NPS Form 10-900
(Oct.1990)

OMB No. 1024-0018

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NAT. REGISTER OF HISTORIC PLACES
NATIONAL PARK SERVICE

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If any item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name *S. S. Pomona*, Shipwreck

other names/site number N/A

2. Location

street & number Fort Ross Cove, off Fort Ross Historic State Park N/A ☐ not for publication

city or town Jenner – Fort Ross Historic State Park ☒ vicinity

state California code CA county Sonoma code 097 zip code 95450

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1986, as amended, I hereby certify that this ☒ nomination ☐ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ☐ meets ☐ does not meet the National Register Criteria. I recommend that this property be considered significant ☒ nationally ☒ statewide ☐ locally. (☐ See continuation sheet for additional comments.)

Stephen D. Mikesell DSHPO 1/30/08
Signature of certifying official/Title Date

California Office of Historic Preservation
State or Federal agency and bureau

In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. (☐ See continuation sheet for additional comments.)

Signature of commenting or other official Date

State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that this property is:

☒ entered in the National Register
☐ See continuation sheet.
☐ determined eligible for the National Register
☐ See continuation sheet.
☐ determined not eligible for the National Register
☐ removed from the National Register
☐ other (explain): ____________

for Signature of the Keeper — Erika K. Martin Seibert

Date of Action — 1/31/08

5. Classification

Ownership of Property
(Check as many boxes as apply)

- ☐ private
- ☐ public-local
- ☒ public-State
- ☐ public-Federal

Category of Property
(Check only one box)

- ☐ building(s)
- ☐ district
- ☒ site
- ☐ structure
- ☐ object

Number of Resources within Property
(Do not include previously listed resources in the count.)

Contributing	Noncontributing	
		buildings
1		sites
		structures
		objects
1		Total

Name of related multiple property listing
(Enter "N/A" if property is not part of a multiple property listing.)

N/A

Number of contributing resources previously listed in the National Register

6. Function or Use

Historic Functions
(Enter categories from instructions)

Cat: Commerce/Trade
Sub: Business
Cat: Transportation
Sub: Water-related

Current Functions
(Enter categories from instructions)

Cat: Recreation and Leisure
Sub: Outdoor Recreation
Cat: Landscape
Sub: Underwater

7. Description

Architectural Classification
(Enter categories from instructions)

Other: Steam Schooner

Materials
(Enter categories from instructions)

foundation **N/A**
roof **N/A**
walls **N/A**

other **Metal: Steel Hull**

Narrative Description
(Describe the historic and current condition of the property on one or more continuation sheets.)

The *S.S. Pomona* was built in 1888 by the San Francisco Union Iron Works in California. Irving M. Scott, Jr. an architect, who designed numerous ships for the Union Iron Works, prepared her plans. The *S.S. Pomona*, christened "Propeller Pomona," was first recorded on July 2, 1888, as a three-decked, two-mast, propeller steam schooner, built with a steel hull and complete heat and electric lighting system. She was 225 feet long, 33 feet wide, and 16 feet deep. On March 8, 1908, while en route from San Francisco to Eureka, the *S.S. Pomona* struck a submerged pinnacle off Monterey Reef and was sunk approximately ½ mile south of Fort Ross.

Today the *S.S. Pomona* lies on a terrain of boulders, thick with marine life. Her stern is oriented towards shore at a 33 degree angle from magnetic North, submerged in 17 to 40 feet of water. The steel hull and machinery are well preserved and have remained stable since their sinking. Almost fifty percent of the vessel remains intact despite prior salvage operations.

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing)

- ☒ A Property is associated with events that have made a significant contribution to the broad patterns of our history.
- ☐ B Property is associated with the lives of persons significant in our past.
- ☒ C Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- ☒ D Property has yielded, or is likely to yield information important in prehistory or history.

Criteria Considerations
(Mark "X" in all the boxes that apply.)

Property is:

- ☐ A owned by a religious institution or used for religious purposes.
- ☐ B removed from its original location.
- ☐ C a birthplace or a grave.
- ☐ D a cemetery.
- ☐ E a reconstructed building, object, or structure.
- ☐ F a commemorative property.
- ☐ G less than 50 years of age or achieved significance within the past 50 years.

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets.)

Areas of Significance
(Enter categories from instructions)

Transportation
Commerce
Engineering
Architecture
Archaeology: Historic Non-aboriginal

Period of Significance
1888-1908

Significant Dates
1888 – the year *S.S. Pomona* was constructed, 1894 – the year the engines were refurbished with the Howden's forced draught system giving the vessel greatly increased speed, and 1908 – the year the *S.S. Pomona* wrecked

Significant Person
(Complete if Criterion B is marked above)

N/A

Cultural Affiliation
N/A

Architect/Builder
Scott, I.M. / Union Iron Works (San Francisco, CA)

9. Major Bibliographical References
(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS):
- ☐ preliminary determination of individual listing (36 CFR 67) has been requested.
- ☐ previously listed in the National Register
- ☐ previously determined eligible by the National Register
- ☐ designated a National Historic Landmark
- ☐ recorded by Historic American Buildings Survey # ____________
- ☐ recorded by Historic American Engineering Record # ____________

Primary Location of Additional Data
- ☐ State Historic Preservation Office
- ☒ Other State agency
- ☒ Federal agency
- ☐ Local government
- ☒ University
- ☐ Other

Name of repository: California State Parks, Sacramento,CA. National Maritime Museum, San Francisco, CA. Indiana University, Bloomington, IN.

10. Geographical Data

Acreage of Property : 0.57 acres

UTM References
(Place additional UTM references on a continuation sheet)

	Zone	Easting	Northing		Zone	Easting	Northing
1	10	478599	4262268	3			
2				4			

☐ See continuation sheet.

Verbal Boundary Description
(Describe the boundaries of the property on a continuation sheet.)

The *S.S. Pomona* lies in Fort Ross Cove, Sonoma County, California, between 17 and 40 feet of water. Fort Ross Cove is located at latitude 38, approximately 12 miles north of Jenner. The site boundaries for the shipwreck *S. S. Pomona* are defined by a rectangle 250 feet along the long axis of the hull remains encompassing the bow section forward of the Fort Ross wash rock traveling to the north north-east at 33 degrees through the stern rudder assembly, and a width of 100 feet wide perpendicular to this axis. The area defined is less than one acre with the UTM provided as the geographic center of the site.

Boundary Justification
(Explain why the boundaries were selected on a continuation sheet.)

The *S. S. Pomona* is a substantially intact vessel that includes documented features from the bow section forward of the Fort Ross washrock to the stern rudder assembly, with upper deck debris scattered on the starboard side. Magnetometer survey initially provided the location of the site as identified the hull remains from bow to stern. Site boundaries have been delineated by scuba divers setting a datum baseline along the central axis of the hull and measuring all visible features with hand-held tapes. Snorkel and scuba visual transects were conducted from established data points using underwater compass and surface bearings, with features plotted on the site plan. The site is far enough from the Fort Ross Cove bluffs to not be effected by erosion. The water depth of the bow section and breakwater of the Fort Ross wash rocks provides some storm protection to the hull remains.

11. Form Prepared By

name/title: **Charles Beeker / Director**

organization: **Underwater Science, Indiana University** date: **December 20, 2005**

street & number: **HPER Building, Suite 296** telephone: **812-855-5748**

city or town: **Bloomington** state: **IN** zip code: **47405**

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A **USGS map** (7.5 or 15 minute series) indicating the property's location.

A **Sketch map** for historic districts and properties having large acreage or numerous resources.

Photographs

Representative **black and white photographs** of the property.

Additional items
(Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of the SHPO or FPO.)

Name California: **State Lands Commission**

street & number: **100 Howe Ave., Suite 100 South** telephone: **916-574-1900**

city or town: **Sacramento** state: **CA** zip code: **95825**

S.S. *Pomona*, Shipwreck
Sonoma County, CA

The Career of the S.S. Pomona and Shipwreck

The steamship *Pomona* was built by the Union Iron Works at their Potrero Point facility on San Francisco Bay (Figure 1 and 2) and launched in the summer of 1888.[1] The steamship's career spanned twenty years and was witness to remarkable changes in the economy of the Pacific coastal trade. Registered under certificate number 150444, *Pomona* carried the designation "SCSRP" classifying her as a "screw steamer schooner with propeller." She flew the call letter "KFHC."

As Designed Description Summary

Vessel Name: *Pomona*
Launch Date: 28 July 1888
Builder: Union Iron Works
Built: Potrero Point, California
L.O.A.: 225 ft. (68.58 m)
Beam: 33 ft. (10.06 m)
Draught: 16 ft (4.88 m)
Tons: 1264 tons
Power Source: Triple Expansion Steam
Engine Horsepower: 1250 HP
No. of Masts: 2 (gaff headed; foremast capable of carrying a square sail)
Stack: 67 ft
Propulsion Type: Single Propeller
No. of Decks: 3

Pomona Specifications As Designed

Pomona was built by Union Iron Works with Irving Murray Scott listed as the Chief Draughtsman. From a notation on the general plans it appears that *Pomona* was the 9th hull built from these specifications, which were likely purchased by Union Iron Works from another designer or shipyard.

The design was built to the "first division class" specifications of the French-based international ship classification society Bureau Veritas, the highest classification available from that society. To insure that the specifications were met, the hull and machinery were regularly inspected by an inspector of the society during construction and every year thereafter. First division vessels were also surveyed fully in dry dock every four years and after any collision or other damage. The contract required that work was to be "complete in every respect and adapted to the requirements of a passenger and freight vessel on the Pacific coast."[2] It was during the second dry-docking, at the time of sale to the Pacific Coast Steamship Company, that the all specifications regarding the hull and machinery were recorded and published.[3] (See Appendix 1)

The hull was of a type just becoming common for freight-carrying passenger steamers, with a plain vertical stempost at the bow, a rounded elliptical stern, and two decks (cargo and main) within the hull proper. In addition, there was a raised forecastle deck, lower cargo handling well forward, and a long raised hurricane deck extending nearly three quarters of her length to the stern.

The hull exterior was built of riveted steel plates 1/2 inch thick, tapering to thinner 7/16 inch plates at the ends, with 5/16 inch plating used for the area between the main and hurricane decks. Rivets were also of steel, in accordance of Bureau Veritas rules that all structural materials should be consistent. Steel construction allowed the builders to make reductions in the scantlings (dimensions of the hull components) of up to 20%, allowing savings in first cost, as well as in increased internal area for cargo. Angled frames were made 3/8 inches thick, spaced 24 inches apart, and measured 3 x 4 inches, with reverse frames of 5/16 inch thick, 3 inch angles (together forming a "z" shape). The keel was a single iron bar 2 3/8 inches thick and 8 inches high made in four lengths with 21 ½ inch scarphs between lengths. The vertical center-plate keelson was attached to the tops of the floors, extending from forward to after collision bulkheads, with intercostal plates extending down on each side of the floors to the top of the keel. Side keelsons were made up of intercostals plates between floors. The hull was further strengthened by bulb plate stringers 9 inches high, attached by 3 x 4 ½ inch angles for the entire length of the hull, and joined at the ends. All steel work was required to be repainted with three coats of enamel paint every year, and the bottom of the hull interior coated with Portland cement. Bureau Veritas rules specified that all steel used in construction had to be tested, approved for use, and stamped with a particular mark on each plate.[4]

The interior of the hull was subdivided by seven watertight steel bulkheads: a collision bulkhead at each end of the hull extending up to the main deck, separated by five interior bulkheads extending to the cargo deck. The 12 inch high hatch coaming was supported by 3 x 3 inch angle iron 3/8 inches thick, caulked to make it watertight. In addition to the hatches in decks, there were also several openings in the side of the hull to ease cargo and coal fuel handling. These included three cargo ports, two opening on the main deck, and one on the hurricane deck, as well as a coal port on the main deck.

The hull had three decks, a lower deck (called a cargo deck in the hold), a main deck, and a lighter, partial hurricane deck. A wooden superstructure, reinforced by steel beams, was built atop the hurricane deck. First class passengers occupied staterooms in the superstructure, running along each side of the house, and enjoyed a social hall finished in hardwoods, with an ornamented cupola or skylight atop. A pilothouse and captains cabin topped the front of the superstructure.[5]

Steerage passengers resided in spaces on the main deck; a larger space fitted with 27 berths for men on the port side, and a smaller room to starboard fitted with 12 berths for women. Each steerage room was finished with a "plain, neat appearance" and had a single shared water closet and washroom. Within the steerage 28 air-ports provided light and air when weather conditions allowed them to be opened.[6]

The ships crew lived in three rooms in the hull; the "glory hole"; another space fitted with berths below the forecastle; and a quartermaster's berth fitted aft of the forecastle on the starboard side. The forecastle berths were to be finished in "a plain manner." The "glory hole" was filled with "as many berths as can be fitted" with 8 air ports and a plain iron floor. Ships officers lived in rooms in the deckhouse, except the captain who had a room just aft of the pilothouse.[7]

The pilothouse held the ships steering wheels, two compasses, and flag signal lockers. Bell pulls, and speaking tubes provided speed and other commands to the engine room. Another compass was mounted on the open flying bridge above the closed pilothouse.[8]

Boats and life rafts were carried to accommodate 220 passengers and crew. Two 24 ft long boats fitted with metal davits and one 16 ft long life raft were carried on each side of the hurricane deck resting on chocks. Fire hoses and buckets were also provided to meet government safety regulations.[9]

All places occupied by passengers and crew were heated with steam pipes, and lighted by 150 electric lights of 16 candle power. Electric power was provided by an auxiliary steam engine turning a dynamo. The main light fittings inside, as well as the navigation light fittings, were capable of being lit by both oil lamps and electric lights, reflecting the uncertainty of availability of the early electric light system. Electric call bells were also fitted from all staterooms leading to the pantry.[10]

Pomona also carried an auxiliary schooner rig, to provide some maneuvering capability in case of temporary engine failure. Many steamships of the last half of the 19th century used such sails to steady their motion when under steam. The steel masts were each fitted with cargo derricks, as well as the gaffs to set the sails.

