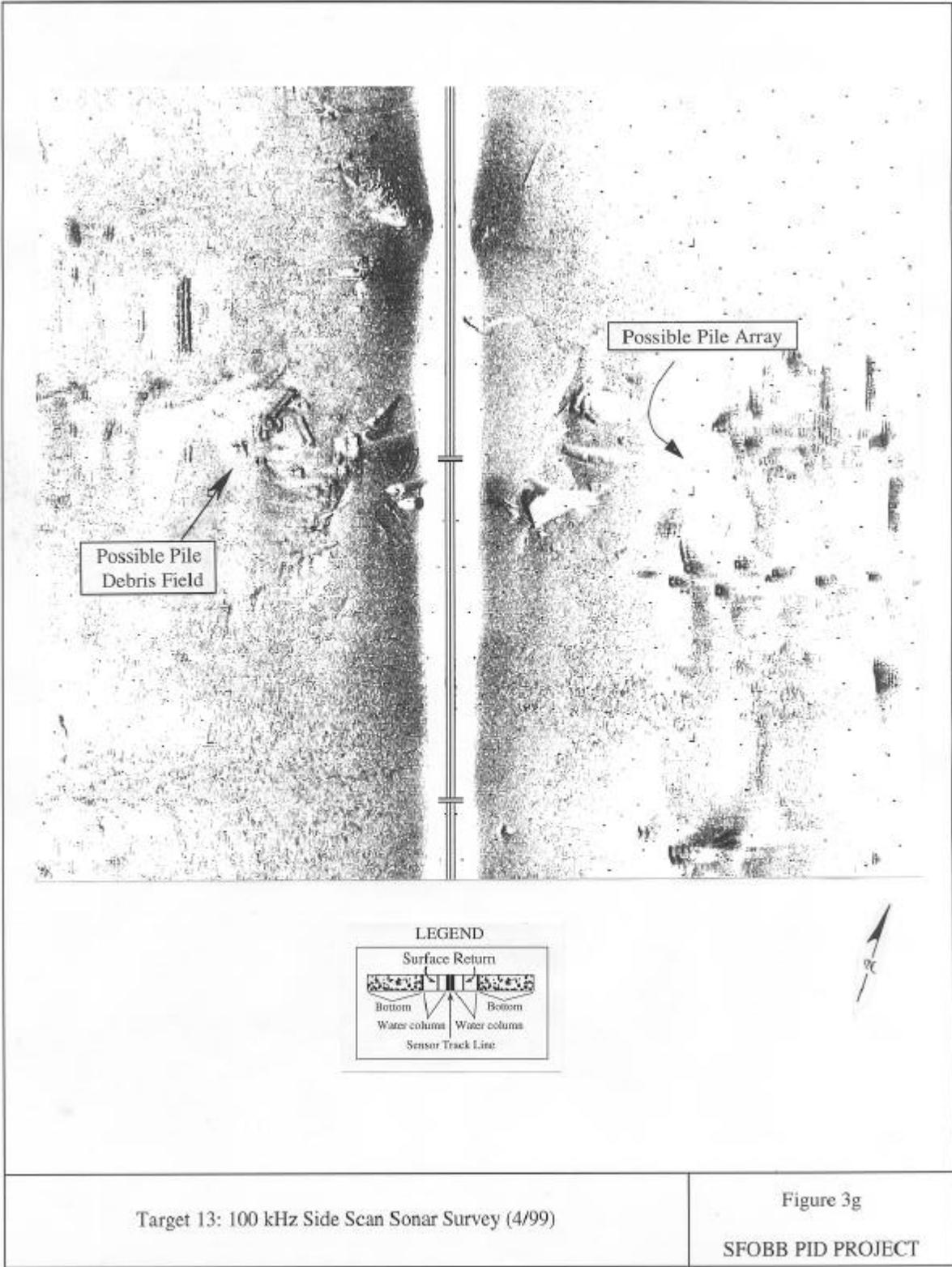


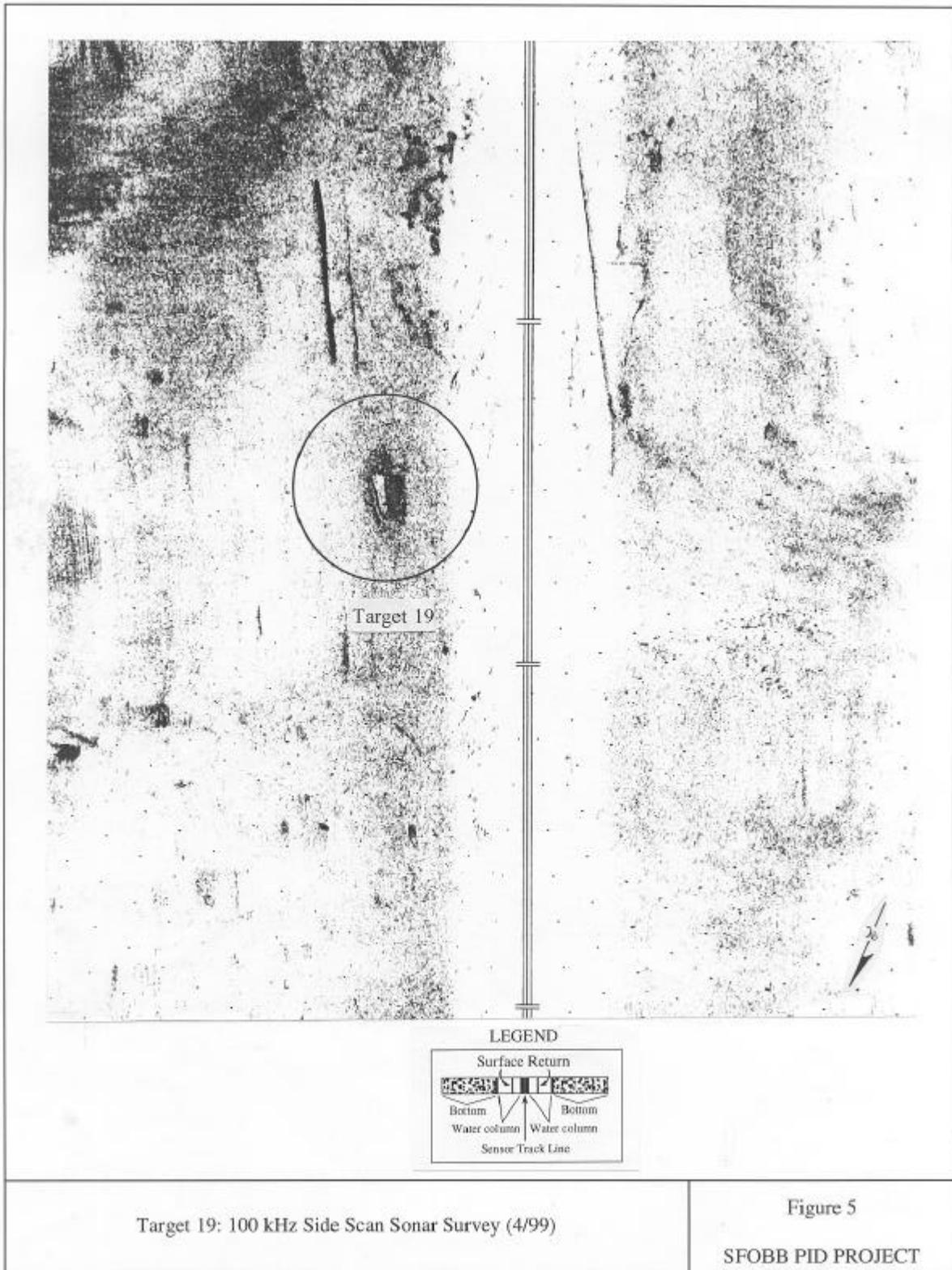
Figure 3e
Target 13: 100 kHz Side
Scan Sonar Survey (4/99)
SFOBB PID PROJECT

