HABS No. CA-1543-G

MARE ISLAND NAVAL SHIPYARD, ACID MIXING FACILITY (BLDG. NO. 463)
CALIFORNIA AVENUE AND E STREET
VALLEJO
SOLANO COUNTY
CALIFORNIA

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Buildings Survey
National Park Service
Western Region
Department of the Interior
San Francisco, California 94107

HABS
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HISTORIC AMERICAN BUILDING SURVEY

MARE ISLAND NAVAL SHIPYARD,
ACID MIXING FACILITY (BLDG. NO. 463) HABS NO. CA-1543G

Location: Northeast corner of California Avenue
and "E" Street
Mare Island Naval Shipyard
Vallejo
Solano County
California

United States Geological Survey (USGS)
Mare Island Quadrangle (7.5)

Universal Transverse Mercator Coordinates:
10.563320.227 mE - 4218090.059 mN

Present Owner: Department of the Navy
Mare Island Naval Shipyard
Vallejo, California 94592-5100

Present Use: Currently vacated, this facility functioned as a battery acid mixing facility. Proposed for demolition as part of Installation Restoration cleanup efforts.

Statement of Significance: Building 463 was built in 1932 as an acid mixing facility. It and related acid storage tanks had a significant role during World War II in supporting submarine battery repair and overhaul. This use continued until 1983 when the facility was closed.

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Title: Architect/General Engineer
Affiliation: Mare Island Naval, Staff Civil Engineer Department
Facilities Planning Division Code 913

PART I - HISTORICAL INFORMATION:

A. Physical History:

1. Date of Erection: Building 463 was built in 1932 to provide a facility for the mixing and storage of acids used in the repair and overhaul of submarine propulsion batteries. The construction period is established by review of shipyard records, a period facility map(June 1932) and the approval date of the earliest original construction drawing (November 17, 1931). The facility is located on the northeast corner of California Avenue and "E" Street. Functions performed in Building 463 were related to other battery shop operations located in Buildings 461, built in 1932, and 463A, constructed in 1937. The reader is referred to separate HABS documentation on Building 463A recorded as
CA-1543H.

2. Architect: The design for the original building and first two elevated storage was accomplished by the staff of the United States (US) Navy, Bureau of Yards and Docks, which eventually became the Naval Facilities Engineering Command. Approval of the design for the Shipyard was made by Commander (CEC, USN) Ralph Whitman, Public Works Officer from July 1929 through July 1934.

3. Original and Subsequent Owners: Building 463 was constructed as the result of Congressional appropriation on Federal land under cognizance of the Department of the Navy. Mare Island Naval Shipyard is recorded (July 12, 1978) as US Government property with the Office of the Solano County Recorder, Fairfield, California as Parcel No. 67-010-030 in Book 56594 of these records. Title and ownership of this building and related tanks has rested with the Department of the Navy since originally constructed.

4. Building, Contractor(s) and Suppliers: Initial construction appears to have been accomplished by Shipyard Public Works Forces although there is a possibility that construction may have been through some form of Federal work program, such as WPA, as some construction at other Navy installations in the San Francisco Bay Area, notably Naval Air Station Moffett Field, was accomplished in this fashion. The construction year of 1932 would have been in the middle of the economic depression that occurred in the United States, beginning in 1929. The planning for the first "New Deal" project to be funded out of the National Recovery Act at Mare Island, construction of a diesel

oil reclamation facility at the submarine base, was begun within this period of time and construction was started in 1933. By 1938, over 2,000 workers were on the shipyard, funded out of Public Works Administration funds. So the above assumption above appears feasible.

Materials for construction were typical of readily available materials within the area and were most likely procured from local suppliers. Construction materials are not exotic or unusual.

5. Original Plans and Construction: Drawings showing original construction as well as subsequent modifications are on file at Mare Island Naval Shipyard, Staff Civil Engineer Office Plan Files.