The ship owners supplied hawsers, mooring lines, cargo falls, cargo chutes, gang planks, cooking utensils, crockery, silverware, loose furniture, musical instruments, bedding, upholstery draperies, carpets, curtains, stores of all kinds, bunting, and nautical instruments. Shipping lines often preferred to supply such materials in order to save money by purchasing specialized items wholesale.[11]

Pomona was provided with a thoroughly modern power plant to drive her single screw propeller and multiple steam auxiliary engines. The main engine was a direct-acting, inverted-cylinder, triple expansion type with a high pressure cylinder 23 inches in diameter, an intermediate cylinder 34 inches in diameter, and low pressure cylinder 56 inches in diameter, all having a stroke of 36 inches. The collective indicated horse-power of the engine was 1,300 at 105 revolutions. Each piston rod was steadied by a vertical box slide, mounted on the engine support legs, which kept the crosshead rigidly in line while operating. The engine saved space by mounting the surface condenser in the framing for the cylinders above, and mounting the air pump, bilge pumps, and the thrust bearing on the engine bed plate. The three cylinders and their associated valves were mounted atop six iron legs, three from the bedplate, and three from the top of the condenser. Hand operated reversing gear was mounted to the cylinder legs. A hand operated worm type reversing gear was mounted on the forward end of the engine shaft to get the engine off center for easier starting.[12]

Steam auxiliaries in the engine room included air pump, which was operated by levers worked by the main engine, and three independent pumps: a centrifugal circulating pump, a steam fire and bilge pump and a sanitary and fresh water pump. Steam auxiliary power helped provide power for various tasks on board requiring heavy work, allowing *Pomona* to operate with a smaller crew than otherwise. Steam steering gear, backed up by a cable system from the bridge, eased steering. A steam windlass sped up anchor hauling and provided a much safer system than employed on earlier ships. Two bower anchors, and a smaller kedge anchor, were carried as well as 150 fathoms of 1 3/8 inch chain cable. The anchors were not self-stowing, requiring that they be catted to the side of the upper hull. . A steam capstan aft eased line handling when mooring, a feature particularly important in several West Coast "dog hole" ports where the ship had to moor just off the rocky coast to load cargo. Four steam winches for use with the cargo derricks, two forward and two atop the deck house, provided efficient cargo handling. *Pomona* was also fitted with an auxiliary boiler connecting to the main stack for use when the main engines and boilers might be undergoing maintenance. A steam ash hoist eased the work of the stokers by lifting coal ash from the boilers through the fire room ventilators for disposal overboard through the ash chute.[13]

The main condenser was formed of a single iron casting, with one manhole on the top and two on the bottom for cleaning. The condenser held 834 brass, tinned tubes 5/8 inch outside diameter, 15 feet long, providing a total cooling surface of 2,023 square feet.[14]

Two single-ended cylindrical boilers, mounted side by side with their backs to the engine, provided steam at a working pressure of 160 lbs per square inch for the engine, auxiliaries, and heating. Each boiler had three Morrison suspension corrugated furnaces of 36 inches in diameter, all opening into a common combustion chamber at the rear of the boiler. Five-feet long grates on which the coal burned were fitted into each of the furnaces. The 2 ½ inch diameter boiler tubes were expanded into the tube plates at each end of the boiler and beaded at both ends. Slightly larger stay tubes of 2 5/8 inches were screwed into the tube plates at the front of the boiler and expanded and beaded at the back end.[15]

Each boiler was controlled and monitored by standard steam fittings as required by law and good practice. These included: a main stop valve with auxiliary branch on each boiler; two gauge glass stands and six gauge cocks on each boiler; surface and bottom blow valves; main and auxiliary feed check valves; a salinometer pot; a steam gauge; and several spring loaded safety valves.[16]

A Howden forced combustion system, installed in 1894 and recorded in the 1896 specifications increased the efficiency of the boilers by preheating the air entering the boiler fireboxes by forcing it through the boiler exhaust uptakes. Another auxiliary engine powered a boiler blower for the Howden system. Hot air which had been heated by passing through tubes in the boiler exhaust gasses traveled to distribution boxes fitted into the furnace doors; hand fitting of air valves and other associated fittings kept the system efficient and safe.[17]

Construction and Career

The Union Iron Works, who built *Pomona*, was initially known for its locomotives, boilers and engine castings, but under the managerial guidance of Irving Murray Scott, the company turned to shipbuilding in the 1880s.[18] The company already had a solid reputation for building ship steam engines and, in fact, the first casting job the fledgling company took on in 1849 was a propeller bearing. Thus the Iron Work's transition to shipbuilding was not as radical as it might appear at first glance. In the late 1870s, Irving Scott made a comprehensive tour of eastern seaboard iron shipbuilding facilities and brought the knowledge back to the west coast (Figure

3). By 1882 the Union Iron Works were building ships as well as the engines that powered them. Steadily building a reputation for well-built steamships, Union Iron Works went on to become one of the premier shipbuilding facilities on the Pacific coast, eventually adding the last critical component for a totally vertically integrated shipyard, production of steel, when they merged with Bethlehem Steel. The Union shield, brass plate attached to products of the Union Iron Works became synonymous with excellence.

In 1888 Union Iron Works produced three steel hulled vessels, the warship USS *Charleston*, the merchant steamship *Pomona*, and the tug *Active*. They rebuilt the 3069 ton *Walla Walla* and repaired hulls or inserted engines in many more. *Pomona* was just one of 59 ships built in San Francisco that year and one of the largest of the 28 propeller registered ships.[19]

On *Pomona*'s register, Scott is listed as the draughtsman of record and James Dickie of the Oregon Improvement Company as the master carpenter, suggesting that the Union Iron Works was not producing original ship lines, but rather using pre-existing, possibly purchased patterns that they then designed and built tailored interiors for. Scott was a mechanical engineer by apprentice training and a self-taught draughtsman.[20] His name on the ship's registry suggests that the Union Iron Works maintained a stable of draughtsmen that created the actual electrical and engineering drawings for the interior of the ship overseen by Irving Scott and James Dickie. This practice was commonplace as was the purchase of ship architectural patterns. As mentioned earlier, the patterns could have been purchased from a ship architect on either the East or West Coast. Advertisements for patterns were commonplace in New England newspapers.

Built in the last quarter of the nineteenth century *Pomona* joined the fleet of medium sized steam ships that carried the lion's share of cargo and passengers up and down the Pacific Coast. Although railroads, under the entrepreneurial stewardship of California leaders such as Leland Stanford and Charles Crocker, were making rapid inroads into the hinterlands of the bountiful California agricultural regions, maritime carriers still monopolized long-distance travel along the coast and trans-Pacific.

Pomona's sturdy built 'steel hull' represented a new technology for the West Coast. Although steel hulls had been around since the early 1860s, steel hulls were not widely produced after the American Civil War in the 1870s.[21]

Iron ships had been built in the United States since the *Codorus* in 1825. However, they were expensive to build and maintain. Few shipyards had the tooling needed to construct iron ships and the more rapid fouling of iron hulls over wooden hulls slowed iron hull adoption. But the strength of iron, its durability, and greater cargo capacity or iron vessels gradually won shipbuilder over. Most of the iron ships built prior to 1880 were tugs, ferries, coastal steam packets, and warships. The majority of American iron hull vessels were built in the shipyards of the mid-Atlantic seaboard—Philadelphia, Wilmington and New York—where there was ready access to the iron ore and coal for iron making, as well as local established iron manufacturing.[22]

Steel, although similar to iron, could only be produced in small batches by the "puddling process" until blast furnaces were developed. Still, a dozen or more, small, riverine, narrow hull, steel vessels were built before blast furnaces were introduced. Finally, British inventor Henry Bessemer and American inventor Alexander Holley perfected the processes of smelting steel by the 1860s. Then the American Civil War created the need for speed in an effort to elude southern port blockades. There was a huge financial incentive for blockade running. Bessemer & Holley's process made it possible to produce steel cost-effectively. The *Banshee* (1862), an Anglo-Confederate Company blockade-runner was the first all steel hull vessel to sail under the American flag, after her capture. Several dozen more, fast, steel steamships were built and although their wartime cost was not an issue considering the potential profit, their uncertain quality was, causing several blockade-runner hulls to buckle. But even with these noticeable drawbacks in cost and construction quality, the strength of steel was apparent. Several of the steel hulled blockade runners were captured while dozens of other steel hulled blockade runners were sold abroad introducing the world rapidly to sleek designs and the potential of steel hulls, as well as the new steel producing process.[23]

Within the first decade post Civil War, blast furnaces began to appear and craftsmen began to master the steel smelting process involved in the cost-effective production of consistent quality steel. The first steel vessel built in the United States was the tug *Sport*, designed and built by Frank E. Kirby at the Wyandotte Iron Shipbuilding Works in Michigan in 1872. In 1992, the wreck of the Sport was the first underwater historical site marked for protection by the state of Michigan.[24]

When the United States Navy began to rebuild after the Civil War and subsequent years of neglect, steel warships were their highest priority. The first four of steel warships were built in the Philadelphia shipyard of John Roach.[25] The ships did not exactly match the contract specifications and a protracted dispute arose between the Navy and John Roach.[26] When the Navy was ready to let contracts in 1885 they were looking for other shipyards with successful experience in steel hull construction even if the bids ran higher.

Thus the Union Ironworks, who had built the steel hulled collier *Arago* and the British designed steel hull *Premier* and was about to launch the steel hull, passenger steamer, *Pomona*, received its first contract for a modern warship, the USS *Charleston.*[27] Satisfactory completion of the contract led to more warship contracts from the US Navy, as well as for several foreign navies, and allowed the yard to expand and modernize its industrial plant to work with steel.[28]

The infusion of naval contracts in combination with the Union Iron Works existing contracts allowed the company to further expand and modernize the Potrero shipyard.

When launched in 1888, *Pomona* was fitted out with an economical triple-expansion steam engine and a single brass propeller. Propellers, like steel were not new ideas on the East Coast but had not been widely adopted until later on the West Coast. In 1888 when *Pomona* slid off the weighs an equal number of sailing ships were launched.[29] Triple-expansion steam engines, invented in the first quarter of the 19th century and almost universally used in ships by the 1880s were so reliable that their use continued up through World War II, some vessels with triple-expansion engines lasting almost through the entire 20th century (Figure 4). The combination of the triple-expansion steam engine and propeller provided *Pomona* with a reliable power plant and improved source of propulsion for ocean-going ships.

The concept of propellers was first discussed in print in the 17th century. However, it wasn't until 1804 that when the Steven brothers built and tested a double-screw propelled boat on the Hudson River that the applicability of the concept took hold. Throughout the 1820s European inventors took out patents on propeller designs but there did not catch on with shipbuilders. Finally, John Ericcson the Swedish/American inventor, and Petit Smith, a British farmer/inventor both took out patents in 1836 for propellers that created an elongated helix. Four years later the US Navy commissioned its first screw-steamer, the *Robert F. Stockton*, named for Captain Stockton who championed the use of propellers in the navy. In 1841 the USS *Princeton* was the Navy's first steam-screw frigate.[30]

For engineers of the time, one of the biggest hurdles was constructing and engine that could turn at 60 to 100 revolutions per minute. Paddle wheels engines only turned at 10 to 15 revolutions per minute. Ericsson overcame the problem initially by dispensing with the paddle wheel engine gearing thus boosting the propeller shaft revolutions to 40. Continuous refinements by persistent engineers overcame the hurdle and soon capable engines were readily available.[31]

One of the great advantages of the propeller is that the driving propulsion system moved to the lowest part of the hull, dropping the center of gravity and thereby increasing stability and reducing pitch and roll. In addition, paddle wheels are susceptible to damage and less efficient in ocean conditions, while propellers are less so. Installing a propeller on *Pomona* with a triple expansion engine capable of producing enough horsepower to maintain 15 knots of speed insured that the coastal steamer was well suited to the tasks she was designed to do (Figure 5).

Local newspapers covered the ship's initial sea trials describing her as the "Propeller *Pomona*" and the steamship's interior as a "floating palace."[32] *Pomona* was fitted out with passenger cabin accommodations for 200, a social hall, dining room, and a coffee shop, all outfitted with expensive hardwoods of superb craftsmanship. The papers touted that new steamship was latest in innovative design featuring heat and electric lighting systems and new and an improved propulsion system. The Daily Alta dubbed her the "Pride of the Coaster Fleet."[33]

The San Francisco papers were not exaggerating when they wrote of the innovative design. The introduction of incandescent bulbs and the 3-wire system was new. Edison Electric lit the first town in the United States, Roselle, New Jersey in 1882. Illumination in most cargo vessels prior to the 1930s continued to be by candles and oil lamps, but once electric lighting became available it was quickly applied to naval vessels and passenger steamships.[34]

Practical electric arc lamps powered by dynamos were fitted in lighthouses as early as the 1850s and to warships in the early 1870s. But arc lights required careful management. It was not until the American inventor, Thomas Alva Edison and the British inventor, Sir Joseph Swan worked out the production problems of electric light bulbs that electric light became widespread. The glass bulb burns a carbon filament inside the vacuum of bulb.

One of the earliest electric light systems was fitted in the saloon of the Trans-Atlantic passenger ship, *City of Berlin* in 1879. The success of that system prompted other owners to follow suit by fitting lighting in both passenger accommodations and the engine rooms of new vessels. The

Cunard Line included an extensive electric lighting system with 178 light bulbs in their first steel luxury liner, *Servia*, in 1881. Edison Electric patented the 3-wire electric light system and bulb in 1882. The following year the first US built, vessel the USS *Trenton* was fitted with an electric light system.

Early marine electric lighting systems used small auxiliary reciprocating steam engines to power electrical dynamos. The early electric wiring systems used three-wires, but by the late 1880 a safer, 2-wire system with a ground wire replaced the earlier systems. In ships, the hull was used as the ground. Early Edison patent lamps, quickly nicknamed "light bulbs", used a wooden base and plaster insulation that easily cracked or swelled with moisture, ruining the entire bulb. In the moist and rugged conditions at sea, numerous replacement bulbs had to be kept on hand.[35]

Pomona was a pioneer in the new illumination method. She was fitted with an early Edison electric generating dynamo and electric light bulbs. However, advancements in electrical lighting were so rapid that in 1894 when *Pomona* was refitted her lighting system was replaced with a safer, more efficient new one. The new system included the safer wiring, a more efficient steam generator and dynamo, as well as longer lasting bulbs.

The mention of a dining room and coffee shop in conjunction with cabins reflects the intended versatility of the vessel. The dining room and cabins accommodated long distance or overnight travel while the coffee shop accommodated short hauls within the coastal trade routes. Historically, ferries had coffee shops and passenger liners had dining halls. Having both reflects that *Pomona* was conceived and built for multiple uses in the coastal trade.

Although *Pomona* immediately joined the Pacific Steamship fleet running up and down the coast, the steamship was built for that company (Figure 5). She was commissioned for a partnership consisting of the Oregon Improvement Company, Captain Josiah Nickerson Knowles and Union Iron Works. From 1888 through 1896 when *Pomona* was sold, the ship's registry rotated through the three owners, starting with Union Iron Works and ending with the Oregon Improvement Company. It was during this time that the boiler room was refurbished with a Howden forced draught system and new boilers. In late 1894 the system, which helped draft the exhaust included a fan, which helped preheat the air used in the boiler by passing it through the exhaust before feeding it into the boilers. Preheating the air before it fed the coal fire increased the temperature augmenting the delivery of heat to the boilers and thus increasing the ship's speed and efficiency.[36] Before modification, *Pomona*'s average trip from San Francisco to Vancouver took her 19.87 hours; after modification, it took only 18.25 hours, using less coal. The Howden modification increased the horsepower of each cylinder by 166%. In moderate conditions *Pomona* could sustain 15.5 knots, making her the fastest steamship on the West Coast.

Finally 1897 the Pacific Coast Steamship Company purchased *Pomona*. The fact that after a decade of continual use the steamship was still worth purchase is a testament to the quality of the vessel's original construction and the superiority of steel hulls. In fact, the Pacific Coast Steamship Company and Union Iron Works published a book that year called, Specifications for a Steel Screw Passenger and Freight Steamer '*Pomona* Type.' This is quite impressive considering the design was a decade old in a time of dynamic change.

Wooden hull coastal steamers of the same period rarely lasted longer than a decade. This was in part due to the rugged and dangerous lay of the Pacific coastline and nature of coastal trade. Yet, if they managed to avoid wrecking, the toll taken by salt water and the dynamic sea conditions weakened the hulls to the point that they were deemed un-seaworthy and hulked. However, after a decade *Pomona* was still going strong with only minor repairs. Even when the Pacific Coast Steamship Company set about remodeling *Pomona* the refit focused on the ship's rear superstructure, shortening it by 20 feet (6.1 m). During the 1897 remodel they also modernized the electrical system replacing the Edison dynamo with a newer, steam-driven electric generator. This replacement was undoubtedly for economic reasons. *Pomona*'s original electrical system was constructed in the early years of electrifying ships. The bulbs for the early systems were expensive and the generators not as powerful. In 1897 improvements to the generators and bulbs were sufficient to warrant the cost of the replacement.

Pomona's remarkable career in the rugged and often dangerous waters of the Pacific coast lasted another ten years following the refit of 1897. Her boilers were replaced in 1900 and repaired in 1907 and 1908. The steamship's hull was repaired after collisions in 1901, 1903, and 1904, but there were no other major refits made to the ship after 1897.[37] The triple-expansion steam engine and the steel hull served *Pomona* right up until the vessel wrecked in 1908 and the large parts of the engine were considered valuable enough to warrant salvage.