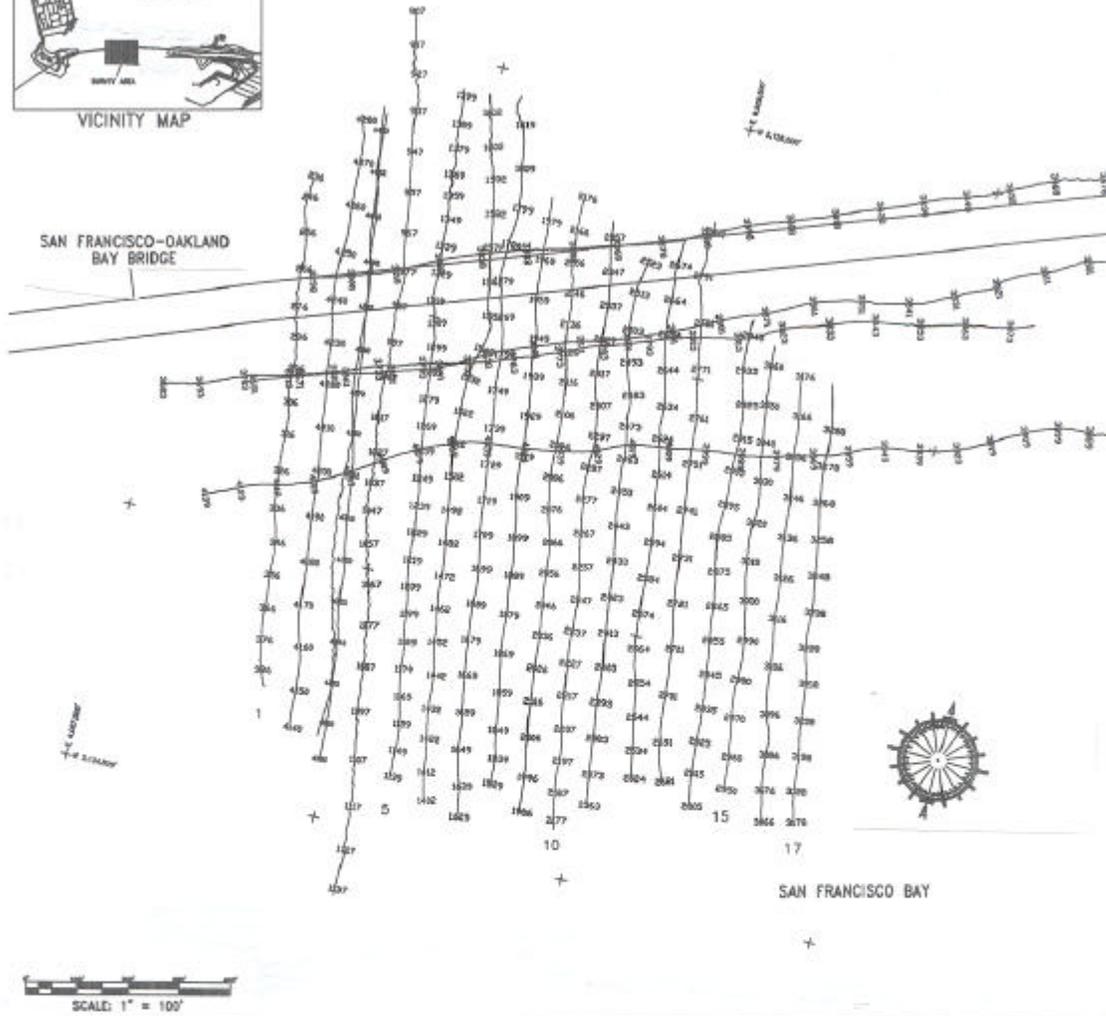
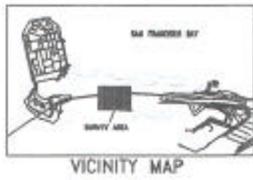




Target 13: 100 kHz Side Scan Sonar Survey (4/99)

Figure 3g
SFOBB PID PROJECT

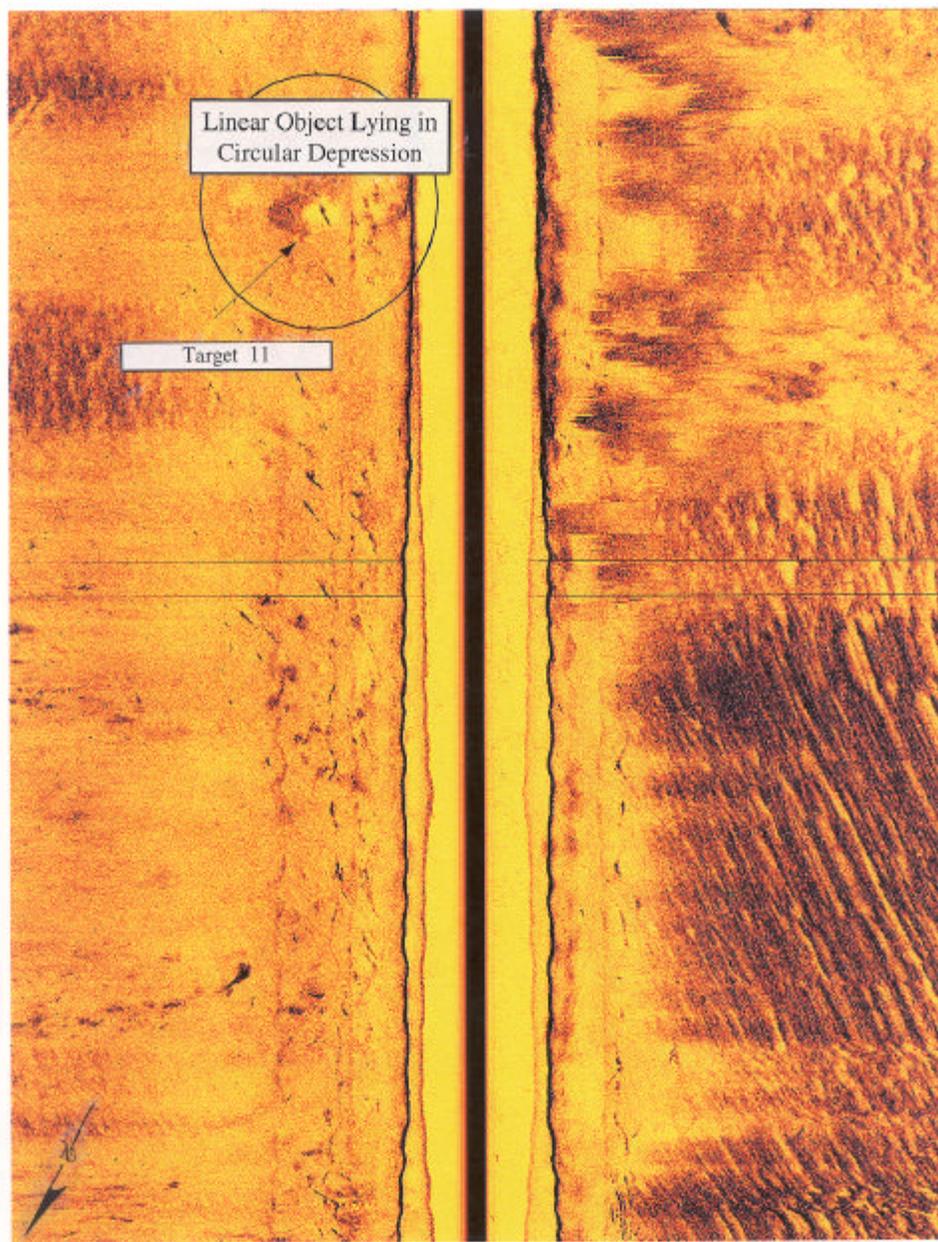




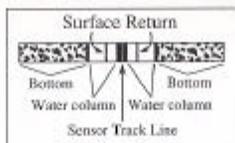
MARINE ARCHAEOLOGICAL SURVEY SIDESCAN SONAR TRACKLINE CHART JUNE 30 1999	
WILLIAM SELF ASSOCIATES 810 AVENUE DE ORINDA ORINDA, CA 94553 (925) 253-8970	
SURVEY PERFORMED BY: See Surveyor, Inc. William Self, Principal David A. Johnson, V.P. P.O. Box 208	SCALE: 1" = 100' Sheet No. 1 of 1

Survey Transects Over Target 13: 600 kHz Side Scan Survey

Figure 6
SFOBB PID PROJECT



LEGEND



Target 11
20 Meter Range Scale. 300 kHz Side Scan Survey

Figure 7
SFOBB PID PROJECT



Portion of Target 13
50 Meter Range Scale. 600 kHz Side Scan Survey

Figure 8
SFOBB PID PROJECT



Portion of Target 13
50 Meter Range Scale. 600 kHz Side Scan Survey

Figure 9
SFOBB PID PROJECT

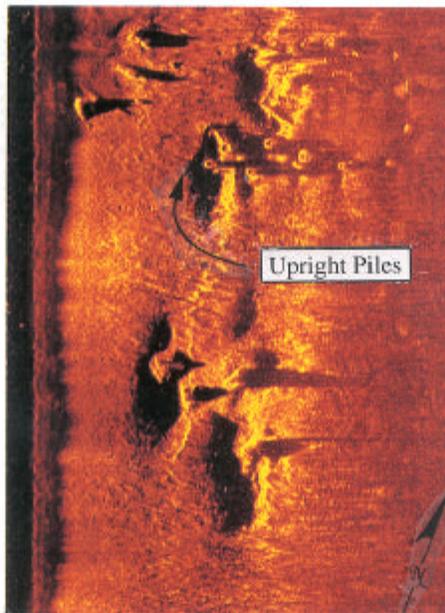
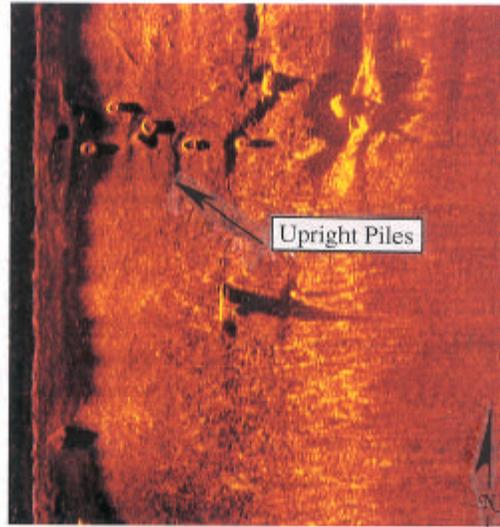