6. Alterations and Additions: Review of record drawings in the Staff Civil Engineer Plan Files records several alterations made over the years to Building 463 and related tank structure. Original construction included a pile supported reinforced concrete grade beam structure on the east side of the building to support the first two elevated exterior steel acid storage tanks built concurrent with the facility. Between 1932 and 1958, five additional exterior redwood tanks were constructed on the east side of the building. The first two additional wooden tanks were built in 1943 on concrete pad extensions to the original pad. The last three redwood tanks were built in 1958, including perimeter elevated walkway and access structures. All tanks are supported on a heavy timber or steel framed structure, placing the base elevation of the tanks at approximately 12 feet above the floor of the building and slab. The construction drawings for the installation of the original and five additional tanks are listed under the drawing file for Building 461, the main battery shop, in the Staff Civil Engineer Plan Files and shown in photographs CA-1543G-20 through CA-1543G-26 and CA-1543G-29 through CA-1543G-30.

Another significant modification accomplished in 1975 was the installation of an Electrolyte Aerosol Removal System, installed to control the extraction of acid fumes through a scrubber system before venting into the air. Design was done by Williamson Engineering of Walnut Creek, California. Construction was performed by Rothchild, Raffin and Warwick, San Francisco, California under contract N62474-75-C-7725. A unique feature of this installation is that all ducting, piping and plenums were constructed of polyvinylchloride plastic. Photographs CA-1543G-27 show major details of this installation.

Minor alterations and improvements included installation of an overhead 3" diameter steam line from Building 461 to 463 in 1937, installation of a lead sheet floor covering and curb in 1943, installation of an electrolyte mixing vat in 1963

(original vats previously removed-no date), installation of two emergency personnel washdown shower stalls, replacement of Tank No. 3 with a stainless steel tank in 1978, replacement of the acid piping and pump transfer system in 1975 and installation of a tank level indicator system into Building 461 in 1982. Photographs CA-1543G-28 and CA-1543G-31 through CA-1543G-32 show details of some of the more significant modifications.

B. Historical Context: Mare Island Naval Shipyard was established in 1854 by then Commodore David Glasgow Farragut as the United States Navy Yard, Mare Island. This was the first Navy shipyard established on the west coast by a still young nation. Throughout the decades thereafter, the Mare Island Naval Complex has been intimately connected with military history, development of industrial design, ship construction, repair and conversion and with the lives of men and women significant in U. S. History. With its establishment, Mare Island Naval Shipyard symbolized both the culmination of U.S. expansionist desires to obtain and hold California as well as to protect and extend its political and economic interests throughout the Pacific region. During the War Between The States, Mare Island was able to maintain the small Navy fleet on the west coast needed to patrol the Isthmus of Panama and San Francisco Bay where the threat existed that Confederate raiders might seize the ships carrying gold to finance the war effort of the North. During the Spanish-American War, Mare Island was the base that repaired ships of the Asiatic Squadron and became the refuge for the sick and wounded sailors from battles in the Philippines. During World War I, the base served as a training base for Marines and Medical Corpsmen who did meritorious service the Europe. During World War II and later years, the shipyard built a large number of ships, submarines and landing craft as well as repairing and overhauling ships and submarines of the U.S. Navy and its allies.

In the century and a half of its existence, Mare Island has built 513 vessels, beginning with the Saginaw in 1859, and repaired/overhauled thousands more. Mare Island built the Civil War monitor Monadnock, the collier Jupiter (later to become the Navy's first aircraft carrier Langley), dozens of destroyers, escort and amphibious craft, submarine tenders, tankers and submarines. Large capital ships constructed here included the heavy cruisers San Francisco and Chicago and the battleship California, the only Navy battleship built on the west coast. And finally, beginning in 1954, Mare Island Naval Shipyard entered the atomic age by beginning the construction and overhaul of nuclear powered ships and submarines, thus completing the evolution of propulsive power from canvas to coal, from diesel oil to the atom.

The construction of Building 463 occurred at the time that the United States began expanding it's navy from a "treaty fleet" to one capable of becoming a "fighting fleet". At this time, Mare Island Naval Shipyard also received authorization to begin construction of several naval warships and submarines. Building 463 and related storage tanks were originally built to provide for the mixing and storage of acids and other chemicals used in the repair and refurbishment of submarine propulsion batteries. While currently not listed on the National Register of Historic Places nor located within any listed historic district of the Shipyard, it is felt that the facility housed functions that were significant to the repair of submarine batteries during World War II, thereby contributing to critical submarine operations of the United States Navy during this period that were instrumental in disrupting logistic support of Japanese forces in the Pacific theater. During World War II, submarines constructed and repaired at Mare Island sank a total of 252 enemy ships totaling 988,357 tons. Photograph CA-1543G-16 shows the inside plate detail of a typical submarine battery (circa 1969).