Over the two decades of her career, the steam ship *Pomona* sailed through a remarkable period of West Coast history. *Pomona* carried the people and cargo that transformed California from a boom-time economy to a fully functioning economy helping set the state on the road to becoming one of the world's most prosperous economies. The timeless shape of the hull, with its efficient and reliable triple-expansion steam engine coupled with effectiveness of a single propeller, are the hallmarks of good design. The quality of Union Iron Works construction and thoughtful refits and additions, over the course of the ship's career insured the longevity of the vessel's lifespan. Like the durable Model T design in automobiles, there are pivotal moments in maritime technological history where the combination of parts creates a product so well suited to the task that it endures for a long period of time. *Pomona* represents such a blending of late 19th century components. If *Pomona* had not wrecked in 1908 it is possible that the steamship would have continued in service well into the 20th century.

The Shipwreck

In the evening dusk, around 6:30pm on March 17, 1908 on route to Eureka, the S. S. *Pomona* struck a submerged reef, off the rugged coastline of northern California, while traveling from San Francisco north to Eureka. *Pomona* was steaming slowly in heavy seas north towards

Eureka, carrying 84 passengers, a crew of 62 men, and 300 tons of general merchandise. Accounts vary, but modern scholars believe *Pomona* struck Monterey Rock just south of the double-bowl cove below Fort Ross in Sonoma County. Fort Ross was established on the 38th parallel of latitude as a Russian outpost in 1812 and the cove below served as a port throughout the 19th and early 20th centuries.[38] Fort Ross is approximately 100 miles (161 kilometers) north of San Francisco and was erected to protect the southern Russian interests on the Pacific coast.

There are hundreds of submerged rocks and reefs off the coast of northern California, which pose a danger to navigation. These rocks and reefs sit just under the surface of the water and are rarely exposed. Generally the only telltale sign distinguishing them is the turbulent surf washing around the rocks giving them the colloquial name "wash rocks." Monterey rock, falls within this category of navigational hazards and was named for the first ship that struck it in 1880, thus giving the rock a name and a position on the charts.[39]

According to Captain Swansen, the ship was close to shore because he was concerned that the rough weather would make passengers uncomfortable and many were seasick. However, some passengers on the S. S. *Pomona* speculated that the boilers were malfunctioning and could not hold enough pressure to give the engine the horsepower it needed to plow the ship through the swells and winds in the open waters, thus had to come close to shore. According to L.F. Puter, a self described veteran of 350 trips between San Francisco and Eureka, the S. S. *Pomona* was running closer to shore than he had ever seen a vessel go "so close to shore you could tell the color of a cow on the hillside…the truth is the S.S. *Pomona* could not buck the weather."[40]

The boiler system had been repaired in 1904 and John Bulger, the Inspector of Boilers, had certified the S.S. *Pomona*'s boilers to the working pressure of 150 lbs on August 15, 1907.[41] However, on January 10, 1908, the boilers developed a leak that required a $6,800 repair, which had only been completed March 5, 1908. The S. S. *Pomona* was only on her second voyage since the repair when she wrecked.[42]

After striking the wash rock, *Pomona* began taking on water, fast. Captain Swansen called for full steam and veered off-course steering the ship toward nearby Fort Ross Cove, in hopes of grounding her on one of the beaches and saving passengers, crew and cargo. This was standard practice at the time. Not until 1913, after the infamous *Titanic* disaster, were ships required to carrier sufficient life-saving gear to get everyone off a sinking ship, let alone save any cargo.[43] Running a vessel up into the shallows and grounding it saved lives and presented the possibility of salvaging cargo. Sinking in deep water almost always resulted in loss of life and complete loss of cargo and ship.

Captain Swansen was not able to turn *Pomona* fast enough to make the shallower southeastern beach in Fort Ross Cove and so tried to head for northern bowl of the cove where lumber schooners moored to take on cargo and passengers. However, while entering the cove, *Pomona* struck another wash rock (Figure 6). The Fort Ross Cove wash rock is centrally located at the mouth of the cove (Map 1). The rock was buoyed and used by lumber schooners as a pick-up mooring to pivot their vessels and tuck them into the small cove where they picked up several other moorings, securing them tightly into place. Whether Swansen did not recognize the pick-up mooring on the wash rock or the sinking steamship proved too difficult to accurately steer, is unclear. What is clear is that *Pomona* ran up onto the wash rock and stuck. As the stern settled, the ship pivoted, swinging completely around with the bow pointing seaward. Listing heavily to starboard Captain Swansen feared the vessel might roll into deeper water and gave the order to abandon ship. It took several trips for *Pomona*'s lifeboats to ferry all the passengers and the crew the final 200 yards (193 m) to shore (Figure 7). Luckily *Pomona* did not roll over but remained upright, her bow projecting out of the water perched on the wash rock. Although *Pomona* was a total loss, there was no loss of life or injury during the abandonment, "even a parrot and three dogs were evacuated."[44]

George Call and his family, who lived on the nearby bluffs overlooking Fort Ross Cove, assisted Captain Swansen on shore. George and his sons helped unload passengers and some cargo, while his wife provided shelter in their home and gave the women and children milk and coffee. Many of the male passengers spent the rest of the night on the "inhospitable beach" lighting fires to stay warm.[45] The Call family was initially praised for their assistance and hospitality during the wrecking event, but later the Pacific Coast Steam Ship Company sued them, claiming the Calls subsequently salvaged and sold large quantities of the ship's stores, including two cases of rifles. Charges were eventually dropped for lack of evidence. One of the S.S. *Pomona* nameboards hung on the Call house front porch until New Year's Eve of 1972, when it was stolen (Figure 7). The other S. S. *Pomona* name board is located at the San Francisco Maritime Museum.[46]

The Salvage and Subsequent Archaeological Studies

Immediately after sinking Lloyds of London, the Pacific Steamship Company's insurer, contracted with Thomas P. Whitelaw of the Coast Wrecking Company to salvage *Pomona*. The salvage agreement was a 75/25 split for cargo, in favor of the salvage company and a 60/40 split for the ship. Pacific Steamship Company insured *Pomona* for US$100,000. Lloyd's eager to recover the profitable vessel advanced US$10,000 toward the ship's salvage.[47]

Whitelaw and his crew of hardhat divers moored the salvage vessel Greenwood to starboard of the wreck and began salvaging. Although they were unable to recover the hull, they did succeed in recovering the majority of gear and items from the decks above water including ceramics, glassware, utensils, linens and mattresses. Also they were successful in recovering the items from the bridge as well as boats and davits, anchors and chain, ventilators and other running rigging gear. The salvaged items were sold at auction on Broadway Wharf in San Francisco later in the year for a total of US$3,000.[48]

After stripping portable objects from the shipwreck, Whitelaw's salvors turned their efforts to the more substantial objects, anchors, propeller, hoists, the upper works of the triple expansion engine, the water system, and other power system mechanisms (Figure 9). To do this, the salvors had to break down parts of the ship including the wooden superstructure to gain access to the machinery below. In the process of recovering the engine and/or gaining access to it, they may have dislodged the portside boiler. In either case, the work was slow going, for they were still at work salvaging items from the vessel five months later.

Californians followed the salvage of *Pomona* through regular articles in the San Francisco papers. A late September news article featured a story about the hardhat divers and the "monster devil fish" that had taken up residence inside *Pomona* within one of the boilers.[49] In reality the monster was a large octopus.

When the first storm of winter hit on November 21st, *Pomona*'s weakened hull began to break apart. The bow, which had sat suspended on the Fort Ross wash rock broke away and slid seaward coming to rest in approximately 40 ft (12.1 m) of water. The rest of the hull slipped back and permanently came to rest on the shoreward side of the wash rock in shallower depths.

After the November storm *Pomona* became a serious navigational hazard to the smaller lumber schooners entering the northwestern side of the cove. Charges were set by divers to further break apart the hull and accelerate the site formation process. The storms of winter 1908/1909 finished the salvors' work flattening the hull into large fragments on the bottom. After that the shipwreck was quickly forgotten and the natural processes of shipwreck site formation took over.

Fifty years later, after the advent of scuba, divers rediscovered the underwater remains of *Pomona*. Like other shipwrecks along the Pacific coast, divers annually visited the site and removed mementos. Then in 1970 the bottomland within Fort Ross Cove was added to the protected acreage of Historic Fort Ross Park. It took a few years for sport divers to become aware of the state protection laws and a decade for archaeologists to begin systematically studying tne site. During the intervening years sport divers in response to an active campaign regarding *Pomona*, returned numerous artifacts to State Parks.

In 1981 California State Parks instigated the first underwater survey of the cove. The survey included remote sensing with a magnetometer, which located 55 iron anomalies. These anomalies were visually inspected. Cluster #6 on the wash rocks revealed the remains of *Pomona*. James Delgado, National Park Service, produced the first site plan for *Pomona* with help from State divers in 1984[36]. Another archaeological survey was mounted in 1988, but weather and a robust kelp forest that year prevented completion of a systematic site map. However, by 1988 enough information had been gathered to archaeologically register the site. The California Information Resource Center assigned the trinomial CA-SON-1704H to the S.S. *Pomona*.[50]

It took another ten years for California State Parks to mount further archaeological study of the shipwreck. Starting in 1999 students from Universities of San Diego and East Carolina along with students from the California State Universities Northridge, San Jose and Sonoma coordinated by Indiana University's Underwater Science Program began annual work on the site (Figure 10 and 11). Over the next three years the archaeological team recorded the shipwreck remains, helped conserve several recovered objects, created a waterproof site map with brief history for sport diver use, and produced two master's theses.[51]

Current Site Description and Environmental Impacts

Today, one hundred years later the remains of the S.S. *Pomona* lie on the bottom of Fort Ross Cove. The inshore stern remains sit in 17 ft (5.18 m) of water, while the bow, which broke away in 1908 sits out-shore of the wash rock in 40 ft (12.19 m) of water. A central point in the shipwreck at the intact boiler represents the more precise UTM coordinates for the archaeological site. Using true magnetic orientation, *Pomona*'s wrecked hull lies on an axis pointing 33° northeast toward shore.

The bottom terrain of the cove is sandy on both the northwestern and southeastern sides. However, a promontory extends out underwater in the center of the cove past the wash rock into deeper water. The remains of *Pomona* rest within the rocky outcrops of the submerged promontory. The makeup of the bottom terrain while exposing the shipwreck to aerobic deterioration has also worked to keep the shipwreck remains in a well-defined area.

During summer months the shipwreck is covered with thick bull kelp further inhibiting the movement of wreckage but marking the rock outcrop and thus *Pomona* quite clearly (Figure 12). Bull kelp, which latches on to the rocky bottom substrate can grow up to one foot per day in season. When mature, each kelp plant reaches from the seafloor to the surface. A forest of bull kelp works like a baffle dissipating wave action within the forest. The seasonal kelp forest on the *Pomona* site mitigates the ocean swell power, protecting the site from deterioration caused by the dynamic environment of the Pacific Ocean.

The cold, nutrient rich water of the northern Pacific and the rocky outcrop substrate on the floor of the cove provide a healthy habitat for marine life including abalone, starfish, anemones, and nudibranchs. Within the water column are numerous species of fish and mammals including lingcod, great white sharks and harbor seals.[52] Annual water temperature ranges from 35°F to 50°F (1.6°C to 10°C) and visibility varies from 5 ft to 30 ft (1.5 m to 9.1 m).

The orientation of Fort Ross Cove deflects the prevailing sea swells coming in from the northwest, buffering the *Pomona* from the full force of the Pacific. One hundred foot high cliffs surrounding the cove also protect it. It is this protective combination that made Fort Ross a popular small port. Prior to European contact the northern bluff was the site of an expansive

Kashaya Indian settlement. During the heyday of Russian Fort Ross there was a shipyard and warehouses on the southern side of the cove. Later, a lumber chute and railway were built on the northern side of the cove, which provided safe anchoring for schooners loading lumber and goods. It is the continued protection of the cove that contributes to the relatively good preservation of the shipwreck *Pomona*.

The Archaeological Site Defined

The Fort Ross wash rock, only visible at Neap low tides, exhibits a groove worn into the top from *Pomona*'s bow rocking back and forth before finally breaking loose and sliding into deeper water. After sinking in 1908 and subsequent 8 months of salvage, the remains of *Pomona* were left to settle in place. *Pomona* experienced a normal sequence of shipwreck site formation process.[53] All organic materials, such as wood, bone and fiber quickly disintegrated in the aerobic, nutrient rich waters, leaving the more impervious objects such as metals, glass and ceramics.

In the second stage of the site formation process, natural elements such as storms and wave action worked at loosening the hull's integrity and flattening it out. The groove in the wash rock stands as mute testimony to the wrecking process in the earliest phase of this stage. The well-placed charges of the salvors simply accelerated this natural process.

In the final site formation process the remains of *Pomona* have reached equilibrium with the ocean floor. Due to salvage and sea state dynamics, the curvature configuration of the hull has broken down and large hull fragments, complete with hull plates, framing construction, deck attachment points, and ceiling plates, lie flattened on the bottom, to either side of the vessel's centerline. One of the boilers, the condenser, and a piston rods stand proud of the bottom in their original positions. The propeller shaft with pillow blocks, crankshaft and rudder mechanism clearly define the centerline of the shipwreck. Although no longer aligned with the ship's centerline, large fragments of the bow are substantially intact as well, presenting easily discernable construction features and elements, such as outer stem, framing, hull plates, hawse pipes, and railing.

The portside boiler is intact but dislocated off the starboard stern quarter. The displacement of the port boiler is attributed to past dynamiting of the site, but this is questionable since the boiler is intact and appears to have simply rolled away from its original mount. It is possible that the salvors removed the portside boiler to gain better access to the triple expansion engine, which was a prized salvage component. In this scenario, it is possible that the salvors dumped the less valuable boiler off the stern of the salvage vessel Greenwood, which was tied alongside the starboard stern of the wrecked *Pomona*. As either a relic of the salvage process or natural dynamics the portside boiler currently lies intact off the starboard stern quarter.

In its flattened state there is approximately 35% to 45% of steel hull remaining. The majority of her three decks, the superstructure, the ship's interior, the majority of machinery including the water system, and most of the upper hull are gone. The remaining ship hull and machinery is slowly deteriorating in the saltwater environment but appears to have reached equilibrium in the site formation process.

Once located, the construction and propulsion features of the *Pomona* are easily identified and the layout of the ship still clear to the observer. Although somewhat protected inside Fort Ross Cove, given the average dynamics of an open ocean environment the *Pomona* shipwreck is a remarkable archaeological site with substantial context intact. Today, the remains of *Pomona* cover an area roughly measuring 250 ft (76.2 m) from stem to stern and out 50 ft (15.2 m) to either side of the site's centerline or 25,000 sq. ft (1158.2 sq. m). This is not substantially larger than the original footprint of the vessel (225 ft by 33 ft/68.6 m by 10 m)(Figure 10).

Intact hull components on the *Pomona* shipwreck

Bow

Seaward of the wash rock the remnant, bow section includes large hull fragments with intact framing, hawse pipes, and a hatch cover. The two cast iron hawse pipes lie side by side in the bow. The pipes are riveted to the shell with heavy flanges for use with anchor chain. The bower anchors are evident in the historic images of *Pomona*. The structure of the bow, although broken, still reveals the outer stem profile as well as intact port side framing and hull. Another piece of hull fragment with the intact triangular shaped collision bulkhead has slipped down underneath the larger portion of the bow. In the same general area is a small hatch, which would have provided access to the forward-most bow lockers. An upper hull section lays nearby with intact portholes that let-in daylight below deck in the focs'le. Portholes can also be seen in the historic photographs running in a line along the entire length of the hull. The two recovered are all 12 in. (30.48 cm) diameter, but one is hinged with brass flanges and locking dogs while the other is not. The porthole without hinge is from the bow area reflecting the need to keep that area watertight.