Sensor Track Line



Portion of Target 13
50 Meter Range Scale. 600 kHz Side Scan Survey

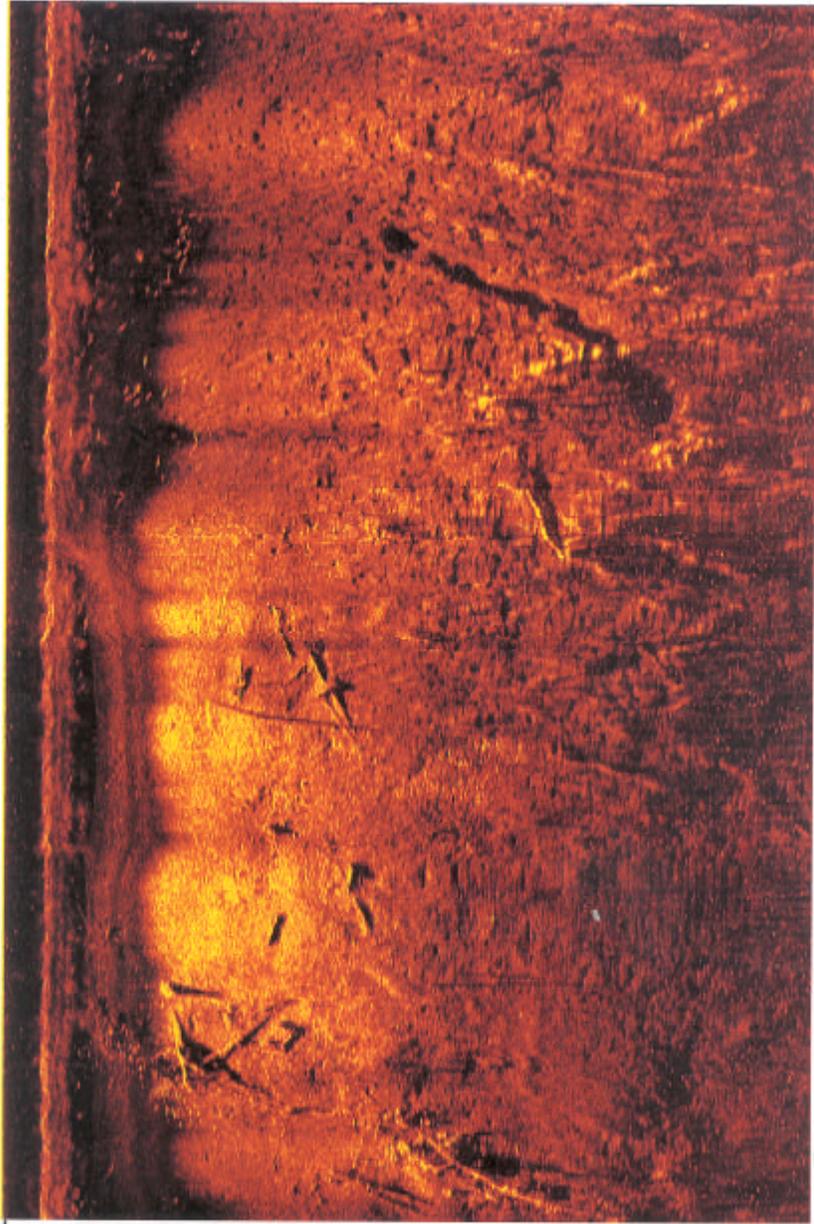
Figure 10
SFOBB PID PROJECT



Sensor Track Line

Portions of Eastern Side: Target 13
50 Meter Range Scale. 600 kHz Side Scan Survey