Mare Island Naval Shipyard has a long history associated with the repair, overhaul and construction of US Navy submarines. The first vessels that could actually be called submarines stationed at Mare Island were the USS Grampus and USS Pike, arriving in 1904. These vessels were very small, measuring 60 feet in length with a beam of only 11 feet. Submerged operations were limited to only 2 hours and crew members were required to sign a will prior to their first dive. Propulsion was by means of gasoline internal combustion engines; while submerged, a small 70 horsepower electric motor run by 60 interconnected batteries was used to propel the small craft. Crew members were actually referred to as "divers" rather than submariners. Mare Island's long association with the Navy's submarine fleet was thus started and was later expanded as construction of submarines began with the launching of the first submarine built at Mare Island. The USS Nautilus (hull number V-6), not to be confused with the first nuclear powered submarine, was launched at Mare Island on March 15, 1930. She measured 371 feet in length and displaced 3,960 tons submerged. The battery shop and Building 463 were constructed shortly after this launching as Mare Island increased its industrial capacity to support submarine operations on the west coast. Over ninety years of support to the Navy's submarine fleet will end with the closure of Mare Island Naval Shipyard in April of 1996 and demolition of such buildings as Building 463 is completed.

A submarine battery is essentially a self-contained galvanic cell whereby electrical energy is produced by means of the electrochemical action (ion transfer) between internal liquids and materials. Classes of submarines that were in operation prior to and during World War II were primarily powered by

diesel-fueled engines, which required the submarines to operate on the surface in order to vent off exhaust gases. However, once submerged, primary propulsion power was provided by large banks of interconnected batteries which also provided power for instrumentation, ventilation and other systems aboard the submarine. The amount of time a submarine could operate submerged was limited to the extent of the charged condition of the batteries as well as available oxygen for the crew and numerous other factors. The fact that a submarine could operate for long periods of time submerged made for its success as a military weapon. While operating on the surface, the batteries would normally be recharged; however, as with liquid cell batteries of today, a point is reached where the battery must be drained of internal fluids, casings cleaned out and overhauled, plates replaced, and new battery fluids added.

Battery electrolyte solutions were primarily made from sulphuric acid and distilled water. The tanks at Building 463 were used to store the acid and distilled water. The elevated structure allowed gravity flow of these liquids into the large electrolyte mixing tank. Chemical reaction created fumes and heat. Fumes were extracted with the aerosol removal system. The solution was cooled by means of a simple water bath. Hot electrolyte would be pumped through lead piping shaped into a coil immersed in a cold water bath, located in a vat below the tank support structure. Photograph CA-1543G-11 shows the remains of this cooling coil. Once mixing was completed, the solution would be pumped to the main battery shop for eventual use in restoring the repaired batteries. Photograph CA-1543G-17 shows a typical portable electrolyte transfer tank used in this process.

After World War II, later classes of submarines continued to operate with similar means of propulsion until the advent of nuclear powered reactor plants to provide for primary propulsion. Batteries are still employed as part of the secondary power system for nuclear powered submarines in conjunction with a shipboard emergency diesel generator. So even though the significance of Building 463 has been linked to submarine operations during World War II, it actually functioned in this capacity until 1983, when the facility was closed after new storage tanks meeting then current environmental standards were constructed at the primary battery shop facility.

PART II - ARCHITECTURAL SURVEY:

A. General Statement: Building 463 consists of three elements, the primary shop being a single story rectangular building, measuring approximately 16 feet in the east-west direction and 30 feet in the north-south direction. The second element is a roof extension approximately 29 feet in width on the west

side creating an overhang for a concrete slab 30 feet in length matching the building's long dimension. The third element is the seven external elevated storage tanks located on the east side of the building, supported mostly on steel or wood-framed support structures with an elevated access and walkway structure system around the tanks.