In-shore of the wash rock, the lower hull retains the lines of the narrowing shape of the bow reflecting a sleek entrance for the hull below the waterline. Historic photos reveal a plumb stem and confirm a sharp bow (Figure 6). The first 15 ft (4.6 m) of the hull inshore of the wash rock also displays the pressure exerted on the suspended bow hung on the wash rock. The intact hull is bent at an angle greater than the simple rise generated in the ship's original architectural lines. The hull had probably already begun to sag at the juncture of the keel and the stem when the winter storm tore the bow section away.

Out to starboard in the bow area lays a cargo hatch. Whether it is for an upper deck or lower coalbunker is unclear. Historically coalbunkers were forward of the boilers but their hatches were round in shape to better accommodate coal-loading chutes. Cargo hatches, on the other hand, were rectangular in shape and depending on their size 4 ft (1.2 m), 8 ft (2.4 m), or even 12 ft (3.7 m) were built on multiples of the 4 ft (1.2 m) distance between deck beams.

Amidships

Intact lower hull structure stretches out from either side of the centerline toward the turn of the bilge in a northeast direction from the wash rock a total of 185 ft (56.4 m). This represents 82% of the ship's overall length and represents most of *Pomona*'s register length. The keel is an 'I' beam style and is clearly visible forward of the boiler and engine platforms. The minimal deadrise of the frames to either side of the centerline amidships reflects the beamy, relatively boxy design of steamship hulls from the last quarter of the 19th century. The combination of a beamy amidships with a sharp entrance at the bow and a rapidly narrowing exit at the stern provided *Pomona* with reasonable hull speeds while allowing for adequate cargo space.

Large fragments of hull lie out to either side of the intact run of lower hull. One fragment is off the starboard stern and measures 35 ft (10.6 m) in length. The hull, framing, system like the keel exhibits 'I' beam construction. The lower frames measure 20 inches in height. The outer hull plates are riveted to the frames and cross strapping, as well as triangular, plate knees provide additional hull strength.

There is only sporadic evidence of the decking and interior superstructure. Although we know that *Pomona* had three decks at launching (cargo/lower, main and hurricane), we also know that her aft superstructure was cut down by 20 ft (6.1 m) in 1897 and that the salvors probably would have cut away her decks to get to the engine and salvageable cargo. Although her main deck was steel, her upper Hurricane deck was wood with laid canvas. Decking was regularly salvaged and it is possible that so were the substantial, steel, deck beams and deck plating. The two 30 ft (9.1 m) long I-beams located off the starboard with connecting steel plates (8 ft by 2.5 ft by 4 in. thick) evenly spaced along the length of the beams may be remnant decking superstructure with remnant plate decking, the engine room crane rails, or may even be re-used deck beams the salvors erected as a staging platform to lift engine components. Either way, the lengths of the beams are within the constraints of the width of the hull.

The Stern

Aft of the run of lower hull lies the rudder. The cast steel rudder is 10 ft (3 m) long and lies just off the starboard stern. A few feet forward from the rudder and 10 ft (3 m) to starboard lies the steering assembly, consisting of a 3 ft diameter wheel lying on top of the steam steering gear that originally connected to the top of the rudder post. The steering gear, hoists, boilers and engine were all patented styles widely in use throughout the world by the time *Pomona* sank.

Lying near the rudder parts are two bits. These reflect the configuration of the upper deck of the stern where mooring lines were secured while the vessel was in port. The fact that the rudder, steering gear and bits were not salvaged while the engine, propeller and anchors were, reflect the priorities and comparable values assigned by the salvors in 1908.

Pomona's single propeller had a span of 10 ft 6 in. (3.2 m) and a 16 ft (4.9 m) pitch. Union Iron Works cast the brass propeller. Its value, at the time of casting, was substantial; twenty years later it was still very valuable and most likely one of the top priorities of the salvors.

The Engine and Boilers

When launched, *Pomona* was equipped with a pair of cylindrical "Scotch" style boilers that sat side-by-side to either side of the centerline of the ship just forward of the engine. The boilers sat in steel plates known as "saddles." Scotch boilers were a popular type of design developed in the shipyards of the Clyde River in Scotland in the early 1860s (Figure 13). Coal fueled the fire that heated the water in the boilers. Firemen shoveled coal from the bunker into the fireboxes at the forward end of the boiler through small doors set midway up the face of the boiler. Firebrick lined the firebox and the coal fire burned on top of a grate. The super-heated air and exhaust from the firebox passed, first beneath the boiler crown plate holding the water, then the hot exhaust began an upward journey rising through a series of pipes that ran through the water inside the boiler, eventually venting out of the boiler through the smoke stack at the front. Meanwhile, the heated water turned to steam and the steam was funneled into the series of pipes to the engine cylinders and other machinery.

The *Pomona* was fitted out with a triple expansion engine powered from the dual Scotch boilers. From refit records, we know that a more modern steam-driven electric generator was added in 1897. Also, there were pumps and several auxiliary donkey engines used to deliver both hot and cold water throughout the ship as well as power the hoists and winches.[54] Numerous diagnostic components remain of the power plant that drove *Pomona*.

Still sitting in its saddle is the starboard Scotch boiler [Boiler #1 on Figure 10]. As noted previously its portside mate [Boiler #2] is intact but now sits adjacent to the stern starboard quarter, 15 ft (5 m) from main hull. Both boilers are Scotch, single ended, marine boilers measuring 10.5 ft (3.2 m) in diameter and 11.7 ft (3.6 m) long. The firebox doors of the starboard boiler are still in place but deterioration holes, several feet wide in the outer boilerplates, expose the interior tubing of both the boilers. Upon close inspection several steam pipes in Boiler #2 appear to be crimped, but these tubes are actually the 'stay tubes,' where solid rods ran through the tubes and were bolted at either end. Early on in the archaeological survey researchers speculated that the crimping was intended to close off damaged tubes and that the artifactual evidence supported the post-wrecking contention that the boilers were not producing enough steam power. However, after her sinking a company inquiry calculated that *Pomona* was traveling at about 11 knots when she struck the Monterey wash rock. At top speed, in optimum conditions *Pomona* only ran at 15 knots. On March 17th *Pomona* was running north against prevailing currents and a head wind and the artifactual boiler evidence supports the inquiry's findings.

The outer plating of the firebox on Boiler #2 is gone providing a clear view of the exhaust and grating system. Firebricks line the #2 boiler firebox. One firebrick retrieved for exhibition from the wreck site bears the stamp "CARNEGIE" (Figure 14)

The Carnegie Brick and Pottery Company were located east of San Francisco near Tracy, California in the San Joaquin Valley. John and James Treadwell built their factory in 1902 and were in business between 1903 and 1911, when destroyed by winter floods.[55] The factory sported the latest patent pressed brick machines, which could produce up to 20,000 bricks per day. Each brick was stamped with the name "CARNEGIE" on its face. Salmon and buff colored brick, just like those lining *Pomona*'s boiler firebox were among the company's range of colors. The freckles in the brick are caused by bits of iron oxide and black coal present in the clay. Carnegie firebricks do not have the company's distinctive frog stamp on them. The presence of a Carnegie firebrick in *Pomona*'s boilers reflects the type of repair made on the boilers in 1907 and 1908.

Just forward of starboard boiler, in its original position, is the main condenser, which recycled the steam cooling it back into its liquid state before sending it back to the boiler. Like the boilers, it is now possible to see inside the condenser and examine a number of the condensation pipes. All of the pipes connecting the condenser to the boiler remain intact and one of the valves at the base of the condenser. These valves were most likely relief or drain valves. Each valve was attached to a small section of deteriorated plate steel. As required for steam engines, the valves contained adjustable steam pressure activated poppets for release of excessive steam pressure.[56] Aft of the boiler many of the large bronze pipes and their flanges still connect to the boiler. These pipes delivered the steam power to the engine.

Aft of the boiler sits the flywheel or "jacking gear." The jacking gear allowed the engineer to move the crankshaft off dead center. Behind the jacking gear is the massive crankshaft with connecting rods rising off the hull defining the exact location of the triple-expansion engine in the hull. The maximum relief of the remaining engine parts is only 8 ft above the surrounding seafloor. The triple expansion engine originally stood about 17 ft (5.2 m) high within *Pomona*'s hull.

It was in the cylinders of the engine that the steam translated to power ultimately turning the propeller and driving the ship. The cylinders were arranged in order of pressure required to push the piston and turn the crankshaft. The smallest diameter piston required the highest steam pressure to work. The steam entered the highest-pressure cylinder first working its way down to the lowest pressure cylinder as the steam lost it energy. As each piston "fired" it pushed the connecting rod turning the crankshaft that turned the propeller shaft. The steam returned to the condenser to be recycled.

All three (high, intermediate, and low) pressure connecting rods stand upright the starboard side of the crankshaft. The 23 in. (58.4 cm) high-pressure cylinder and the 34 in. (86.4 cm) intermediate-pressure cylinder heads are gone. The 56 in. (142.2 cm) low-pressure cylinder head remains, but the connecting rod is broken near the stroke attachment point (Figure 1). The large, low-pressure piston and connecting rod, with wrist pin and brass shims, lies next to the crankshaft on the seafloor.

Running aft toward the stern is the elevated propeller shaft. The intact, 14 in. (35.6 cm) diameter, forged steel, propeller shaft is 65 ft (19.8 m) long. At the forward end is the "thrust block" that transmits the thrust energy produced by the turning propeller into forward motion. The thrust block also protects the crank webs on the engine from bending due to excessive torque. The propeller shaft is intact from the coupling to the stern where it attached to the propeller that was salvaged along with most of the triple-expansion engine in 1908. Beginning at 10 ft (3 m) aft of the thrust block, under the intact propeller shaft, is a series of evenly spaced mounts or "pillow blocks" supporting the shaft. There are a total of three, 3 ft to 4 ft (.9 m to 1.3 m) high. The tops of the blocks, complete with access oiling holes, on either side of the propeller shaft, remain in place. Out to either side of the propeller shaft running parallel are 25 ft (7.6 m) I-beams. These are stringers adding extra support to the bottom of the hull in the area where vibrations from the engine and weight were the greatest.

Mast and Rigging

Sections of the two steel masts lie to either side of the main hull fragment. On the portside of the wreck, approximately 10 ft (3 m) out from the propeller shaft is a 37 ft (11.3 m) long section of mast running in the same general alignment as the keel. Historic images of *Pomona* in conjunction with her register show that the steamship had two masts rigged for carrying fore-and-aft, gaff-headed, sails. The presence of these masts is why many steamships, which once served on the West Coast, are sometimes referred today in print as "Steam Schooners." Wooden "steam schooners" served contemporaneously with larger iron and steel coastal passenger steamships such as *Pomona*. The year *Pomona* (1264 tons) was built, the first, purpose-built, lumber, steam schooner, *Newsboy*, of only 218 tons, was built in San Francisco, as well.[57] That sail-only, schooner-rigged, lumber vessels were plying the coastal trade as contemporaries of *Pomona* also serves to confuse modern researchers. It is doubtful if *Pomona*'s crew ever sailed the ship but the booms on the masts were frequently used to load and off-load cargo.

Salvage and Salvor Debris

Salvage of *Pomona* is well documented in contracts, newspaper articles and historic photographs. From these sources it is clear that the salvage of *Pomona* weakened then flattened the already damaged hull accelerating the site formation process of the shipwreck. However, their presence at the shipwreck site did not vanish from the archaeological record. The salvage debris piles both reflect important comparative information and distort the context of some objects, particularly deck superstructure and piping systems.

Off the starboard side of the main wreckage is scatter of unassociated hull components. This may be reflective of the fact that historic reports note that shipwreck listed to starboard and as the ship collapsed in the wrecking process objects slid to the lowest side of the hull. Historic photos also show that the salvors moored to the starboard side of the wrecked *Pomona*. In almost all salvaged shipwrecks there are distinct secondary clusters of salvaged and rejected shipwreck debris. Among the objects in this area are an encrusted bell shaped object, a single coat hook, and other debris including the two 30 ft (9.1 m) long I-beams with connecting plates and random lengths of pipe of varying diameters. The context of the parts, unlike elsewhere on the main shipwreck, is not readily apparent. The presence of the extended scatter of artifacts may reflect either scenario or both. However, the fact that the heavier pipes occur more on the starboard side of the shipwreck where the salvors moored supports that contention that at least some of the debris reflects the salvors' spoil piles.

In conclusion regarding the integrity of the archaeological site and potential to capture maritime history information from the remains of the shipwreck, the presence of the hawse pipes and the rudder mechanism clearly bookend the entire run of the hull. In addition, the presence of intact lower hull, ample bow structure, engine and boiler parts and the rudder and steering assemblage reflects that although the site lies flattened due to the salvage and wrecking processes, it is not widely spread out over the cove's seafloor and thus has the type of contextual integrity that can potentially answer many questions regarding construction and placement of machinery.

Recovered Artifacts

In addition to the artifacts documented on the site, a small number of artifacts were recovered between 1998 and 2001.[58] These objects were stabilized at the East Carolina University conservation lab and then returned to Fort Ross for display at the Visitors' Center.[59] These objects joined an assortment of artifacts chronicling *Pomona*'s career.

At the base of the main condenser, two, brass, over-pressure, release valves were documented *in situ* and then one was removed and conserved (Figure 5). The other, over-pressure, release valve remains in place.

One of two, 6 inch (15.2 cm) diameter, high-pressure steam, receiver pipes from the Scotch boilers was documented *in situ*, where it lay next to a 12 inch (30.4 m) diameter, high-pressure, receiver T-connector (Figure 15). The connector sits just forward of the crankshaft on the starboard side. Built in accordance with specifications for high-pressure steam pipes, the receiver pipe is a thick copper tube with a composite bronze flange brazed onto the discharge end of the pipe.[60] A second, portside, steam receiver pipe was not found. It is likely that salvors unbolted the pipes from the T-connector during salvage of the engine. Archaeologists recovered the documented receiver pipe lying to starboard.

While documenting Boiler #2 firebox (originally the portside boiler) archaeologists recovered a "Carnegie" brick. The brick was desalinated and stabilized before being added to the display.

Although very few small portable objects remain on the *Pomona* shipwreck site, several artifacts were documented, recovered and conserved. Among the portable artifacts were ceramic shards of the ship's dining plates. They were found off the starboard stern quarter just 5 ft (1.5 m) from the propeller shaft and near the location of the pillow blocks. The fragments were recovered and compared to complete examples of plates recovered from *Pomona* at the time of salvage in 1908. The intact examples are on display in the historic Call House next to the Fort.[61] The fragments match the intact historic plates. Both the fragments and complete plates are ironware carrying the "John Maddock & Son's" maker's mark on the base. The British Maddock's Pottery manufactory produced plain, utilitarian wares often used on passenger ships and in hotels.[62] Under the maker's mark is importer's name, Nathan Dohrmann Company of San Francisco. Dohrmann supplied chinaware to hotels and ships in the Pacific.[63]

These plates may have been part of the cargo but it is more likely they represent pieces from the ship's dining room or coffee shop. White ironware was the common style used aboard coastal passenger ships of the time. In addition, the lack of a wide scatter pattern of ceramics on the seafloor suggests that the majority of ceramics were salvaged from the dining and kitchens in the upper superstructure.

Off the starboard side, 25 ft (7.3 m) forward of Boiler #2, archaeologists found and documented a single, brass, coat hook. Passenger cabins and salons on ships in the 19th century often sported brass hooks on which passengers and crew hung hats and coats. Historic photos of *Pomona* clearly display the location of the bridge, cabins and dining area in the wooden upper superstructure and the 1916 Union Iron Works specifications call for "officer's quarters were to be fitted with four brass coat hooks."[64] Hooks would have been ubiquitous throughout the ship. Earlier in the century cast brass hooks were a popular import item from China reflecting the wide spread use both on land and at sea.[65] The presence of a single hook, out of context, is inconclusive as to the fixture's role aboard *Pomona*, or its original location. It could reflect the fact that some of the wooden superstructure deteriorated on site or it could reflect the demolition of the superstructure by Whitelaw's salvors as they removed the upper works to get to the engine.