Figure 11
SFOBB PID PROJECT



Sensor Track Line

Target 13, North Side. 600 kHz Side Scan Sonar Survey

Figure 12
SFOBB PID PROJECT



Sensor Track Line

Target 13, North Side. 600 kHz Side Scan Sonar Survey

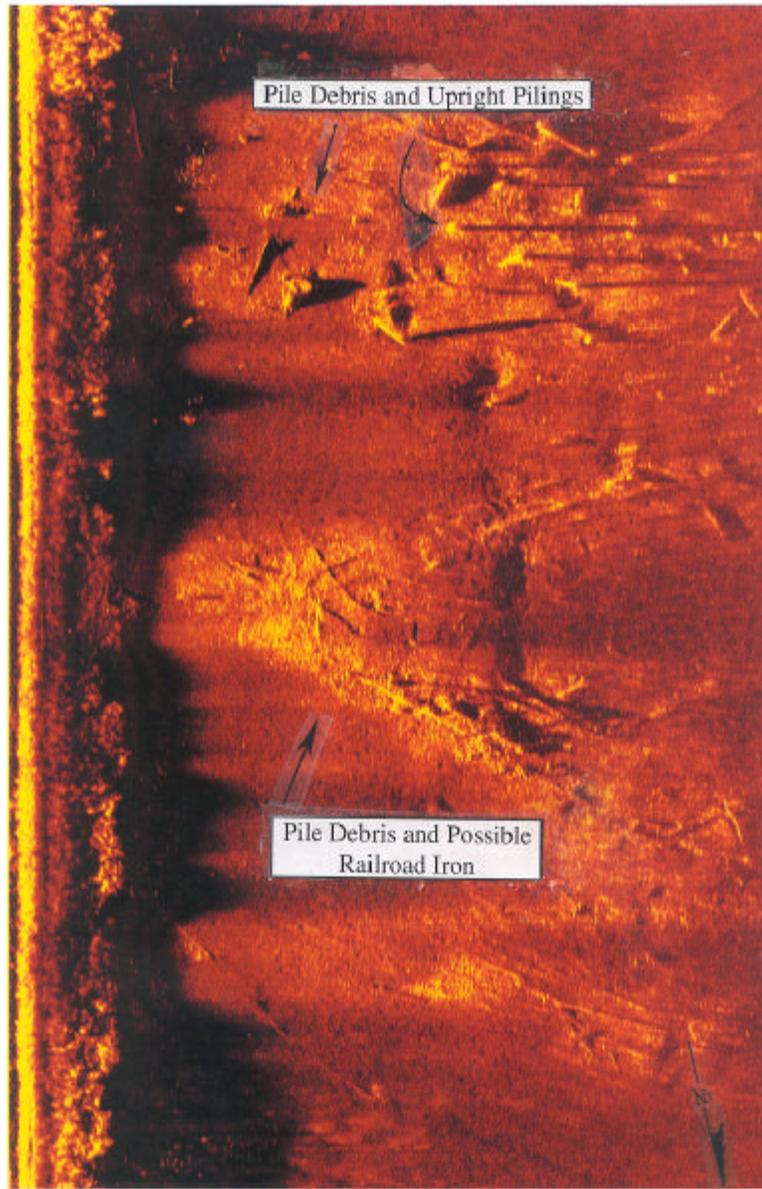
Figure 13
SFOBB PID PROJECT



Sensor Track Line

Target 13, North Side. 600 kHz Side Scan Sonar Survey

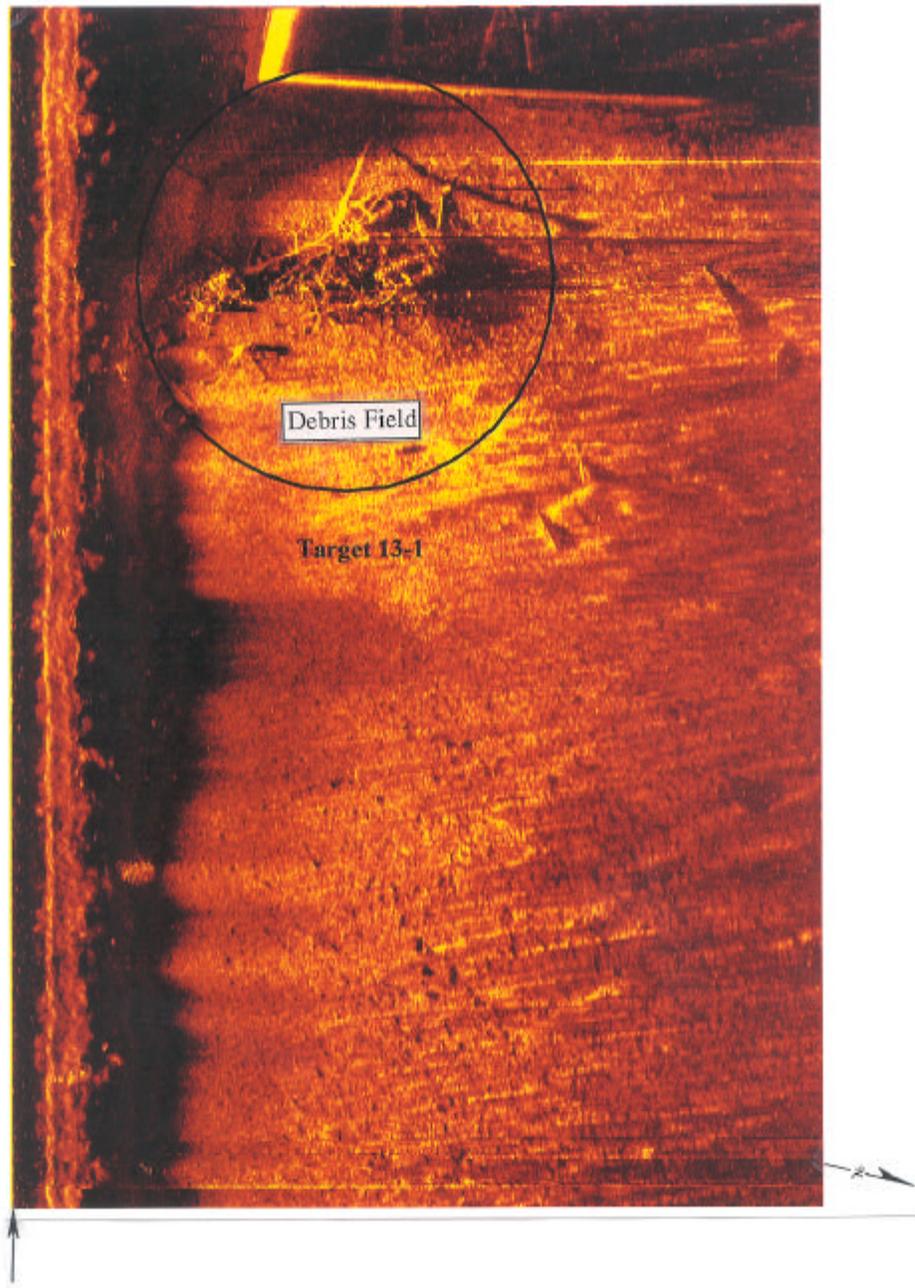
Figure 14
SFOBB PID PROJECT



Sensor Track Line

Target 13, North Side. 600 kHz Side Scan Sonar Survey

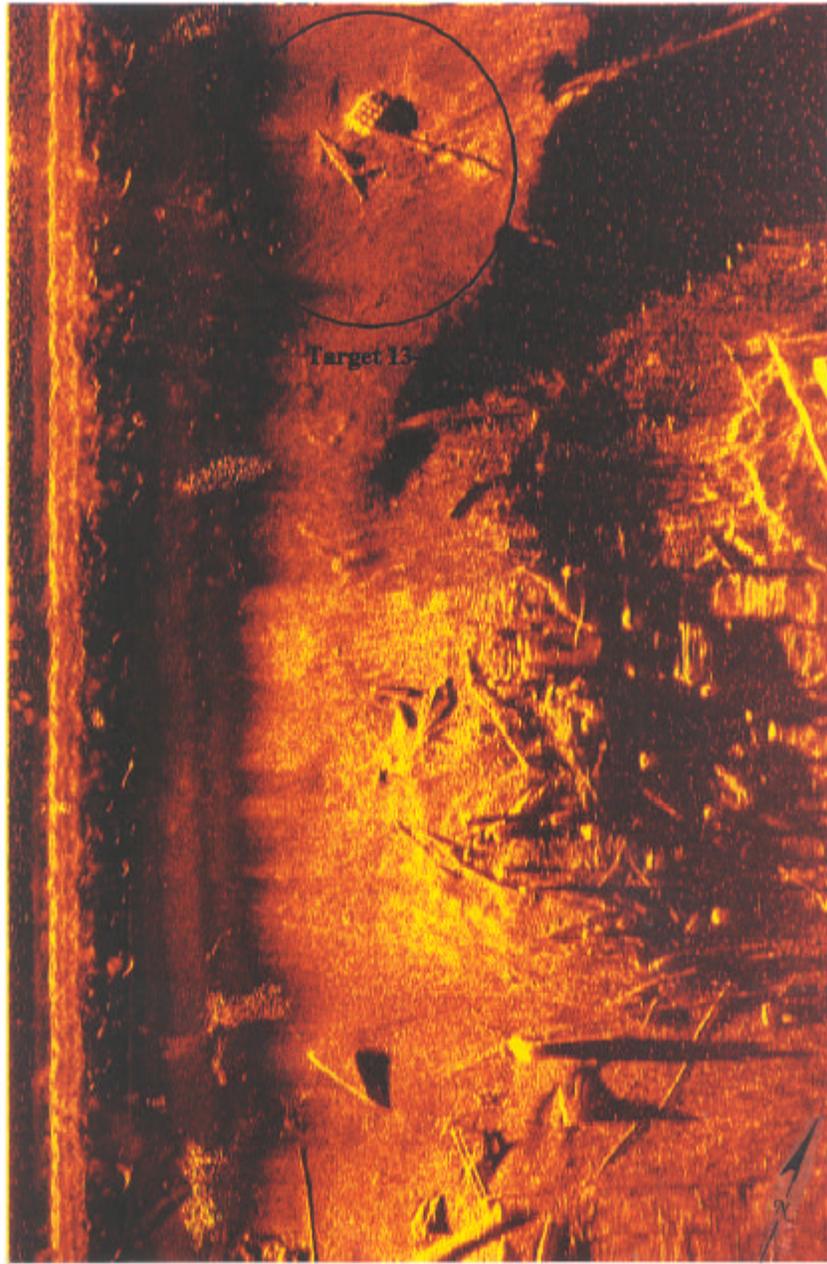
Figure 15
SFOBB PID PROJECT



Sensor Track Line

Target 13-1. 600 kHz Side Scan Sonar Survey

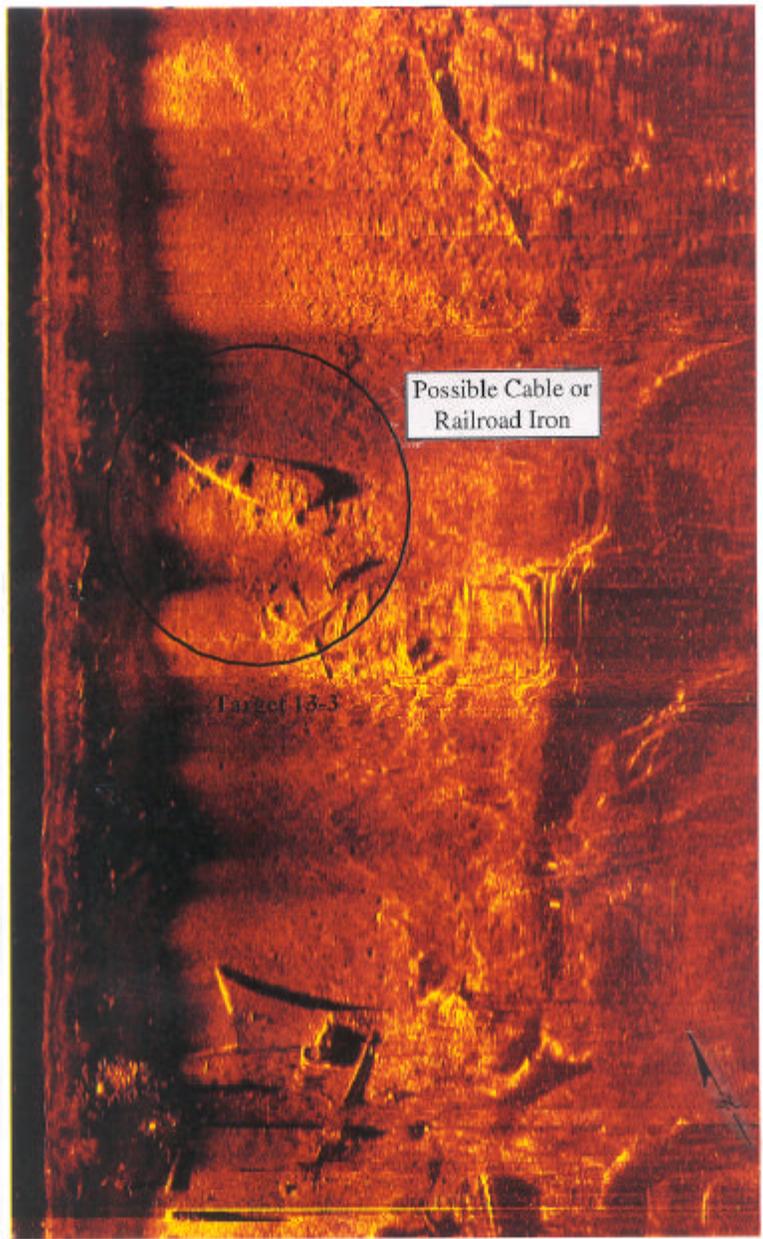
Figure 16
SFOBB PID PROJECT



Sensor Track Line

Target 13-2. 600 kHz Side Scan Sonar Survey

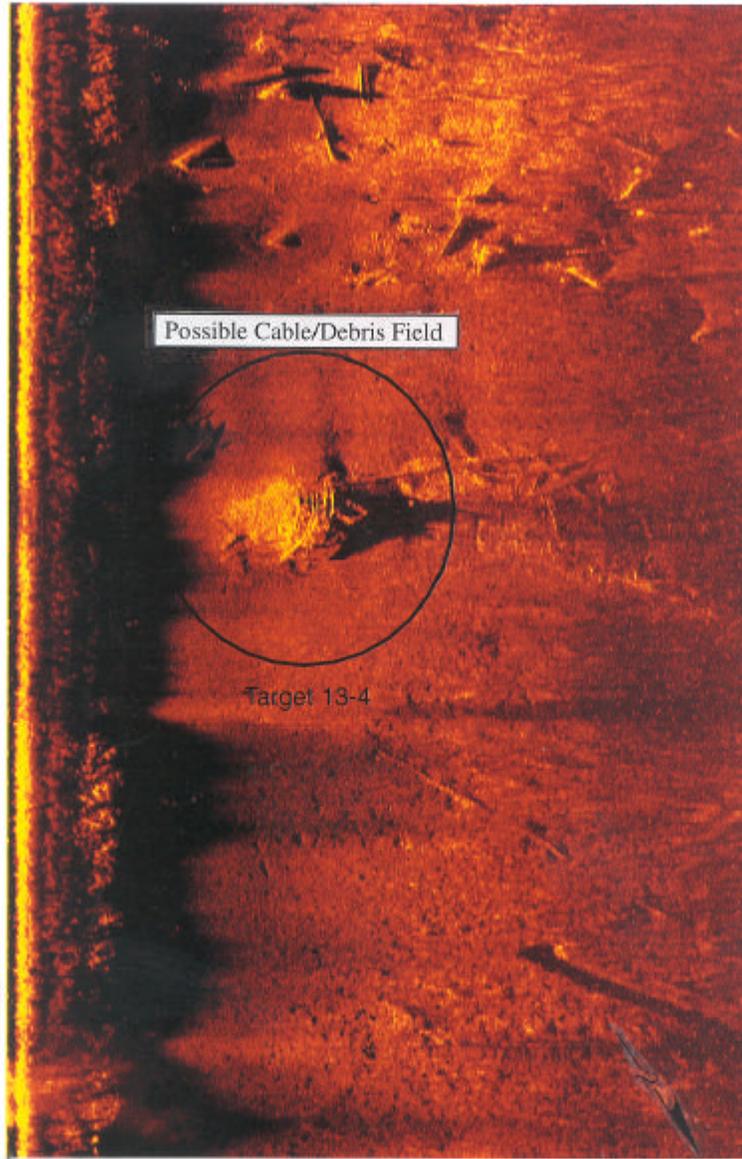
Figure 17
SFOBB PID PROJECT



Sensor Track Line

Target 13-3. 600 kHz Side Scan Sonar Survey

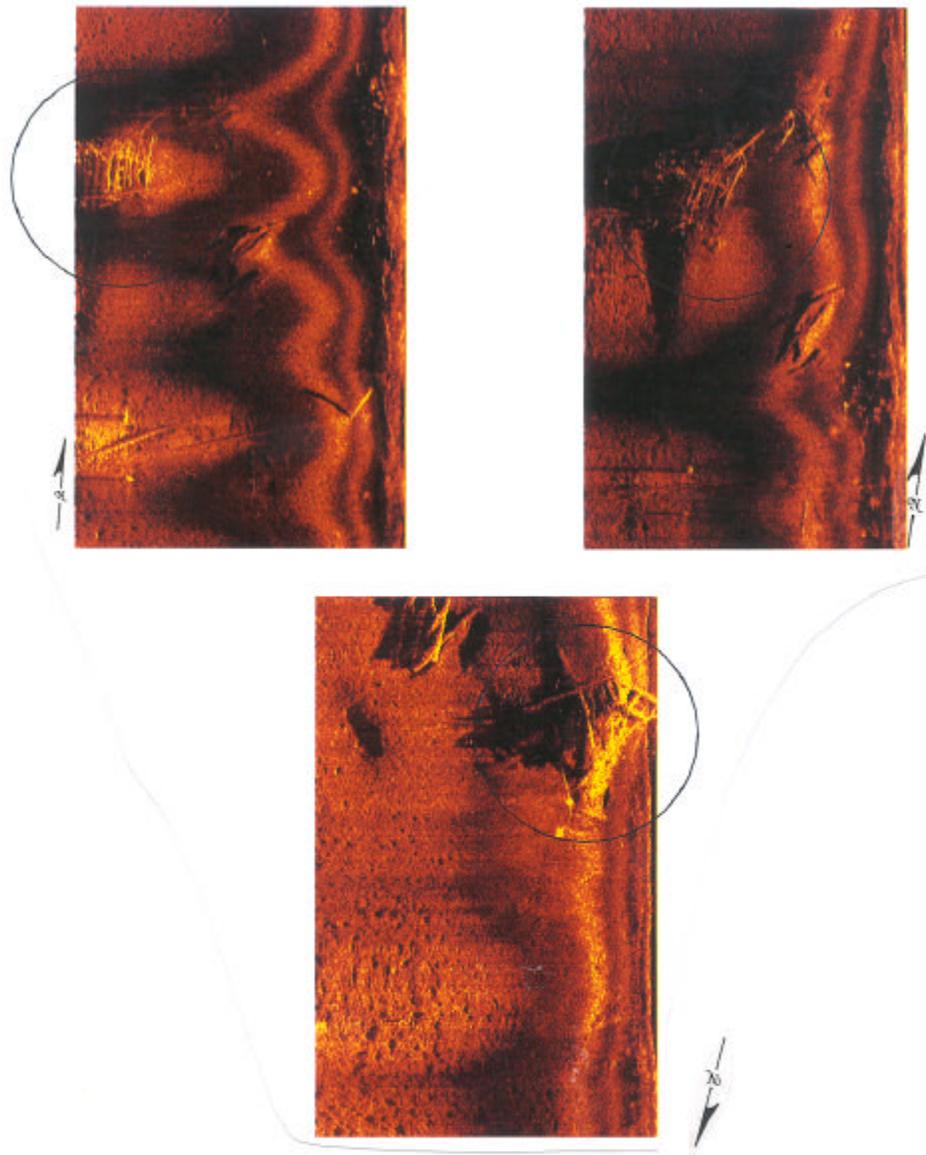
Figure 18
SFOBB PID PROJECT



Sensor Track Line

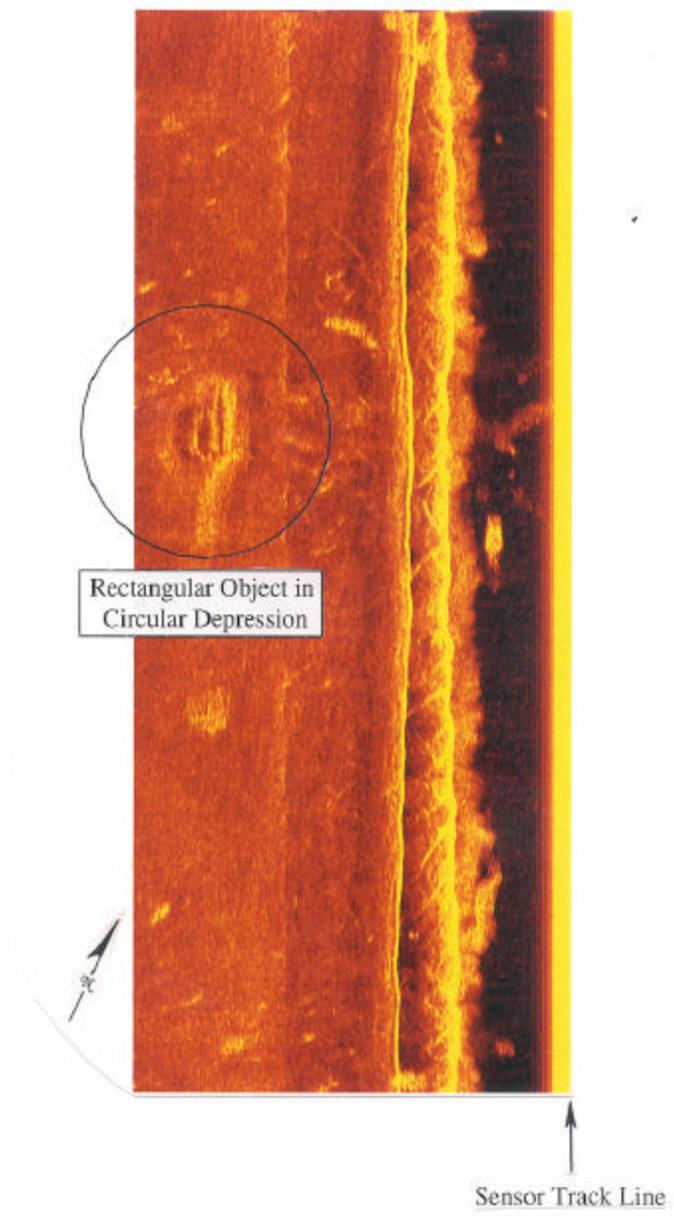
Target 13-4. 600 kHz Side Scan Sonar Survey

Figure 19
SFOBB PID PROJECT



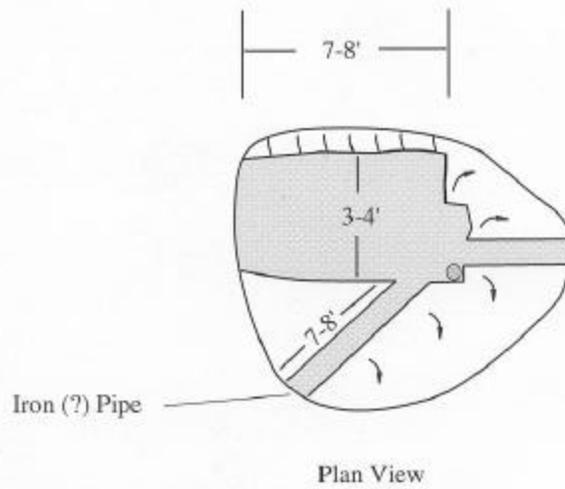
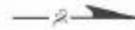
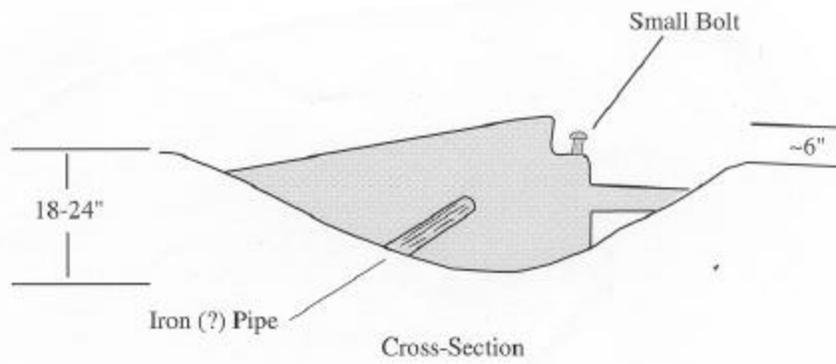
Target 13-4. Images Acquired in Ground Truthing

Figure 20
SFOBB PID PROJECT



Target 19. 600 kHz Side Scan Sonar Survey

Figure 21
SFOBB PID PROJECT



NOT TO SCALE - Measurements are Diver's Estimates

Target 19. Diver's Representation