1. Architectural Character: The basic architectural character of the building is not one of significance other than perhaps in the choice of materials used that would better resist degradation from exposure to acid fumes and spills. It may be considered fairly typical of a very small industrial support building of the period. The elevated tank support/access structure and tanks are the more significant visual element as this reflects the functional use of the building throughout its useful life.

2. Condition of Fabric: Age and general deterioration have resulted in the condition of the building and tanks to be judged fair to poor; demolition and site cleanup have been scheduled.

B. Description of Exterior:

1. Overall Dimensions: Photographs CA-1543G-18 and CA-1543G-19 show details of the original construction. Building 463 measures approximately 16 feet by 30 feet in plan, with the long dimension running in the north-south direction. The height of the building is 12 feet measured from the top of the floor slab to eaves. The roof extends from the west elevation approximately 29 feet to the west and covers a pile supported reinforced concrete slab. The length of this overhang matches the long dimension of the building. This roof extension is supported by six "H" section columns. Adjacent to the east elevation are the seven tanks, elevated tank access structure and walkways, measuring 38 feet in the east-west direction and 58 feet in the north-south direction in overall footprint. The platform structure is approximately 12 feet above grade. Adjacent to the north elevation is the electrolyte aerosol removal system scrubber installed in 1975 and shown in photograph CA-1543G-27.

2. Foundation: The 6 inch thick reinforced concrete floor slab of the building is supported by six wood piles interconnected by a 10 inch by 14 inch perimeter grade beam. The floor is elevated approximately 4 feet above the grade beam creating a crawl space below. A 12 inch high curb runs around the perimeter of the floor and is notched in two places on the east side to receive two sets of double doors. Ventilation and access to the crawl space under the slab is provided by a series of cast iron

grills and an access panel. The six inch reinforced concrete slab that extends on the west side of the building is supported on grade at the same elevation as the floor of the building. The columns supporting the roof overhang are supported on a wood pile (each column) with concrete base. The initial two tanks, constructed concurrent with the building, are supported on a steel structure which in turn is supported on pile supported 12 inch by 18 inch reinforced concrete beams.

The foundation for the support structure of the scrubber, installed in 1975 as part of the electrolyte aerosol removal system, consists of a 6 inch reinforced concrete slab with 24 inch by 30 inch deep footings for the support columns located at each of the four corners. The support structure is of steel framing.

The floor of the building was originally covered with a 1/2 inch mastic topping that extended up the curb 12 inches (3/4 inches thick). No information is available to indicate the exact material used, but based on similar materials used in the main battery shop, it was most likely an bituminous-based material that would be resistant to acid spills, providing protection to the primary floor structure. This mastic also was sloped to create a pan floor to contain any spilled acids. The floor was repaired in 1943 when a bituminous coating was placed over the original floor, raising the floor elevation sufficiently to slope into a new floor drain at the middle of the floor. The northwest quarter of the floor was not raised and a lead lining was placed into the resultant pit area. Within this pit was located an acid mixing vat. It is conjectured that the original vats were long since replaced and that the vat currently in the building is a replacement. No record drawings exist to indicate when the vat was installed.

3. Walls: The exterior walls of the building are made of 6 inch terra cotta tile, covered on the exterior side by stucco (cement plaster). The upper half of the north and south elevations were originally penetrated by 3 each copper ventilation louvers. On the north elevation, one louver has been removed to allow for the electrolyte aerosol removal system duct to exit the building. The east elevation is similarly penetrated by 6 copper ventilation louvers. The exterior walls are not load bearing as six "H" section columns, located on the building interior, support the roof.