Finally, a single, leather, shoe sole and a sample of coal were recovered and conserved. The shoe sole is cut for a left foot and the even stitch along the edge reveal that it was machine made, which is in keeping was shoe cordwaining for the late 19th century.

The coal is most likely Franklin coal. Originally *Pomona* ran on coal mined from a seam in California's Mount Diablo, but it was low-grade and after tests run in May of 1895, *Pomona* switched to Franklin coal, dropping the amount of coal needed to produce dry steam from over 11 lbs to just over 7 lbs.[66]

Today, all the artifacts have been returned to Fort Ross Historic Park where the story of *Pomona* and her role in Pacific coastal trade are told alongside the history of the Kashaya people, Russian settlement, and lumber and cattle ranching eras. Thanks to the combined efforts of historians and maritime archaeologists, *Pomona*'s role as a model coastal steamer in a time of dramatic growth on the Pacific Coast is once again brought to the public's attention.

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[1] *Pomona* Register

[2] "Classification of Iron and Steel Vessels, " Bureau Veritas, Registry Number 58, Paris, 1886. pp. 9-58; and Union Iron, 1896. This small book appears to have been compiled when *Pomona* was hauled into Union Iron Works to be serviced after the sale to the Pacific Coast Steamship Company. There are penciled notations in the book, which correspond to the changes made in the 1916 Specifications book for a single screw propeller passenger and freight steamer, also published by Union Iron Works. The style of description changes slightly throughout the book suggesting that the each shop within the Shipbuilding yard was tasked with accounting for their part of the ship. These specs were then handed to at least two people who ultimately compiled all the information for printing. The penciled changes for 1916 are all made in the same hand-writing.

[3] Union Iron Works, *Specifications for a Steel Screw Passenger and Freight Steamer, "Pomona Type"* 1896 The specifications are very detailed and were published as a joint effort by the two companies immediately after the 1896 dry-docking and sale to the Pacific Coast Steamship Company.

[4] *ibid*

[5] *ibid*

[6] *ibid*

[7] *ibid*

[8] *ibid*

[9] *ibid*

[10] *ibid*

[11] *ibid*

[12] *ibid*

[13] *ibid*

[14] *ibid*

[15] *ibid*

[16] *ibid*

[17] *ibid*

[18] California State Archives; History of the Union Ironworks http://web.mac.com/vtlyon/iWeb/The%20Lyon/Union%20Iron%20Works%20History.html (December 2007) http://www.oac.cdlib.org/ (December 2007)

[19] *Alta California Newspaper* January 1, 1889

[20] California State Archives; History of the Union Ironworks http://www.oac.cdlib.org/

[21] World Book Britannica

[22] David Budlong Tyler, 1958.

[23] Kevin Foster, 1991.

[24] John Halsey, 1996 In reference to the *Sport*.

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[25] The ships were named the *Atlanta, Boston, Chicago and Dolphin*, leading to the nickname, the "ABCD ships."

[26] The legal dispute ultimately resulted in receivership for the Roach yard. Then the other large yard in Philadelphia, William Cramp & Sons experienced delays on several vessels. As these shipbuilders were having trouble the navy was engaged on a huge expansion effort.

[27] The navy supplied drawings for the hull copied from those drawn by the Armstrong Shipyard of Newcastle-on-Tyne of a Japanese cruiser, and machinery for cruisers built for Chile and Italy. Despite the problems cause by conflicting plans Union Iron Works was able to complete the contracts on time and to the satisfaction of the Navy.

[28] David Budlong Tyler 1958

[29] Alta California Newspaper January 1, 1889

[30] World Book Britannica

[31] World Book Britannica

[32] *The San Francisco Morning Call* July 1888

[33] *Alta California* 1889

[34] World Book Britannica

[35] Edgar Smith; KT Rowland, Robert Gardiner

[36] Rudmann 2000

[37] Rudmann 2000; Simoulin 1999

[38] California State Parks http://www.parks.ca.gov/default.asp?page_id=449

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[39] California Managed Maritime Area Cultural Resource Study, 2001; Foster 2000

[40] *San Francisco Morning Call* Newspaper March 19, 1908

[41] *San Francisco Morning Call* Newspaper March 19, 1908

[42] *San Francisco Morning Call* Newspaper March 19, 1908

[43] International Conventions for the Safety of Life at Sea (SOLAS) London 1913

[44] *San Francisco Morning Call* Newspaper March 18, 1908

[45] *San Francisco Morning Call* Newspaper March 18, 1908

[46] Simoulin 1999

[47] Bennet 1908

[48] Simoulin 2000

[49] *San Francisco Morning Call* Newspaper September 27, 1908

[50] Foster 2000; Foster 1981

[51] Hunter and Fischer 1988

[52] Beeker, Personal Communiqué 2007

[53] Indiana University Survey 1999

[54] John O'Shea The Archaeology of Scattered Wreck Sites: Formation Processes and Shallow Water, *Archaeology in Western Lake Huron* 2002, J. Riley Shipwreck Deterioration, In Depth 2:21-24, 1987, IAK Ward, P Lancombe and P Veth, Towards new process oriented models for describing wreck

disintegration – an example using the *Pandora* wreck. Bulletin of Australian Institute of Maritime Archaeology 22:109-114, 1998

[55] Cal Archives Brick Makers of California Bricks, Dan Mosier http://calbricks.netfirms.com/index.html (December 2007)

[56] Osbourne 1941

[57] *Alta California* Newspaper, January 1, 1889; Gordon Newell, 1960, pp. 64-65, 67. Gordon Newell & Joe Williamson, Pacific Coastal Liners, New York, Bonanza Books, 1959, pp 27, 33-36. The newspaper lists all the ships built in 1888, their builder and their tonnage. There were 59 vessels registered at San Francisco and built in shipyards between San Francisco and Seattle. Of the 59 only 4 were over 1,000 tons. Twenty-eight of the vessels were listed as propeller while 26 were listed as sail. Only three were listed as steamers. In the article going along with the list the *Pomona* is listed as having been built for Captain JN Knowles. Captain Knowles was one of the owners. In other references *Pomona* is listed as being built for the Oregon Improvement Company also one of the owners. But the original registry for the steamer is under Union Iron Works, the third owner of the steamer.

[58] Foster 2007

[59] Marx 2001

[60] Union Iron Works 1916

[61] Woods 1999

[62] Simoulin 1999

[63] Wood 1971

[64] Wood 1971

[65] Thomas Layton, 1997. Frolic carried a large cargo of bronze coat hooks from China in 1850. The coat hooks were recovered from the shipwreck as well as listed in the ship's manifest for her last voyage.

[66] Simoulin 2000 The results of the coal trials were plotted for a report and the originals are still on file in the J. Porter Shaw Library.

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

S.S. *Pomona*, Shipwreck

Sonoma County, CA

Summary Statement of Significance

On March 17, 1808 when *Pomona* settled to the seafloor in Fort Ross Cove, the people of the Pacific Coast lost one their true maritime treasures. For twenty years the steamship plied the coastal waters delivering hundreds of passengers and tons of cargo to destinations such as Los Angeles, San Francisco, Point Arena, Mendocino, Eureka, Astoria, Seattle, Victoria and Vancouver. Some of the towns became cities and each and every one of the cities depended on the other towns. Moreover, these cities and towns depended on *Pomona*, and those "*Pomona* type" steamships that followed, to connect the people of the Pacific Coast.

Many ships have been lost along the rugged Pacific coast and never found or the ocean dynamics are so intense that the remains are broadly scattered making identification and interpretation difficult. However, this is not the case with *Pomona.* The lay of the cove and the annual growth of the kelp forest protected the remains of the shipwreck, so that one hundred years later recreational divers, researchers and fish can still enjoy the shipwreck, garner important historic information from the remains and utilize the habitat. Thus protecting the shipwreck *Pomona* by all means available is part of the continuing stewardship of California's historic treasures. To date, the shipwreck has been protected locally by Fort Ross Marine Managed Area, and regionally by inclusion on the California Archaeological Register and the State Register of Historic Places. Nomination to the National Register of Historic Places adds the national level of recognition and protection to the archaeological remains.

The remains of the S.S. *Pomona* are eligible for listing in the National Register of Historic Places under three of the four possible criteria.

Criterion A: The S.S. *Pomona* is associated with the events, people and companies that shaped the burgeoning state of California in the 19th century. *Pomona*'s role in Pacific maritime coastal trade exemplifies the importance of steam transportation in California's history.

Criterion C: The S.S. *Pomona* epitomizes the combination of 19th marine technologies in an optimum arrangement—a classic hull design in steel, an efficient and cost effective power plant in the triple-expansion steam engine, and innovation in the single propeller and on-board electrical system. This combination in conjunction with superior construction and good management led to the replication of this vessel in a class of steamships that carried her name, as well as a twenty year career in the coastal trade.

Criterion D: The remains of the S.S. *Pomona* still contain important information that reflects early steel ship construction on the Pacific coast, and has the potential to answer future questions regarding 19th century technologies.

Supporting Historical Information for Criterion A eligibility:

The steamship *Pomona* was launched in the second half of the 1880s. It was a dynamic time, the Civil War was over, the depression of the 1870s waning and the resources of California beginning to carve a niche in world markets. Railroads formed an essential delivery network bringing produce and resources to the coastal ports, but ships delivered the products to the world. Lumber, flour, produce and oil all required an economical and efficient transportation system. The Pacific provided the maritime highways and steamships provided the delivery system. Responding to market needs, the Union Iron Works of San Francisco shifted from building locomotives to building ships in the late 1870s.[1]

The Union Iron Works (UIW) is one of the original California Gold Rush companies that survived into modern times. It was the dream of a young Scot immigrant, 27 year old, Peter Donahue

(Figure 16). He came to San Francisco in 1849 and quickly realized he could make more money using his apprentice skills in metal casting than in prospecting. Donahue first set up the Union Iron Works in a tent. His first commission was a propeller bearing. Convincing his brothers, James a boilermaker (Figure 17), and Michael a molder, to join him, the Donahue's built the Union Iron Works into a thriving business.[2] By the 1860s, James and John sold their shares and Peter, although retired, pushed the company's focus toward building locomotives. Union Iron Works went after the railroad and mining machinery contracts with gusto and were soon producing about 90% of the machinery for the railroads and mining industries working the Comstock Lode.[3] Meanwhile, the Union Iron Works (UIW) continued to build steam engines and boilers. The distinctive, brass, Union shield identifies historic engines built at UIW and became synonymous with excellence. During the 1860s Irving Murray Scott, a trained mechanical engineer and self-taught draughtsman, rejoined the Union Iron Works as a partner and took over the management (Figure 3). Scott, who realized the Union Iron Works had to shift direction to survive, made a thorough tour of shipyards on the Eastern Seaboard in the 1870s.

His goal was to integrate what the company already produced with something they did not, but had the equipment to produce. For years other shipyards in California Washington and Oregon had been building ships and towing them to San Francisco to have their engines installed. One of the Union Iron Works more important contracts was the construction and installation of the steam engine of the steam sloop USS *Saginaw,* the first U.S. Navy vessel built on the Pacific coast. *Saginaw* was built at Mare Island Naval Shipyard in 1858/1859, engined by UIW in 1859, and cruised in Chinese coastal waters for the suppression of piracy until 1862, when she returned to California for service in the Pacific Squadron. *Saginaw* ultimately wrecked in 1870 on the Northern Islands of the Hawaiian archipelago.[4]

The company was well positioned to take a role in the construction of America's modern merchant and naval fleets. Upon return from his tour of the eastern shipyards, the Union Iron Works relocated to property Scott had already secured at Potrero Point. It was a bold and successful gamble. The move greatly expanded the size of the plant and when finished in 1882 it boasted a boiler shop, a blacksmiths' shop, riveting and erecting shop, machine shop, a 120' chimney, a brass-plating shop, an iron foundry and a pattern shop.[5] Before moving to Potrero Point Union Iron Works employed 600 men. After the move and securing of several naval contracts, Union Iron Works doubled their workforce. Along with state-of-the-art machinery, G.W. Dickie of the Union Iron Works designed and built San Francisco's first hydraulic dry dock at the Potrero location. By 1882 Union Iron Works was building ships from the hull plates to the engines. The company launched its first, Potrero Yard built, ship, the 800-ton collier *Arago*, in 1885. By 1886 Union Iron Works had switched to steel and quickly secured a major contract with the Navy (Figure 18). The year *Pomona* was launched UIW also launched the battleship USS *Charleston*, refitted the 3,069 ton *Walla Walla* and had the steel tugs *Active* and Acme on the weighs.[6]

Combining their established reputation in steam engine and boiler construction with proven hull designs the Union Iron Works quickly garnered a reputation for well designed and built steamships. Over the next decade Union Iron Works launched many ships for both the merchant trade and navy.

One of the hallmarks of the Union Iron Works was Scott's ability to combine proven technologies with innovative technologies in optimum arrangements. *Pomona* exemplifies this ability of the Union Iron Works. Steam, steel, and electricity are three of the great advancements of the 19th century. Each changed the world.

Steam transportation changed the world and one of the areas that it affected most is maritime transportation. Within the span of twenty-five years, less than one generation, the meaning of "on schedule" changed from referring to an arrival within a week or month to within an hour. The published schedule of the Pacific Coast Mail Steamship Company for 1888 names steamer, day and time for ports from Los Angeles to Alaska.[7] Rapid turn-around meant more cargo, passengers and information movement. Steam was doubly important to consistent transportation along the routes north on the Pacific coast, where prevailing currents and winds hamper sailing.

Steel and its improved qualities as a building material changed the world. Simply put steel production removes the impurities such as sulfur, carbon and silica that make iron weak. Steel does not splinter, crack or warp. It is pest resistant and lighter weight than iron of the same strength. These simple advantages were huge issues confronting wooden ship construction and fuel consumption. Moreover, steel is stronger and thus the longitudinal hogging issue of wooden ship construction was practically eliminated, removing the last obstacle to design and production of larger ships. In 1881 when Cunard launched their first steel ship, the luxury liner *Servia*, only 25 years after Bessemer announced the new process, shipbuilding was changed forever. By 1889, 97 per cent of the shipping tonnage built on the Clyde River, Great Britain's busiest shipbuilding region, was of steel. Union Iron Works was among other world shipbuilders taking full advantage of the lighter, more durable material.[8]

Electricity specifically as it applies to lighting, profoundly changed humans' relationship to one of the most basic components of our species, diurnal behavior. Suddenly, humans could light the dark without flame. The danger of fire and health issues associated with oil burning lamps disappeared. Electric lighting on ships, which already had a power plant to generate electricity, was a natural fit. Portholes and deck lustrals let very limited light below decks even in daylight. The lux or candlepower of an oil lamp is quite low compared to an electric light bulb. The use of early versions of electric lighting on passenger ships such as *City of Berlin* (1879) and *Servia* (1881) prior to Edison's patent of 1882, reveal just how ready shipbuilders were for the advent of electric lighting.[9]

The combination of all three of these technological advancements in the design, construction and propulsion pushed the world economies and cultures toward modernization. *Pomona* is an

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excellent example of the combination of all three as well as the brilliant strategies of the Union Iron Works to position the company as a premier shipbuilder in the United States during a time of dynamic change in history and shipbuilding. *Pomona* represents the Union Iron Works ability to create a product so well suited to the task it was designed for that it enjoyed a longer career than most of its contemporaries.