Figure 22
SFOBB PID PROJECT

Appendix B

TARGET COORDINATES

Coordinates for Acoustic Targets in PIDP APE

Target	Latitude	Longitude	Utm (east)	UTM (north)
11	37 49.194	122 20.679	557677.87	4186035.23
13	37 48.966	122 20.853		
	37 48.966	122 20.883		
	37 49.127	122 20.884		
	37 49.089	122 20.842		
	37 48.974	122 20.822		
	37 49.086	122 20.833	Approximate boundary of target	
	37 48.992	122 20.791		
	37 49.089	122 20.810		
	37 49.014	122 20.760		
	37 49.066	122 20.770		
	37 48.964	122 20.715		
	37 49.054	122 20.733		
	37 48.976	122 20.684		
	37 49.037	122 20.696		
13-1	37 49.073	122 20.830		
13-2	37 49.087	122 20.879		
13-3	37 49.062	122 20.808		
13-4	37 49.075	122 20.771		
19	37 49.105	122 20.915	557333.38	4185867.65

Appendix C

DPR FORMS

State of California — The Resources Agency DEPARTMENT OF PARKS AND RECREATION PRIMARY RECORD	Primary # _____ HRI # _____ Trinomial _____ NRHP Status Code _____
Other Listings _____ Review code _____	Reviewer _____ Date _____

Page 1 of 2 *Resource Name or #: (Assigned by recorder) SFOBB-Pile Installation Demonstration Project

P1. Other Identifier: SFOBB East Span Seismic Safety Project

*P2. Location: Not for Publication Unrestricted a. County Alameda and _____

(P2b and P2c or P2d. Attach a Location Map as necessary.)

b. USGA 7.5' Quad Oakland West, Calif. Date 1959 (1980) T n/a; R n/a; n/a 1/4 of 1/4 of Sec n/a; _____ B.M.

c. Address n/a City Oakland Zip _____

d. UTM: Zone 10, 557398/557694 mE/ 4185686/4185408 mN

e. Other Locational Data (e.g., parcel #, legal description, directions to resource, elevation, etc., as appropriate): N-S along county line on either side of SFO Bay Bridge.

*P3a. Description: (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries):
Feature is a wide-spread debris field comprising the partial, disarticulated remains of either the burned Key System pier, or the remains of a portion of the pier as left following its dismantling after abandonment in 1939. Portions of the feature are scattered on both the north and south sides of the existing SFO Bay Bridge span. The feature consists almost entirely of disarticulated pilings and lengths of railroad iron scattered over an area approximately 300 x 200 meters. Pilings range in size from 6 to over 15 meters in length and many rest crossed, one upon the other. The pilings at the eastern side of the feature appear to be upright, still embedded in the bottom sediment. These project approximately 2 meters into the water column. The feature is largely concentrated directly beneath and south of the existing bridge alignment. A scattered, less-concentrated portion of the feature also lies on the north side of the bridge.

*P3b. Resource Attributes: (List attributes and codes) HP17; AH13;

*P4. Resources Present: Building Structure Object Site District Element of District Other (Isolates, etc).

P5. Photo or Drawing (Photo required for buildings, structures, and objects.)