4. Structural System/Framing: The basic structural framing system of the building and roof overhang is typical of the period for small, lightly framed industrial construction. The roof of the building and overhang extension are supported by steel "H" columns, spaced at 14 foot centers along the north and south elevations and along the east-west centerline, and connected into the steel roof framing structure. Small 2 inch by 3 inch angle knee braces are

located at the upper part of each column and connect into the steel "I" roof beams and perimeter eave channel. Eight inch "I" beams span from column to column, meeting at a 6 inch "I" beam section forming the ridge of the roof (running in an east-west direction).. Seven inch steel channel purlins are located at approximately 3 foot centers between the "I" beams. All steel framing is of riveted construction; considering that ship construction of the period was primarily based upon riveted construction and that the building was constructed by Shipyard workers, it is considered probable that the steel framing was assembled by workers skilled in ship construction. It is noted that the gusset plates connecting the small diagonal bracing used at the column-roof beam interface are similar to that seen on structural details for Navy ships built of riveted construction in the early twentieth century.

There are no interior partitions in this building.

The structural framing for the tank support/access structure, stairs and walkways around the acid storage tanks is of steel or heavy timber construction, nailed or bolted. Originally all wood members were coated with an acid resistant enamel. The deck level is partially wood sheathing and partially of metal deck plating.

5. Porches, Stoops, Balconies, Bulkheads: None

6. Chimneys: None

7. Openings:

a. Doorways and Doors: Two sets of double doors are located on the east elevation of the building providing access to the interior. Original doors are still in use. These doors are hollow core metal covered doors with two-panel upper half lites of wire glass in each leaf. Each leaf measures 4 feet wide by 8 feet high, making the opening width a total of approximately 8 feet for each opening.

b. Windows and Shutters: No windows exist on this building. The only openings through the walls are the previously described copper louvers providing ventilation of the interior. Each louver section measures 3 foot wide by 4 foot high.

8. Roof:

a. Shape, Covering: The roof of this building is a gable roof of fairly flat pitch, approximately 1 inch in rise for each 12 inches in run. Construction drawings refer to the roofing material as "self-supported steel sheathing", possibly comparable to modern day corrugated metal roofing.

b. Cornice, Eaves: Eaves are formed by a 9 inch steel channel with the stucco wall coating extending over the channel and then sealed at the roof line with a combination copper gravel stop and molding.

c. Dormers, Cupolas, Towers: None

C. Description of Interior:

1. Floor Plans: Previously described.

2. Stairways: Stairs leading to the access walkways around the acid tanks are of timber construction considered typical and of no historic significance. An access ladder fabricated from steel and supported by a lightly framed steel structure provides access to the scrubber fan and exhaust system installed in 1975.

3. Flooring: Previously described.

4. Walls and Ceiling Finish: Unpainted wall and underside of roof.

5. Openings: Previously described.

6. Decorative Features and Trim: None of significance.

7. Hardware: None of significance.

8. Mechanical/Electrical Equipment:

a. Heating, Air Conditioning, Ventilation: Ventilation of the interior of the building was originally by means of natural air flow through the large copper louvers located on the upper half of the south, east and north elevations. In 1975, a major alteration was the installation of an electrolyte aerosol removal system. This consisted of the installation of three 24 inch diameter extraction ducts, connected to continuous 4 1/2 inch side-draft vents

located at the long edge of the 8 foot long electrolyte mixing tank. The three ducts merged into a single 40 inch diameter duct which exits the building through the north elevation and connects to a 20,000 cubic feet per minute fume scrubber. All ducts and vents are fabricated from schedule 40 polyvinylchloride(PVC) material. The 40 inch duct is routed through the western-most location of the copper louvers located in the upper wall area; the copper louver has been removed. Photographs CA-1543G-12 through CA-1543G-13 show details of this installation. The scrubber and ventilation system is supported on a light weight, bolted steel frame structure with a overall plan footprint of 12 foot-8 inches by 15 feet, as shown in photo CA-1543G-27.

b. Lighting: The original construction drawings show that the original lighting fixtures installed were a single industrial grade 100 watt incandescent fixture in the building and two 50 watt incandescent fixtures under the roof overhang on the west side. Thses still remain.

c. Plumbing: Original plumbing was limited to piping and valves connected to the various exterior storage tanks for purposes of delivering acids and distilled water to the shop area for mixing electrolyte solutions. A fresh water supply was run into the building and a floor drain connected to the Shipyard sanitary sewer system.

d. Tanks: The original acid storage tanks were constructed of steel with an interior lining of sheet lead. The next five tanks were fabricated of redwood staves-lead lined. Staves were held together with steel rods with an adjustments clamp. The spacing of the steel rod became closer together at the lower levels of the tank to withstand the higher lateral pressures of the fluids at this level. All seven tanks are topped with pyramid shaped roof structures. All tanks are of 5000 gallon capacity and measure 10 feet in diameter by 10 feet in height.. Tank No. 3 was replaced in 1978 with a stainless steel tank with piping and pump delivery system.