A part of the steamship's history that should not be overlooked is the role of shipbuilding in the labor history of the San Francisco and the West. By the time that Irving Scott took over the Union Iron Works, the company was one of the largest employers in San Francisco providing jobs for over 300 people in a wide variety of skills. Scott realized that to succeed his workforce had to be skilled and organized, so he in 1865 he instituted the "tag system." Each employee hung his tag each morning on a peg corresponding to the workshop where he was employed. A quick glance at the pegboard revealed to the shop managers who was tardy or absent. The tags were removed during lunch and re-hung on the pegs afterwards until the end of the day. The tag system promoted punctuality.[10]

To promote and keep a skilled labor force Scott implemented the apprenticeship program taking on young men at the age of 14 for four years and training them in a specialty skill. In 1865 Union Iron Works apprentices made US$4.00 per week and were stepped up to US$10.00 per week by graduation. The apprenticeship promoted pride in the company's products, as well as skill.[11]

By 1882 when the Potrero plant opened Union Iron Works employed 600 skilled craftsmen and they subsequently doubled the work force in the following decade. The residential area of Potrero Point known as "Dogpatch" supplied anywhere from a quarter to half of the company's workforce.[12] Irving Scott was considered a good boss and this is reflected in the comparatively good safety record of the company, as well as his interest in the surrounding community of Dogpatch. The elementary school in Dogpatch was a result of Scott's philanthropy and thus named after him. When the keel of the Battleship *Oregon* was laid in 1893, the children of Irving

Scott Elementary school provided the escort for President McKinley.[13] The rapid growth of the Union Iron Works in the final two decades of the 19th century is in large part due to the excellent quality of the company's products—the engines, locomotives and ship's. There are few better indicators as to the moral and pride of the workforce.

The Union Iron Works with its fully vertical integration from production of steel to production of ships and engines went on to become one of the premier shipyards not only on the Pacific Coast but in the United States. The Potrero shipyard after producing *Pomona* built numerous ships for the U.S. Navy including the cruiser USS *Olympia* launched in 1893, which is the only surviving example of a Union Iron Works ship still afloat.[14] In 1901, Bethlehem Steel became the controlling partner in the Union Iron Works. Their purchase of the company added the final layer of vertical integration, ready access to the raw materials used in steel production. Bethlehem Steel already owned and operated one of the largest shipyards on the Eastern seaboard just outside Baltimore. With the addition of the Union Iron Works facilities on the West Coast they positioned themselves to become one of the largest shipbuilding companies in the United States.

From 1888 to 1908 the S. S. *Pomona* steamed up and down the Pacific coast for the Pacific Steamship Company as a combined passenger ship and cargo carrier. Besides mail and the occasional automobile, the S.S. *Pomona* carried imported goods, raw materials and semi-finished goods, as well as produce and grains. In short, if it was shipped by water, *Pomona* probably carried it.[15]

The Pacific Steamship Company was originally the Pacific Coast Mail Steamship Company subsidized by the U.S government through postal contracts. The company began in 1848 with the goal of establishing regular mail service between the West and Eastern seaboards, as well as China. The company moved mail from Panama to Oregon dominating the Pacific coastal trade in the first half of the 19th century. However, competition increased dramatically with the discovery of gold. Rapid development in California specifically with the railroads began to erode the dominant position the Pacific Mail Steamship Company had enjoyed. By 1863 the Central Pacific Railroad, a monopoly in its own right, positioned itself to take over Pacific maritime commerce as well as Pacific rail commerce. The Pacific Mail Steamship Company joined forces with Wells Fargo, the California Steam Navigation Company, the California Stage Company and the Sacramento Valley Railroad to ward off the takeover. Their effort was only marginally successful and by 1869 when the Central Pacific Railroad brought out the California Steam Navigation Company, the remaining Pacific Mail Steamship consortium was forced to the negotiating table. They came to a series of agreements sharing docking facilities and alternating schedules.[16]

However, the Central Pacific Railroad was not satisfied and continued to chip away at the Pacific Steamship Company until 1880 when they finally managed to gain controlling interest. Not until the advent of World War I did any other company pose a significant threat to their monopoly.[17] By the time *Pomona* slid off the shipways at Potrero Point, the battle for dominance was already over. *Pomona*, although registered to three companies throughout her career, including the Pacific Steamship Company always sailed under the Pacific Steamship Company's published schedule. Moreover, the *Pomona* was the company's flagship, and the model for many ships that the Union Iron Works was subsequently commissioned to build.

By 1916, when Pacific Steamship was sold to the Admiral Line, the company's history spanned the first fifty years of statehood, in a state that over the next fifty years would go on to become the 6th economy of the world. The latter accomplishment could not have happened if the early networks of transportation both marine and land had not evolved into a highly integrated system delivering resources, finished goods and people consistently and reliably up and down the eleven hundred miles of California coastline. Moving cargo and people south along the coast, even during the age of sail, was relatively easy due to the prevailing winds and currents. However, moving cargo and people north was a different matter entirely and did not reach any level of efficiency until steamships took over many of the routes. *Pomona* was launched into that dynamic window of time when supply, demand and capital married technology in a well-balanced, optimum combination making the story of her design, construction and career an important part of California and United States history.

Supporting Historical Information for Criterion C eligibility:

In the first decade of changing focus, the Union Iron Works took on several partners, one of them being the Oregon Improvement Company. The first two ships that the Union Iron Works built, the SS *Arago* (1885) and the SS *Premier* (1886) were completed for a Canadian company and their performances brought more customers including the Oregon Improvement Company.[18] In building the *Pomona*, Scott took advantage of the new product that was only becoming widely available, steel, and his yard's ability to produce and roll it. He combined the relatively new product with successful design.

The hull's boxy shape and plumb stem with a graceful elliptic stern combined several design features that lent themselves to the ocean conditions on the Pacific Coast. The straight plumb stem culminated a narrow sharp bow that readily cut through the rolling long swells of the Pacific. The boxy shape requiring little deadrise in the framing amidships reduced the draught of the 225 ft (68.58 m) long vessel without reducing her cargo capacity. This was an important feature that allowed larger vessels to cross the sand bars at the entrances to Humboldt Bay and Seattle. To further reduce upper hull weight, Scott installed wooden frames above the main, steel deck and a lightly constructed wooden superstructure. The elliptical stern added a graceful sweep to the profile of the ship while reducing stern weight that more traditional transoms provided. These design characteristics allowed *Pomona* to maintain speeds of 11 to 15 knots in the open ocean while still being able to cross shallow harbor entrances.[19]

Into the *Pomona*'s hull Scott installed one of Union Iron Works widely used, efficient and cost effective triple-expansion steam engines. Steam powered engines are synonymous with the 19th century and had been used on ships since the early 1800s. By the 1880s a boiler pressure of 180 pounds per square inch paired with triple-expansion cylinder sizes of 56/34/23 inches was preferred for its reliability, low maintenance, small space required, amount of horsepower, and cost effectiveness.[20]

The triple-expansion engine was more than capable of driving the single 10 ft 6 in. (3.2 m) four-bladed bronze screw propeller. John Ericcson, who introduced the *Monitor* class vessel to naval warfare, also introduced the propeller to American shipping.[21] Scott was acquainted with Ericcson from his tour of the Eastern Seaboard shipyards and relationship with the Navy. In 1886 the Union Iron Works won a Navy contract to produce one of his advanced *Monitor* class designs, the *San Francisco*, which was launched in 1889. If Scott was impressed with the Monitor class, he was probably just as impressed with the concept of a single propeller. Propellers had the advantage of strength over paddlewheels. Plus, submerging the driving propeller dramatically dropped the center of gravity in the 225 ft (68.6 m) hull reducing the ship's roll in the open ocean. Although paddle wheelers were still a superior mode of propulsion in the shallow riverine environments, propeller driven vessels quickly outstripped them on deeper ocean routes. Like the engine, the propeller was cast at the Potrero shipyard.

Scott's finishing touches on *Pomona* utilized a brand new innovation, an electric lighting system and the incandescent bulb. Equipped with Edison's patent dynamo, capable of burning 172 sixteen candlepower incandescent bulbs, lights were distributed all over the ship, one in each stateroom as well as in the engine room and on the decks.[22] The novelty of light bulb is reinforced by the fact that each stateroom also contained an oil lamp to be used in case the electric light did not work. However, the electrical system worked so well that like the sails, the gas lamps were not used. The system was updated in 1895 replacing the older 3-wire system and dynamo with a newer steam powered, electric generator and 2-wire system along with improved incandescent bulbs.[23]

Pomona boasted hot and cold running water delivered to each stateroom. The hot water system utilized the heat generated by the boilers to heat the fresh water pipes. In the early years of the ship's career the staterooms were unheated but and during the 1894 refit *Pomona* was equipped with a ship-wide, steam heating system. Coil, steam radiators kept the public areas, cabins, baths and washrooms, warm. These radiators could be individually adjusted for the comfort of the passengers and gave *Pomona* an added level of comfort.[24]

For a time after the Howden forced air system was added in 1894, *Pomona* was the fastest and one of the most elegant passenger steamships on the Pacific Coast. Her increased speeds of 15 knots, her decreased fuel consumption after the switch to Franklin coal, and her low maintenance steel hull and propeller rivaled even the railroads.[25] *Pomona*'s original design and well thought out improvements put the steamship in an economic category that was hard to rival. Her economic success led to the replication of her design in the "*Pomona* type" class of steamers produced by the Union Iron Works and other shipyards in the 1890s and early 1900s. Pacific coastal steamships such as the SS *Catalina* and *Princess Louise* that followed the model set by *Pomona* operated right up through modern times.

The fact that there is a *Pomona* type and that those who followed the model also enjoyed long careers is a testament to the steamship's enduring design and qualities.

Supporting Historical Information for Criterion D eligibility:

There are many ships that are lauded during their career and yet when lost all but forgotten. Rediscovery of the shipwreck sites provides modern scholars with a powerful tool for research, interpretation and public outreach. The easily recognized remains of the steamship *Pomona* on the seafloor of Fort Ross Cove falls within this category of historic archaeological sites.

Pomona and her exploits were regularly covered in the California newspapers. Even when she sank, Californians eagerly followed the salvage of the steamship. Her history threads through the history of large and medium size ports up and down the Pacific Coast. Photographs of her were taken with regularity and have found their way into numerous historic collections. Three sheets of her plans and the published summary of her specifications reside in San Francisco's J. Porter Shaw Library. Yet, with all of this historical information it is still not enough. History by its very nature records selective pieces of information and neglects to record others. For example, even ships like the USS *Monitor* and HMS *Titanic*, where substantial historical documentation exist, historians and archaeologists have found an equal amount of unrecorded history captured in the actual artifact.

The archaeological remains of *Pomona* still hold lots of unrecorded information. No comparison of designed specifications to built dimensions has been undertaken. How close did the builders at the Union Iron Works follow the linen sheets of design? Did the craftsmen trust the new material steel or did they over-compensate? For example, the Union Iron Works reduced the amount of planned armament on the 1889 monitor class *Monterey* they built because the specified amounts of armament would tip the vessel's displacement.[26]

Was *Pomona*'s steel hull radically different from the naval hulls subsequently built at Union Iron Works? A comparison between *Olympia's* hull and *Pomona*'s might shed light on this question. No metallurgy analysis of the various hull parts has been made. Metallurgy analysis would provide an excellent comparison to the work on American vessels going on in Australia and New Zealand, as well as provide insight into the quality of early steel production on the Pacific coast.

Further inspection of the boilers might lay to rest Captain Swansen's contention that he had to stay close to shore because the boilers were not providing adequate steam in the sea conditions of March 17th.

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Riveting patterns in the hull plates were a signature of the builders and differed region to region. No one has ever studied the riveting pattern of UIW. Did it follow the New England or the Mid-Atlantic pattern, one of the English or Scottish patterns, or did UIW have their own distinctive pattern? These and many more questions about 19th century technologies and historical details have the potential of being answered by the archaeological remains of *Pomona*.

It is true that shipwrecks of other screw steamships exist and that *Olympia* is still afloat, but none of these are the second steel hull built by the Union Iron Works. The keel of *Pomona* was laid down within a year of the launch of *Premier*, the first steel hull built at UIW. *Olympia* was not laid down for another four years and in the rapidly evolving technology of 19th century steel production that has significant implications, as does the fact that *Pomona* was intended for the merchant trade while *Olympia* was a warship. Moreover, *Pomona* was built probably for the consortium of Union Iron Works, the Oregon Improvement Company and J.N. Knowles.[27] The fact that Union Iron Works was its own customer is not readily apparent from the historical records but might be reflected in the artifactual remains.

By enhancing what is known about *Pomona* with what can be discovered from the archaeological record, park rangers, historians and educators gain a powerful interpretive tool that can be used to tie seemingly disparate historical events, people and places together in engaging ways that spark stewardship and maritime heritage appreciation.

By protecting the archaeological site CA-SON-1704H, with all the power that state and federal legislation can bring to bear, researchers and interpreters have a chance to answer and share with the public the questions we have today and the questions that will arise in the future.

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[1] Union Iron Works built their reputation on building locomotives for the burgeoning inland California trade networks, but always ran a diversified industry working with shipping and other iron and later

steel work needs. Their diversity provided a strong alliance with numerous support industries such as coal, and delivery systems.

[2] Kneiss 1946

[3] Christopher VerPlanck, *The Story of Dogpatch.* This is the nomination of the San Francisco historic community to the National Register. 2007

[4] F.M. Bennett, The Steam Navy of the United States, Pittsburgh, PA: Warren & Co., 1896, pp. 166-169; Donald L. Canney, The Old Steam navy: Frigates, Sloops, and Gunboats, 1815-1888, Annapolis: US Naval Institute Press, 1990, pp. 87-88; Paul H. Silverstone, Civil War Navies, 1855-1883, Annapolis: US Naval Institute Press, 2001, p. 37; Hans Van Tilburg, NOAA Survey of the Northern Hawaiian Islands Cultural Heritage in preparation for nomination as National Marine Sanctuary, 2006

[5] Ver Planck 2000. VerPlanck republished the National Register Nomination of the Portrero District in San Francisco where the workers at UIW lived. The area was nicknamed 'Dogatch.' A portion of the area was known as 'Irish Hill' but it was leveled to provide fill for the new UIW quays and shipyard.

[6] *Alta California* Newspaper, 1 January 1889. The story recaps a list of vessels built along the Pacific Coast in 1888 along with the builder, the class of the vessel and the tonnage.

[7] Pacific Coast Steamship Company Published Schedule for 1888 in the California State Archives

[8] Henry Fry, *The History of North Atlantic Steam Navigation*, 1896, Pp. 50, 82; Dennis Griffiths, "Marine Engineering Development in the Nineteenth Century," 1993, pp. 171-172

[9] Robert Friedel, 1987. Although we credit Thomas Edison with electrifying the world, coming up with a way to economically harness electricity was a worldwide race. The economic advantages were widely recognized in both the United States and Europe. The rapid expansion of electrifying whole cities, ships and trains reflects technology catching up to the needs of growing worldwide populations.

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[10] VerPlanck 2000

[11] VerPlanck 2000

[12] VerPlanck 2000. Labor in San Francisco was well organized from the earliest years of the city. By the time the Golden Gate Bridge was built in the early 1930s, San Francisco contained some of the best organized iron and steel worker unions in the United States.

[13] VerPlanck 2000; Karen L. Pratt, Vol. 1, pages 660-668. McKinley and Scott were good friends, which facilitated UIW getting the initial contracts from the Navy. Later, the reputation for well built ships would earn UIW its contracts, but Scott was fully aware of the need to visit Washington DC and lobby for his shipyard in California.

[14] The USS Olympia has been designated a National Historic Landmark, and is on exhibit at Independence Seaport, Philadelphia.

[15] Simoulin 1999

[16] Simoulin, 1999. *Pomona's* design and size allowed for a combined and varied service. Although the route of *Pomona* is published the forethought of the types of service the steamer would provide is also reflected in her design. Fitted with derricks to handle all types of cargo the upper works provided for short hop commuters and long distance passenger trade. This is reflected in the presence of a dining salon and a cafeteria, as well as cabins.