*P5b. Description of Photo (view, date, accession #) _____

*P6. Date Constructed/Age and

Sources: Historic
Prehistoric Both
1903; Historic Literature

*P7. Owner and Address: _____

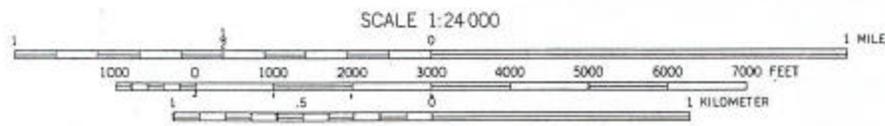
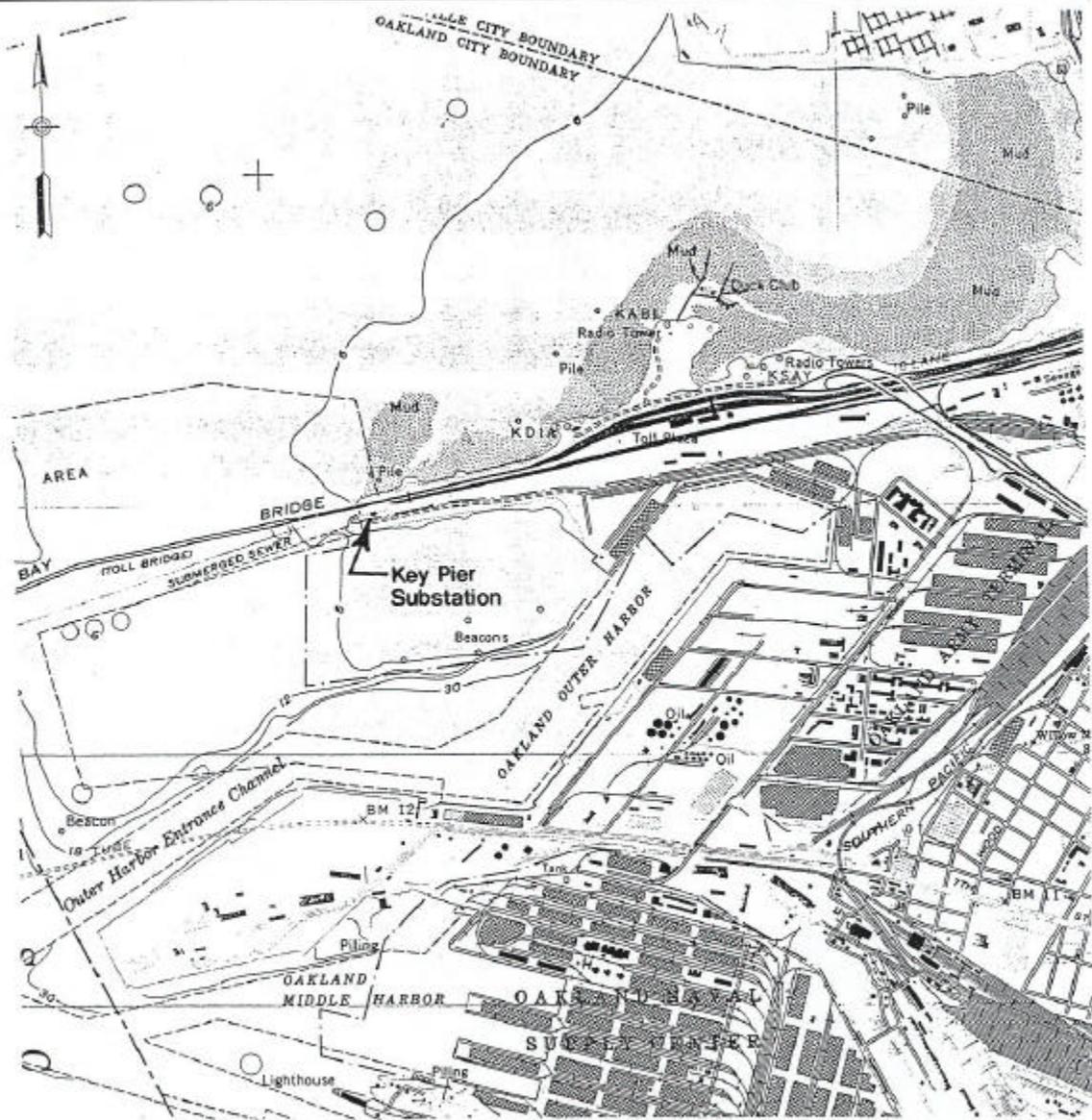
*P8. Recorded by (Name, affiliation, and address): James M. Allan, William Self Associates, PO Box 2192, Orinda, CA 94563

*P9. Date Recorded: Sept. 18, 1999

*P10. Survey Type: (Describe)
Remote Sensing: Side scan sonar and sub-bottom profiler.

*P11. Report Citation (Cite survey report and other sources, or enter "none."): Phase 1 Archaeological Survey Report-Maritime Archaeology. San Francisco-Oakland Bay Bridge Pile Installation Demonstration Project.

*Attachments: NONE Location Map Sketch Map Continuation Sheet Building, Structure, and Object Record
Archaeological Record Artifact Record Photograph Record Other (List): _____



B10. Significance [continued from Page 2]:

This heavy volume of train traffic by required additional electrical power, and construction was begun on the present building in 1925. It was designed specifically for the conditions at this location, near the train switching yards and the Key Pier trestle which extended out to the ferry terminal in the bay. A large amount of electrical energy was needed here during the afternoon rush, to start multiple trains in motion simultaneously. A large motor-generator in the building converted alternating current supplied by a local utility company to 600-volt direct current to power the trains.

The building's entrance is on the south facade, oriented toward the Key Pier tracks that originally ran along the south edge of the peninsula. When the Bay Bridge was constructed in the late 1930s, new tracks were laid along the north side of the building and onto the bridge. Ferry service declined precipitously after the opening of the bridge, but the building continued in service as part of the Bridge Railway. Additional equipment was installed for the Key System trains, as well as new 1200-volt equipment for the Interurban Electric and Sacramento Northern railways, two other electric streetcar systems that ran trains across the bridge. New substations were also built to serve the Bridge Railway, including the larger substation immediately east of this building and similar substations on Yerba Buena Island and adjacent to the bridge approach ramps in San Francisco.

Like other streetcar systems, the Key System declined in the post-war years as automobile ownership became increasingly common, and the last Key trains ran across the Bay Bridge in 1958. Although the Bay Bridge no longer accommodates rail transit and none of the electrical equipment from the railway era remains inside the substation, the building is still used as part of Caltrans' bridge maintenance facilities.

As a rare surviving component of the historically significant Key System railway, the Key Pier Substation appears to be individually eligible for National Register listing under Criterion A at the local level of significance. Although the building's integrity of setting has been compromised by removal of the Key Pier tracks and the tracks that originally ran across the Bay Bridge, the building appears to retain sufficient integrity of design, materials, feeling and association for National Register listing. The building is within the present state highway right-of-way, and the boundary of the eligible property includes only the building itself. The Key Pier Substation is also closely associated with the Bay Bridge, as an integral part of the bridge's former rail facilities. The building therefore appears to also be a contributing component of the Bay Bridge, a property which was determined eligible for National Register listing in 1983.

BUILDING, STRUCTURE AND OBJECT RECORD

Page 2 of 4

*NRHP Status Code 3B

*Resource Name or # (Assigned by recorder) Key Pier Substation

B1. Historic Name: Key Pier Substation

B2. Common Name: Key Pier Substation

B3. Original Use: Electrical substation B4. Present Use: Storage Building

*B5. Architectural Style: utilitarian

*B6. Construction History: (Construction date, alterations, and date of alterations)

This building was completed 1926. At some point in the 1940s or 1950s, a passageway was built to connect this building to the adjacent Caltrans substation. The overhead door in the south facade is a later replacement.

*B7. Moved? No Yes Unknown Date: _____ Original Location: _____

*B8. Related Features:

This building is connected to the adjacent Caltrans substation by a short passage extending from the east facade. Like the Caltrans substation that it is connected to, this building is directly associated with the operation of the San Francisco – Oakland Bay Bridge.

B9a. Architect: unknown b. Builder: unknown

*B10. Significance: Theme: Interurban rail; Bay Bridge construction Area San Francisco Bay region

Period of Significance 1926 – 1948 Property Type electrical substation Applicable Criteria A
(Discuss importance in terms of historical or architectural context as defined by theme, period, and geographic scope. Also address integrity.)

This electrical substation was built as part of the Key System, which provided streetcar service throughout Oakland and other East Bay communities, with connecting ferry service to San Francisco. Originally named the San Francisco, Oakland & San Jose Railway, the system was organized in 1902 by Francis M. "Borax" Smith, through the consolidation of existing streetcar lines. Smith built a long pier extending into the bay nearly to Yerba Buena Island, where streetcar passengers transferred to San Francisco-bound ferries. The railway was officially named the Key System after a reorganization in 1923, taking its name from the shape of the pier. By 1924 the pier was carrying more than 800 Key System trains per day.

[See Continuation Sheet, Page 3 of 4.]

B11. Additional Resource Attributes: (List attributes and codes) _____

*B12. References:

- Bay Bridge plans, Caltrans' District 4 archives (Oakland)
- "Building Bay Bridge Railroad." *California Highways and Public Works*, May 1938, pp. 8–11.
- Demoro, Harre W. *The Key Route: Transbay Commuting by Train and Ferry*. Glendale: Interurban Press, 1985.
- Snyder, John. "Southern Pacific Railroad Property and Interurban Railway Structures." In HPSR for the Cypress Freeway Reconstruction. Caltrans, 1990.