9. Original Furnishings: Original furnishings are not considered historically significant. They consisted of light wood framed shelving and work benches, three mixing vats-1 measuring 5 feet long, the other two measuring 4 feet long, and all three measuring 2 feet wide by 2 feet deep and one soda vat measuring 8 feet long, 4 feet wide and 2 feet deep. All four vats were lined on the inside with l0 pound-per-square-foot lead sheathing. These vats were removed prior to 1963 to make room for a new electrolyte mixing vat.

D. Site:

1. General Siting and Orientation: The orientation of Building 463 and related tanks and access structure place the long centerline axis in a generally east-west orientation. This building sits to the north of the main battery shop, Building 461, directly across "E" Street, as shown in photograph CA-1543G-15. Most recently, fencing has been placed around the site, as can be seen in photographs CA-1543G-1 through CA-1543G-5 to restrict unauthorized access to the area. Site sketches showing building location shortly after construction and showing present conditions are included with this survey report.

2. Historic Landscape Design: The site does not include any landscaping elements considered historically significant.

3. Outbuildings: None

PART III - SOURCES OF INFORMATION:

A. Architectural Drawings: The photographic documentation included as part of this survey report includes photocopies of record drawings for Building 463, including original construction drawings and subsequent drawings showing alterations and modifications. All drawings are currently on file in the Plan Files vault of the Staff Civil Engineer, Mare Island Naval Shipyard.

B. Historic Views: Photograph CA-1543G-15 shows a historical view. Historical aerial views of the shipyard exist but do not show the building in sufficient detail to warrant inclusion as part of this report. Photo research did not find any direct historical views of this building on file in the shipyard photo lab or the shipyard Historian's office.

C. Interviews:

1. A brief interview with Ms. Sue Lemmon, Shipyard Historian, on August 29, 1994 was held to determine the availability of historical documents and photo records.

2. Discussions with Photo Lab staff and a search of photo records was made to locate historical photos of the structure and site.

D. Bibliography:

1. Primary and Unpublished Sources: None

2. Secondary and Published Sources:

a. "Side-wheelers to Nuclear Power-A Pictorial Essay Covering 123 Years At The Mare Island Naval Shipyard" (1977); Sue Lemmon and E. D. Wichels; published by Leeward Publications, Inc.; Library Of Congress Catalog No. 77-90050.

b. "SSN688 Class Submarine Overhaul Support Manual" (1978); published by the Newport News Shipbuilding Company.

c. "A Long Line of Ships, Mare Island's Century of Naval Activity in California" (1954); Arnold A. Lott, LCDR, USN (Retired); published by the George Banta Publishing Company.