[17] Simoulin, 1999, pp 9-11

[18] Simoulin, 1999, pp 10-12

[19] Union Iron Works, Specifications for *Pomona* 1896

[20] Dennis Griffiths1993, pp. 166-173

[21] *World Book Encyclopedia*, "History of propellers," (http://worldbook.com)

[22] Union Iron Works, Specifications for *Pomona* 1896

[23] Simoulin, 1999, pp 14

[24] Union Iron Works, Specifications for *Pomona* 1896

[25] Union Iron Works Test Results for various California coals in the performance of *Pomona,* 1896

[26] Karen Pratt, The Bay of San Francisco Vol. 1

[27] Simoulin 1999; Alta California 1 January 1889; *Pomona* registry

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Sonoma County, CA

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10 Geographical Data

S.S. Pomona

Verbal Boundary Description

The shipwreck of the S.S. *Pomona* lies submerged in Fort Ross Cove, within the Marine Managed Area of Fort Ross Historic State Park.[1] The Fort sits at the 38th parallel, approximately 100 miles north of San Francisco and 12 miles north of the town of Jenner, California. UTM coordinates recorded in this nomination and on the California Register of Archaeological sites at the Sonoma Resource Information Center pinpoint the center of the shipwreck, which covers approximately .57 acres within the park. The axis of the shipwreck aligns with 33° magnetic north. The footprint of the shipwreck is proportionally close to the vessel's original dimensions basically covering a rectangular area 250 ft (76.2 m) by 100 ft (33 m) with a height off the bottom of 12 ft (4 m) at the boiler. The shipwreck sits on a slope at depths between 17 ft (5.2 m) in the stern of the shipwreck and 40 ft (12.2 m) at the bow, at mean low tide.

The *Pomona* shipwreck is located within the boundaries of the Fort Ross Marine Managed Area, which encompasses the entire cove. The seaward boundary line extends from the southernmost point of land defining the cove to northernmost point of land defining the cove, following the 120 ft bathymetric contour. The Fort Ross historic properties were acquired in the early years of the 20th century by the California Department of Parks and Recreation. The Fort Ross Marine Protected Area was established in 1970. The California State Lands Commission leases the bottomland of the park to the California State Parks for management and protection.

Boundary Justification

The shipwreck Pomona sits within the submerged rocky extension of Fort Ross Cove's central promontory. The promontory extends underwater out past the Fort Ross wash rock, which is almost centrally located at the mouth of the cove. The rocky terrain of seafloor and the seasonal giant kelp have both played a part in defining the overall debris field of the shipwreck. The footprint today of the wreck is not substantially different from the original footprint of the 225 ft (76.2 m) long steamship. Although the ship sits on both sides of the wash rock, and there are artifacts to either side of the central axis of the wreckage, the majority of the shipwreck sits in a well-defined area with readily identifiable parts still intact. Significant fragments of the entire ship remain in original context to one another, including 182 ft of keel, the outer stempost and the rudder assemblage.

The shipwreck is close to reaching equilibrium in the site formation process, with the major features concreted to the bedrock on the seafloor and unlikely to move. The defined 25,000 sq ft (.57 acres) for the site nomination encompass all major shipwreck features. The site described is within existing boundaries of a California Marine Protected Area that has specifically defined uses and practices. Nomination to the National Register of Historic Places adds one more layer of protection to this historically significant maritime archaeological site and follows an established pattern of seeking all protection available for the prehistoric and historic features of the Fort Ross Complex.

The Russian Fort is on the National Register of Historic Places. The Kashaya habitation sites scattered along the bluffs are mapped and listed on California's archaeological register, as they are found. The remains of the lumber chute and 'doghole' mooring system have also been mapped and added to the archaeological register, as have the out-buildings and warehouses from the Russian and mid-19th century periods in the park.[2]

There are nine other vessels reported to have sunk in the area of Fort Ross, only the remains of Pomona have been identified and studied. This has not been a quick process. Like the multi-decade restoration of the Fort seasonal accessibility, and available funding have limited the study of Pomona. The California Department of Parks and Recreation with archaeologist James

Delgado led the first underwater study in 1981. Since then two other studies have worked to map and understand the shipwreck site. The boundaries defined in this nomination have taken into account the debris field, site formation processes and existing protected area boundaries.

Seeking the nomination is in keeping with the ongoing stewardship of both the terrestrial and submerged resources of the greater park.

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[1] McArdle pp 60-61; Berry p 32; Smith pp. 67-83. The existing underwater park at Fort Ross Historic Park extends out to the120 ft (36.58 m) bathymetric contour from the tips of both points defining Fort Ross Cove at the northwest extreme and the southeast Windemere Point. This is slightly different than the published larger area extending beyond the cove in McArdle's index of California's Marine Protected Areas. In the MPA index the protection extends out from Clam Beach Cove in the northwest to the latitude 38˚30'. In the southeast the protected area extends out from the middle of the cove just south of Fort Ross Cove to the latitude of 38˚30'.
The underwater park was originally defined for the significance of the unusual *Zostera pacifica* (Pacific Eel grass). The bottomlands were leased to CA State Parks in 1970 for the CA State Lands Commision. The lease extends to July 30, 2029. The area is regulated by California Code of Regulations 14:29.05 in terms of commercial and recreational fishing as well as kelp harvesting. Under California law the cultural sites are regulated under Abandoned Shipwreck Act (1987), the California Managed Marine Area Improvement Act (2000), the California Public Resources Code (Sec 5300, 3600.1(13)(c), and the California Administrative Code (4664).

[2] All archaeological sites around Fort Ross, once identified are submitted for revue and inclusion on the archaeological site information list. California State University, Sonoma maintains the register for the coastal sites, prehistoric and historic.

Additional Documentation

Appendix 1 – Contract Specifications for a "Pomona Type" Steamship

In 1896 the Pacific Coast Steamship Company acquired *Pomona* and, published her specifications in anticipation building a class of screw propeller passenger and freight steamers named for the steamer. The specifications appear to have been collected and written down by at least two people given the variances in grammar and spelling throughout the publication. Transcribed in bulleted format are the vessels scantlings, machinery specifications and accompanying gear that were present in 1896. These specifications take into account modifications, such as the Howden Forced Air addition and the modernization of electrical lighting. All other specifications when compared to the ship's original plans appear to be the same and actually reference the plans. Both the publication of Specifications and the Plans for *Pomona* are on file at the J. Porter Shaw Library in San Francisco, California.[1]

To be built under the inspection of Bureau Veritas and take their first division class

Keel

- Iron bar 2 3/8 x 8 inches, four lengths with 21 ½ inch long scarfs
- 5/8 inch rivets

Stem

- 2 3/8 x 8 inches rabbeted to receive plating
- Well rounded on front edge
- To extend 3 ft above hurricane deck

Stern and Rudder Post

- Forged iron 4 3/8 x 9 inches
- Equal to area at keel between stern and rudder posts tapering above the hub to size of rudder post and at fore end to size of keel
- Rudder post 3 ½ x 8 inches with solid gudgeons for rudder pintles
- To extend to main deck and riveted to transom frame

Rudder and Tiller

- Forged iron stock 5 ¾ inch diameter
- Two pintles
- Bottom step
- Bearing at main deck and hurricane deck
- Pintles on rudder detachable 2 ¾ inch diameter fitted with brass sleeves
- Gudgeons on post to have lignum vitae bearings set in brass bushings
- Rudder to be carried on deck plate having a brass bushing and a flat bearing babbitted with a suitable lip for retaining the oil.
- Suitable stops to be fitted outside bear the counter
- Rudder plates to be 5/16 inch thick in one piece fitted with pitch run in hot
- Preventer tiller to be fitted outside
- Quadrant tiller to be fitted under the hurricane deck

Frames
- 3 x 4 x 3/8 inch for half the vessel's length amidships
- 3 x 4 x 5/16 inches at ends
- Spread 24 inches
- One piece from keel to main deck and hurricane deck alternately except forward or forward port where all frames extend to hurricane deck

Reverse frames
- 3 x 3 x 5/16 inch for half the vessel's length amidships and
- 3 x 3 x 5/16 inch at ends
- All to extend to main deck except forward of collision bulkhead and aft of watertight bulkhead
- To be double through the engine and boiler rooms extending across the straight part of the floors.

Floors
- One piece extending across the middle line and up to the bilges to twice their midship depth
- Gradually reduced at the ends of the vessel
- Size amidships under engine and boiler 20 x 8/16 inch
- In hold 20 6/16 inch
- Outer ends 4 inches wide and midway between ends and centerline not less than 12 inches wide

Center Keelson

- Center-plate keelson standing above floors with intercostals plates extending down to the top of the keel
- Center plate 15 x 9/16 amidships reduced to 15 x 6/16 at ends
- Rider plate 10 x 7/16 reduced to 10 x 6/16 at ends
- Angles 3 x 4 ½ x 7/16 inch reduced to 3 x 4 ½ x 6/16 at ends
- Intercostal plates 7/16 inches amidships and 6/16 at ends
- Connected to floors at angles of 3 x 3 x 5/16 inch
- Limber holes to be 4 inches in diameter in intercostals
- Keelson to extend from after watertight bulkhead to forward water tight bulkhead
- All butt straps to be treble riveted

Side Keelsons

- Formed of intercostals plates 7/16 and 6/16 inches at ends
- Fitted between floors
- Riveted to floors with angles 3 x 3 5/16 inches and also to outside plating with angles the same size
- Plates to extend 4 ½ inches above floor plates and to have tow angles 3 x 4 ½ x 7/16 inches (6/16 at ends) riveted back to back through same plates and to extend 2/3 the length of the vessel and angles the entire length
- Fitted as breast hook at forward end and stopped against the water tight bulkhead at the aft end

Bilge Stringers

- Formed of the bulb beam 9 x 7/16 inch and a 3 x 41/2 x 6/16 inch angle
- Riveted back to back and to double lugs on frames
- To extend the entire length of the vessel and together with plates at ends forming hooks

Bulkheads

- Collision Bulkhead: extend to Main Deck
- Intermediate Bulkheads: 5 steel bulkheads to extend to Cargo deck
- 5/16 inch thick stiffened with angles 3 ½ x 2 ½ x 5/16 inch spaced 2 ft 6 inches apart

Shaft Alley

- Framed with 3 ½ x 2 ½ x 5/16 inch angles
- Plated with 3/16
- Protected with wood on top under the aft hatch; on portside to 4 inches from shaft; on starboard side wide enough to admit easy passage fore and aft

Lower Deck Beams

- 8 x 6/16 inch T-bulb
- Spaced 4 ft apart
- Kneed down at ends to 20 inches deep
- Riveted to frames with five ¾ inch rives in each end
- Hatch beams 9 x 7/16 inch

Hold Beam Stringer and tie Plates
- 54 inches wide amidships x 716 inch
- Tapers to 24 inch x 6/16 inch at ends
- Tie plates placed along side of hatches 8 x 7/16 inch amidships and 8 x ¾ inch at ends
- All riveted to beams with double riveted butts

Hold Deck Waterway and Scupper
- P.S. pine 3 x 6 inches laid vertical grain
- Fastened with 5/8 inch galvanized bolts se in and plugged
- Caulked with three threads best oakum and paved with pitch

Stanchions in Hold
- 2 ½ inch diameter
- One to each beam
- Doubled at one end of each hatch with steps forming ladder to hold
- Beams to crown 8 inches

Main Deck Beams and Stanchions
- 8 x 6/16 inch T-bulb
- Spaced 4 ft apart
- Kneed down at ends to 20 inches deep
- Riveted to frame with 5 rivets at each end
- Beams to crown 8 inches and to have a stanchion under each beam
- Stanchions 2 3/8 inch diameter
- Double stanchions at one end of hatches forming ladder to hold deck

Main Deck Plating and Coaming
- 3/8 inch plating laid flush on top with T-iron under seams
- Butts to be double riveted with butt straps underneath
- Coaming on this deck to be where there is any water
- Coaming to be angle iron, well riveted to deck and made water tight
- 3 x 3 x3/8 inch angle riveted inside of the frames and deck

- 3 x 3 x 3/8 inch angle connecting a deck to the outside plating worked in short lengths between frames and filled with cement to make watertight

Hurricane Deck beams and Deck
- 3 x 5 x 5/16 inch T-bulb
- Spaced 4 ft apart
- Welded ends to take four rivets in frame
- Intermediate beams to be of wood 3 x 4 ½ inches
- Beams at forward hatch to be 7 inch angle bulb
- Beams from hatch to stem 6 inch T-bulb, spaced 4 ft apart with welded ends
- Deck from Foremast forward 3 3/8 x 3 3/8 inch P.S. pine, vertical grain
- Deck fastened with ½ inch bolts set-in and plugged with wood matching deck
- Remainder of deck 3 3/8 x 1 3/8 inch T. G. and B. P. S. pine
- Deck nailed to wood strips on top of steel beams and intermediate wooden beams
- Decking on top of stringer plate inside of waterway to be 4 inches wide x 3 3/8 inch thick to insure solid fastening for bitts.
- Deck to be covered with No. 2 cotton canvas laid on felt and nailed with galvanized iron tacks.

Hurricane Deck Stringer and Waterway
- Stringer plate 24 x 3/8 inch amidship tapering to 20 x 5/16 inch at ends
- Riveted to beams and connected to outside plating with a 3 x 3 x 3/8 inch angle iron
- Waterway or chock to be P.S. pine 7 ½ x 9 inches and fastened to stringer plates

Outside Plating
- Garboard strake to be 36 inches wide x 8/16 inches amidships tapering to 7/16 at ends
- Bottom bilge and side plating to be 7/16 inch amidships and 3/8 inch at ends
- Sheer strake is 36 x 8/16 amidships and 7/16 at ends
- Plating between main and hurricane decks 5/16 inch thick

Bilge Keels
- 10 x ½ inch bulb plate
- Connected to the hull by two angles 3 ½ x 3 ½ x 7/16 inches
- Extending 84 ft along hull tapering at ends to put in the line of least resistance

Riveting
- In accordance with Bureau Veritas rules
- All rivets steel, pan-headed, swell-neck type
- Countersunk heads to be used where necessary

Cement
- To be cemented in the bottom to the upper turn of the bilge with Portland Cement with sharp sand in proper proportions

Guards
- Formed from two angles 3 x 5 x 3/8 inch
- Spaced 11 ½ inches apart amidships tapering at ends
- Inner piece of guard to be 11 ½ x 10 inches of P.S. pine
- Outer piece of oak 4 x 11 inches
- All fastened with bolts and spikes

Cargo Ports and Coal Ports
- 3 cargo ports
- 1 coal port on each side indicated on the plans
- Port frames to be made of 6 x 1 ½ inch iron welded at corners and grooved for rubber
- Port doors to be made of 7/8 inch thick steel plate without angle frames fitted with sufficient dogs to make them watertight
- Upper ports to be made in tow pieces to swing fore and aft
- Lower forward port to be made in three pieces; lower piece to swing down; upper piece swing fore and aft
- After port to be made in two pieces to swing fore and aft
- Coal ports in one piece to swing fore and aft.