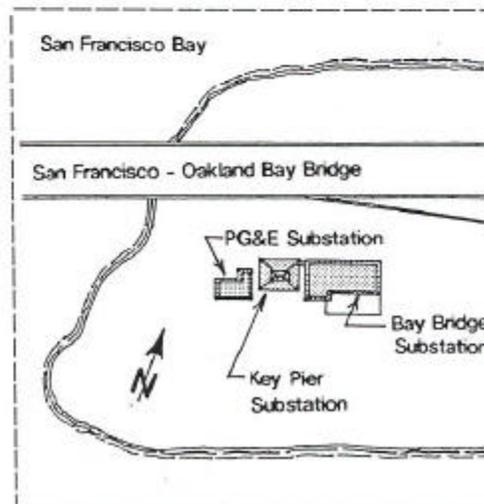
B13. Remarks:

*B14. Evaluator: Andrew Hope

Caltrans, District 4 (Oakland)

*Date of Evaluation: February 1998

(This space reserved for official comments.)



State of California -- The Resources Agency
 DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # _____
 HRI # _____
 Trinomial _____
 NRHP Status Code 3B

Other Listings _____
 Review Code _____ Reviewer _____ Date _____

Page 1 of 4

*Resource Name or #: (Assigned by recorder) Key Pier Substation

P1. Other Identifier: _____
 *P2. Location: Not for Publication Unrestricted *a. County Alameda
 and (P2b and P2c or P2d. Attach a Location Map as necessary.)
 *b. USGS 7.5' Quad Oakland West Date 1959 (Rev. 1980) T: _____ R: _____ 1/4 of _____ 1/4 of Sec. _____ B. M. _____
 c. Address _____ City Oakland Zip _____
 d. UTM: (Give more than one for large and/or linear resources) Zone 10 ; 559110 mE/ 4185970 mN
 e. Other Location Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate)

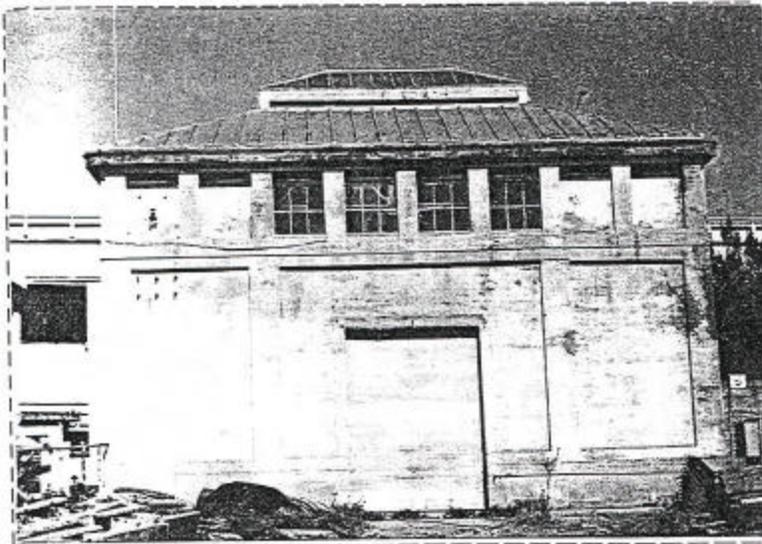
This building is located at the end of the narrow peninsula that extends into San Francisco Bay from the Bay Bridge toll plaza.

*P3a. Description (Describe the resource and its major elements. Include design, materials, condition, alterations, size, setting & boundaries):

This concrete building is approximately 42 feet wide by 32 feet deep, with a slightly projecting base and pilasters. The large doorway in the center of the south facade originally had paired, side-hinged doors, but now has a metal roll-up door. There are rows of small windows, each consisting of a six-pane fixed sash in a metal frame, at the top of the north and south facades. There are also narrow ventilation louvers at the tops of all four walls, just below the eaves. The hipped roof is clad in standing-seam sheet metal and is topped by a raised, central skylight which repeats the hipped roof form. The interior is a single, large room with an open mezzanine along the east and north walls. The roof is supported by steel trusses, which are supported in turn by the concrete walls. A narrow passageway connects the east wall of this building to the larger electrical substation that was built fifteen feet to the east in the late 1930s.

*P3b. Resource Attributes: (List attributes and codes) HP9 -- electrical substation

*P4. Resources present: Building Structure Object Site District Element of District Other



P5b. Description of Photo: (View, Date, etc.) Elect. substation
Looking north
October 1997

*P6. Date Constructed / Age and Sources: Historic
 Prehistoric Both
1925-6

*P7. Owner and Address:
State of California
Department of Transportation
111 Grand Avenue
Oakland, California

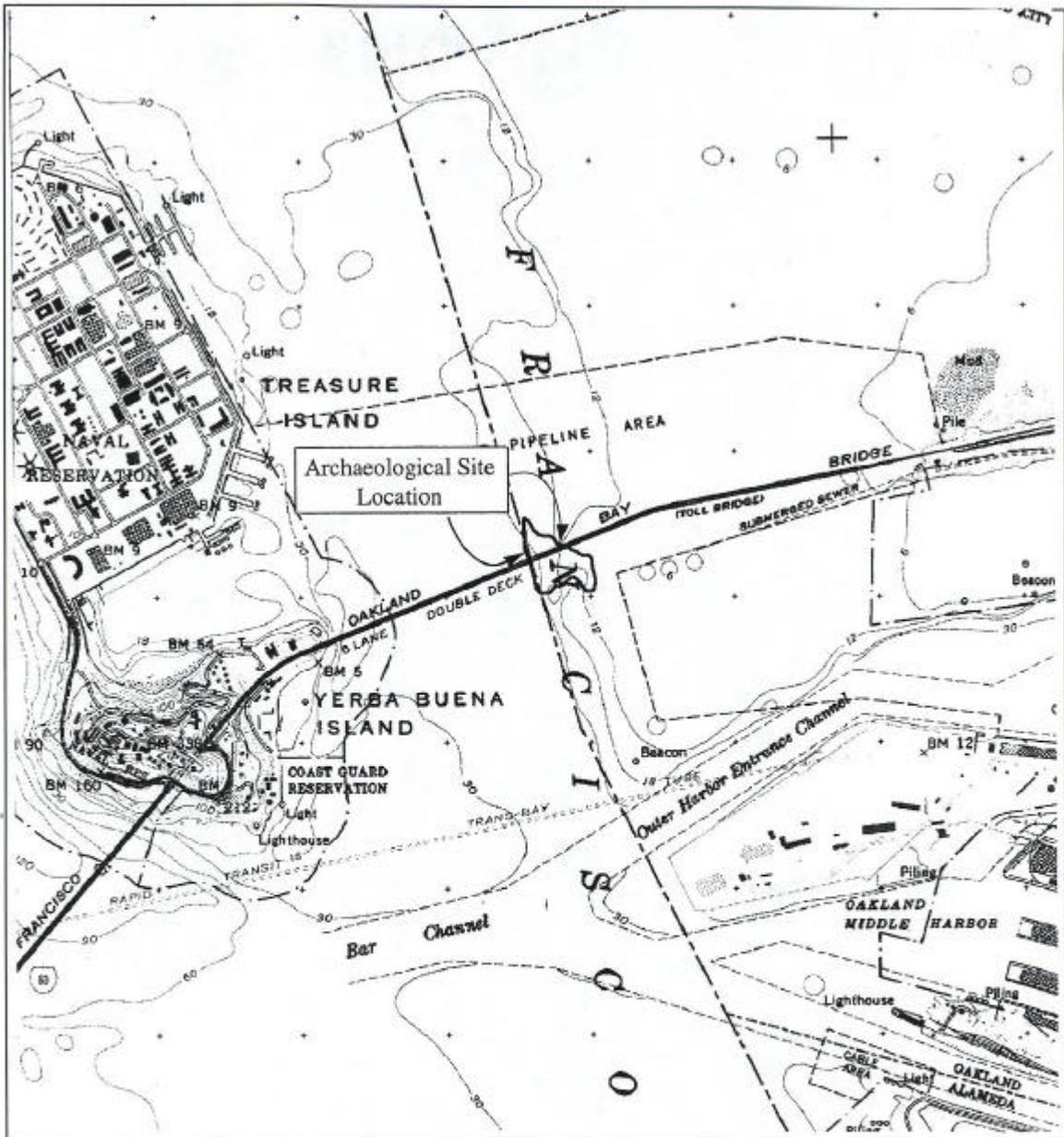
*P8. Recorded by: (Name, affiliation, and address) Andrew Hope
Caltrans, District 4
111 Grand Avenue
Oakland, CA

*P9. Date Recorded: Feb. 1998

*P10. Survey Type: (Describe)
Intensive

*P11. Report Citation (Cite survey report and other sources, or enter "none"): Historic Architecture Survey Report for the Construction of a New East Span for the San Francisco - Oakland Bay Bridge.

*Attachments: NONE Location Map Sketch Map Continuation Sheet Building, Structure & Object Record
 Archaeological Record District Record Linear Feature Record Milling Station Record Rock Art Record
 Artifact Record Photograph Record Other (List) _____



Site Location Map

San Francisco-Oakland
Bay Bridge East Span
Seismic Safety Project