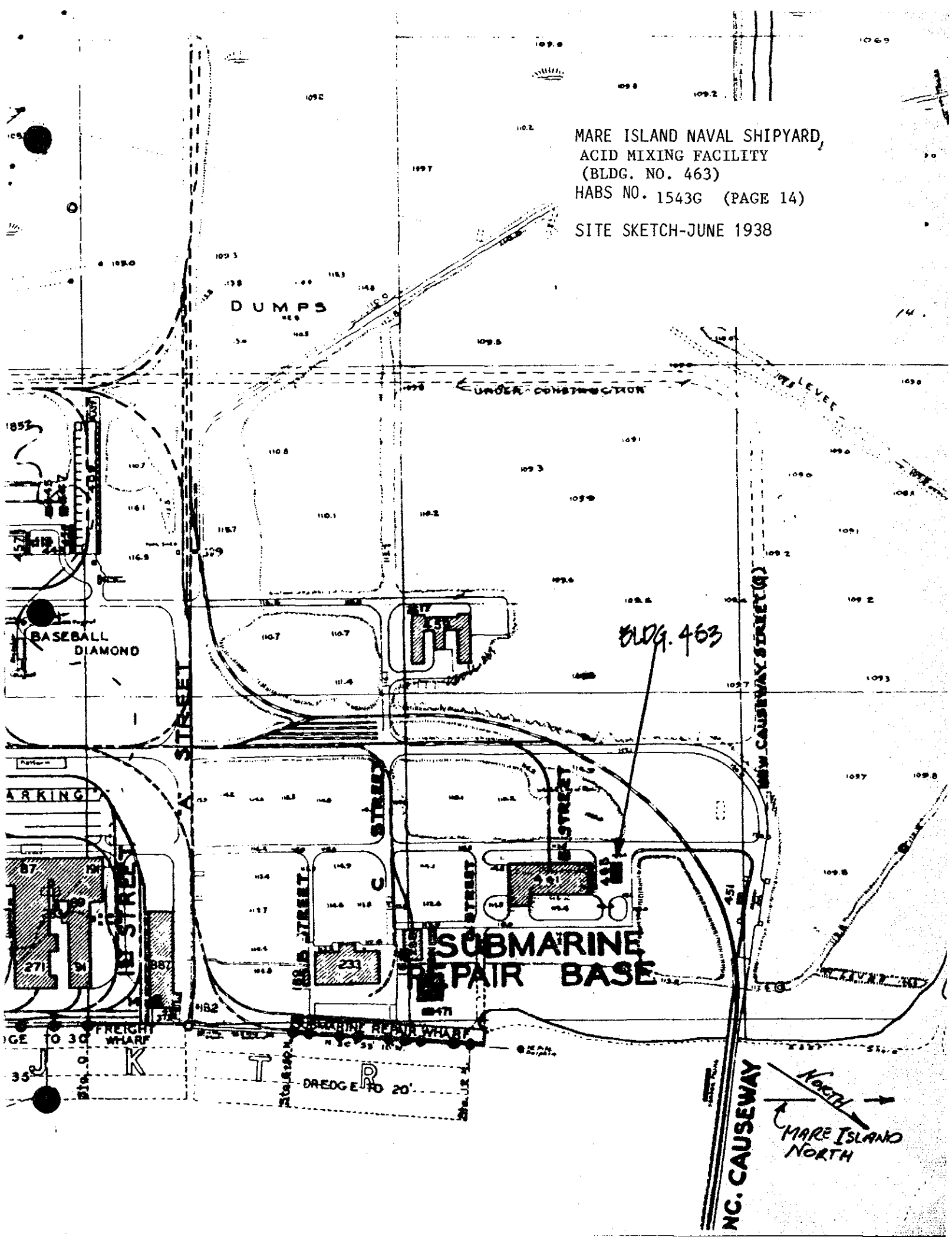
E. Likely Sources Not Yet Investigated: None recommended.

F. Supplemental Materials: None included.

PART IV - PROJECT INFORMATION:

Building 463 and the related tanks and access structure are scheduled for demolition to support environmental restoration and clean up of chemically contaminated soils in the immediate area of the structure, resulting from the handling of electrolyte chemicals used in the repair and overhaul of submarine batteries.

This survey and documentation has been prepared to comply with mitigation requirements established by a Memorandum of Understanding between the United States Navy, the California State Historic Preservation Officer and the Advisory Council on Historic Preservation executed in 1994.


MARE ISLAND NAVAL SHIPYARD,
ACID MIXING FACILITY
(BLDG. NO. 463)
HABS NO. 1543G (PAGE 14)
SITE SKETCH-JUNE 1938
DUMPS
UNDER CONSTRUCTION
LEVEE
BASEBALL DIAMOND
BLDG. 463
A STREET
B STREET
C STREET
D STREET
E STREET
NEW CAUSEWAY STREET(Q)
SUBMARINE REPAIR BASE
SUBMARINE REPAIR WHARF
FREIGHT WHARF
DREDGE TO 20'
NC. CAUSEWAY
NORTH
MARE ISLAND NORTH

MARE ISLAND NAVAL SHIPYARD,
ACID MIXING FACILITY
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SITE SKETCH-AUGUST 1994