Ceiling in Holds and Main Deck
- Entire hold and coal bunker to be close ceiled with 3 inch P.S. pine up to the upper turn of the bilge
- Above turn of bilge to be batten as can be fitted
- Floor to be iron without wood covering

Glory Hole
- To be fitted as shown on plans
- As many berths as can be fitted
- Floor to be iron without wood covering

Steerage
- Fitted as shown of plans
- To contain 27 berths for men on portside
- To contain a room with 12 berths for women on the starboard

- Each room to be fitted with a water closet and washroom as shown on plans
- All work to be plain T, G, and B P S pine with a plain neat appearance

Air Ports
- 8 in Glory Hole
- 14 in Forward Steerage, 8 inch in diameter
- 14 in Forecastle and closets, 8 inch in diameter
- All others to be 10 inch diameter spaced as shown on plans
- Where vessel is closely ceiled inside light frames to be made to reach the inside of the lining to insure against rust

Fittings between Decks
- Forecastle fitted as shown on plans with berths fitted in plain manner
- Aft of forecastle on starboard Quartermaster's berth

Gangways
- Moveable
- To provide easy passage between houses

Boats and Life rafts
- Four boats 24 ft long
- Two life rafts 16 ft long
- All fitted as required by US law, sufficient to carry full complement of passengers 220 including crew.
- Boats to be fitted with suitable chocks and boat grips

Boat Davits
- Four pairs of boat davits of 3 ½ inch diameter
- Able to land boats on hurricane deck
- All fitted with necessary blocks, falls, guys and cleats

Fire Hose and Life Saving Apparatus

Compasses
- Two compasses in pilot house
- One standard on deck

Heating
- Heated by steam pipes in all places occupied by passengers and crew

Water Tanks
- Two fresh water tanks with united capacity of 4,000 gallons
- Connected to the galley by a hand pump

Painting
- All iron work to have 3 coats of oxide paint
- All bottom outside to have 4 coats
- One coat anti-fouling
- Above water to be cemented and have 3 coats of paint
- All joiner work to have 3 coats
- 5 coats where glossed

Electric Lights and Bells
- An engine and dynamo for 150 lights (16 candle power)
- All necessary fittings
- Main electroliers to be of combination oil lamps and electric pattern
- Electric bells in all staterooms leading to pantry

Lights
- Masthead and sidelight of brass fitted for electric and oil

Pilot House and Captains Room
- Pilothouse to contain steering wheels, compass box, compass, signal lockers, bell pulls, and speaking tubes to engine room.
- Captain's room to contain hardwood berth, wardrobe, lounge, desk, washstand, mirror, toilet rack, chart rack, etc

Steering Gear
- To be fitted above or below the hurricane deck with necessary blocks, fair leaders
- All blocks to have patent or metallic sheaves

Steam Steering Gear
- To be placed on main deck under pilot house

Deck House
- To be arranged as shown on plans
- Coaming to be 6 x 8 inches
- Studs 3 x 3 inches
- Outside 1 3/8 T, G & B cedar up to windows
- Above windows panel

- Carlines 2 ¼ x 4 ½ inches
- Plates 4 x 8 inches
- Inside lining 7/8 inch T, G, & B cedar or sugar pine
- Sash & Blinds hardwood
- Doors to be 1 ½ inch sugar pine with brass fittings

Social Hall
- To be finished in hardwoods
- Ornamented skylight or cupola on top

Steam Capstan
- One steam capstan aft

Bitts and Chocks
- Six sets of mooring chocks and bitts on each side

Steam Windlass
- Steam windlass capable of handling anchors

Anchor Davit
- Anchor davit to swing over bow with suitable hook for letting go
- 10 inch double blocks
- 6 inch guy tackles, doubles and singles

Anchors and Chain
- Two anchors 1,800 lbs and 2,000 lbs
- One kedge anchor 550 lbs
- 150 fathoms of 1 3/8 inch chain

Steam Winches
- Four steam winches, two forward, two on top of deck house
- All to be friction winches of approved pattern

Fore Scuttles
- One scuttle leading to the forecastle
- One scuttle leading to steerage

Hatches
- Hatch coaming to be ½ inch thick iron, standing 12 inches above deck
- 2 ½ inch half-round beading around upper edge and all necessary fittings

Masts, Sails and Rigging

- Steel Masts as shown in rigging plan
- Fitted with proper size rigging and set up with screws
- Each mast to be fitted with two cargo derricks with all necessary iron work
- Sails to be of No. 2 canvas and fitted in the usual manner

General Clause

- To be supplied by owner: Hawsers, mooring lines, cargo falls, cargo chutes, gang planks, cooking utensils, crockery, silverware, loose furniture, musical instruments, bedding, upholstery draperies, carpets, curtains, stores of all kings, bunting, and nautical instruments (other than specified)

Engines

- Triple expansion, screw propelling engines with boilers and auxiliary machinery
- Main engine will be a vertical, inverted-cylinder, direct-acting, triple-expansion type with high pressure cylinders 23 inches, intermediate 34 inch and low pressure cylinder 56 inch, diameters with the stroke of all pistons being 36 inches
- Collective indicated horse-power of will be about 1,300 when they are making 105 revolutions
- The high pressure cylinder will be forward and the low pressure cylinder aft
- The main valves will be a piston valve for the high-pressure cylinder and slide valves for the intermediate and low-pressure cylinders.
- Each main piston will have a steel rod with the crosshead secured to a box slide working on a hollow cast iron guide bar.
- The framing will consist of the condenser and cylinder supports on the portside and a hollow cast iron columns on the starboard side.
- The bed plate will be in one piece with facings on the after end to receive the thrust bearing which will be secured thereto
- The crank shaft will be forged solid of steel
- The cranks 120 degrees apart
- Both shaft and crank pins to have an axial hole 3 ½ inch diameter
- The thrust line and propeller shafts also to be of steel
- The condenser will contain 839 tubes 5/8 inch diameter and 15 ft long
- Tube plates will be of brass and fitted with screw packing glands for the tubes
- The air pump will be placed behind the condenser and operated by levers worked from the intermediate crosshead
- The bilge pumps will be operated from the air pump crosshead
- The circulating pump will be an independent centrifugal pump operated by a balance engine

- There will be two independent steam feed pumps, 1) a steam, fire and bilge pump. 2) A sanitary and fresh water pump
- The propeller will be right-hand about 10 ft diameter and 15 ft pitch with bolted on blades of manganese bronze
- There will be two boilers, single ended with three furnaces each, set with backs to engine
- The boilers will be fitted with the Howden system of forced combustion
- There will be an auxiliary boiler blower with engine for Howden system
- There will be other auxiliary and supplementary machinery, tools, instruments or apparatus as are described in the following

Cylinders

- To be of best quality cast iron
- Each cylinder to be a separate casting and jointed together as shown
- The faces of joint to be well fitted together with a joint of corrugated copper covering the whole face when jointed
- The distance between the centers of the cylinders to be 5 ft 9 inches
- The cylinders to be accurately bored to the following diameters:
    - High pressure 23 inches
    - Intermediate 34 inches
    - Low 56 inches
- Each cylinder to be counterbored so that the working face of the cylinder will be of such a length as to permit the edge of packing rings to work jus over the edge of counterbore at eh ends of the stroke
- The high pressure valve chest will be bored to receive the working linings
- The working linings will be made of hard close grained cast iron and the port openings milled out of the solid
- The intermediate and low-pressure valve faces will be accurately faced and the ports dressed out to correct dimensions.
- Facings will be provided on the cylinders and receivers for the following fittings;
    - Relief valves
    - Drain cocks
    - Passover valves
    - Indicator fittings, throttle valve,
    - Main exhaust,
    - Bonnets where required,
    - And such other as may be shown on the drawings or herein described

Cylinder and Valve Chest Covers

- To be made of cast iron, finished and face on flanges and fitted with metal lagging covers
- Eyebolts for lifting
- Jacking bolts
- All nuts, securing covers that have to be frequently removed to be hardened

Piston and Slide Valves

- The high pressure piston valve will be of cast iron each end having two narrow packing rings with a junk ring between
- The junk ring will fit the lining accurately and to fit the steam tight between the piston valve and follower
- The center to be bored to receive a 2 ½ inch valve stem
- The valve will be designed to receive steam on the inside and exhaust on the outside
- The valve stem stuffing box will be on the receiver
- The intermediate valve will be a flat slide with a trick port, the main cylinder ports being 27 x 3 ½ inches
- The valve to be of close grained cast iron, accurately fitted and the tube cast through it to receive a 2 ½ inch valve stem
- The low pressure valve will be a double-ported slide valve, made of close-grained cast iron accurately fitted with a tube case through it to receive a 2 ½ inch valve stem
- The cylinder ports to be finished to 44 x 2 ½ inches

Valve Stems

- The valve stems will be of steel tempered in oil
- The final finishing to be done after being tempered
- The portion working in the stuffing boxes will be finished to a diameter of 2 ¾ inches
- Each will have a collar 5 inches diameter under its valve
- The part passing through the valve will be finished to 2 ½ inches diameter
- The stem for the low pressure valve will be extended beyond the valve and fitted with a piston 12 inches diameter working in a cylinder on the valve chest cover as shown to balance the weight of valve
- The lower ends of valve stems will be threaded to screw into the valve stem guides as shown on the plans

Cylinder Relief Valves

- There will be a 2 inch adjustable relief valve on each end of the high pressure cylinder,
- There will be a 2 ½ inch adjustable relief valve on each end of the intermediate pressure cylinder,
- There will be a 3 ½ inch adjustable relief valve on each end of the low pressure cylinder

- There will be a 2 ½ inch relief valve on each of the receivers

Cylinder drain cocks
- Each cylinder will be fitted with a 1 inch drain cock at each end, placed so as to drain the cylinder thoroughly
- The cocks to be tight without undue friction
- Drains also will be fitted to the receivers
- The drain cocks of each cylinder will be worked by a single lever at the working platform
- All drain cocks will discharge into a pipe leading to the vacuum side of the condenser

Throttle Valve
- A 7 inch diameter, balanced double-beat throttle valve
- To be bolted to the high pressure steam chest
- Operated by suitable levers at the working platform

Piston Rod and Valve stem Stuffing Boxes
- To be made and fitted with Watson's metallic packing having efficient means of lubrication
- The packing of each stuffing box will be made in tow independent sections so that in case of injury to one section the other will make a tight joint alone

Pistons
- To be made of cast iron of a form shown in the drawings
- The intermediate and low pressure pistons will be cast hollow with internal ribs
- The high pressure piston will be cast solid
- There will be one packing ring for each piston 3 ½ inches wide cut diagonal and fitted with a tongue piece
- Brass sockets will be screwed into the piston to receive the follower bolts
- The piston rods will be fitted with a taper of 7/8 inch in 6 inches
- The packing will be set out by elliptic rings
- The high pressure piston may have snap rings if so directed (if so they will be fitted into a junk ring to facilitate removal)

Piston Rods
- The piston rods will be of forged steel 4 ¾ inch diameter and with a 1 inch hole axially through them
- The rods will be oil tempered and finally finished after tempering
- The rods will be turned to fit the pistons and crossheads
- The rods will be fitted with wrought iron nuts at each end

- The parallel part will be smoothly and accurately turned to size

Crossheads

- The crossheads will be made of forged steel and oil tempered before final finish
- The pins will be finished to 5 ½ inches diameter and 5 inches long
- The hole for the piston rod will be accurately bored to fit the taper of the rod
- The crosshead will be bolted to the guide box, which will be of cast iron
- The go-ahead side is to have a bronze slipper with white metal bearing face
- The wearing face will be 22 x 9 inches

Connecting Rods

- The connecting rods, their caps and bolts will be of forged steel, finished all over
- The connecting rods will be 84 inches long between centers
- They will finish 4 ¾ inches at the small end and 5 ¾ inches at the large end
- The crosshead end of each rod will be forked to span the crosshead
- The crank pin end of the connecting rod will be increased in thickness to 7 inches
- They will be faced on each side and bored for the brasses
- Both ends will be provided with brasses, those at the upper end will form the caps
- Both ends will have white metal linings
- Composition distance pieces will be fitted between the connecting rods and caps
- They will be fitted as to be removable without taking out the cap bolts and will be channeled so as to be easily reduce when taking up lost motion
- The caps will be fitted with eyebolts for handling

Bed Plate (page 24)

- The bed plate will be in one iron casting form shown on the plans
- The bed plate will include six main bearings
- Each of the six arms of the bed plate will be flanged and faced to correspond to similar facings on the main condenser casting and will be securely bolted
- The main bearing caps will be fitted to the bed plate
- All bearings bored out in line to a diameter of 13 ½ inches to receive the main journal brasses
- There will be brasses for each of the 6 main bearings. They will be cylindrical in two parts and lined with Parson's white metal with dovetail recesses and hammered in place and fitted with ample oil channels faced at ends, turned to fit seatings, and accurately bored to fit the journals of the shaft
- The caps will be cast iron as shown
- Each cap will be secured by two through bolts 2 ½ inches in diameter
- The caps and brasses will be tapped and fitted with eyebolts for handling

- The brasses will be fitted so that only the bearing of the journals will be on the surface of the white metal

Main Condenser

- The main condenser will be in one iron casting
- The lower portion to form part of the bed plate and to have six flanged facings to match those of the bed plate and be bolted to the bed plate
- There will be a seating and channel to receive the air pump
- The bottom from each end will decline toward the middle so as to drain the air pump
- The condenser will be ribbed
- The condenser will have three facings on top to receive the cylinder columns
- There will be an opening with faced flanges for the main exhaust
- There will be a manhole opening on top and two at the bottom
- There will be 834 brass, tinned tubes 5/8 inch outside diameter, 15 feet long
- Total cooling surface 2,023 square feet
- The tubes will be in two nests
- The circulating water will pass through the upper nest first and return through the lower nest
- Tube plates and center supporting plates to be of brass
- The tubes are to have screw glands to secure the packing.
- The inlet and outlet for circulating water to be so placed that no pipes need be moved to remove the condenser heads

Columns between Condenser and Cylinders and Main Guide

- There will be three box columns between the condenser and cylinders of cast iron with faced flanges to match those on the top of the condenser and the bottoms of the cylinders
- The columns will have facings on the front side to receive the main guides, which will consist of box castings of close-grained iron accurately faced on all four sides
- The facings will have proper oil channels cut in the working faces and fitted for internal water circulation

Front Columns

- There will be three front columns in box form of cast iron with faced flanges to match those on bed plate and on bottoms of cylinders
- The bearings will be cast on these columns for the reversing shaft
- On the center column there will be facings to receive the reversing gear

Crank Shaft

- The crank shaft will be forged solid in one piece of high grade steel

- The whole body of the shaft and crank pins will be finished to a uniform diameter of 10 ½ inches
- The coupling will be 19 ½ inches
- The throw of the crank shaft will be 18 inches
- The thickness of the webs 7 x 12 ½ inches
- There will be an axial hole through the shaft and the crank pins 3 ½ inches diameter

Line, Thrust and Propeller Shaft

- These are to be made of proper length to suit the vessel
- The thrust shaft to be made short, so as to be easily handled
- The diameter of all these shafts to be 10 ½ inches
- All are to be of steel
- Coupling 19 ½ inches diameter
- All 3 ½ inches thick
- The propeller shaft will be eased in bronze where it passes through the stern tube, stuffing box and bearing
- The bronze will be ¾ inches thick in the bearings and ½ inch thick elsewhere

Line Shaft and Thrust Bearings

- The line shaft bearings will be of cast iron with white metal linings and will be placed 12 ft apart
- The thrust bearing pedestal will be of cast iron and securely bolted to the bed plate of which it will form an extension
- The thrust bearing will be fitted to receive five horse shoe rings of cast iron with water circulation through them
- The horse shoes will be 4 ½ inches thick and will have with metal faces in blocks fitted into dovetailed recesses well hammered in place
- The horse shoes will be accurately faced to fit between collars on the shaft and between block on each side of the pedestal
- Each horse shoe will have an oil box with wicks for lubrication
- The ends and side walls of the pedestal will form an oil trough, with pipes and cocks for draining off the contents
- At each end of the pedestal forward and aft of the thrust rings will be a bearing lined with white metal for taking the weight of the shaft
- The caps will be of cast iron with white metal lining and oil box
- At each end there will be a divided stuffing box and gland to prevent escape of oil
- The caps and horse shoes will be fitted with eyebolts for convenience of handling

Stern Tube Bearings

- The stern tube will be of cast iron 1 ½ inches thick turned to fit the hub in stern frame with a faced collar inside and bronze nut outside
- The inner end will have a flange secured to the bulkhead
- The after end will be bored out to receive the stern bearing which will be of brass 40 inches long turned off outside to fit the stern tube and bored inside to receive the lignum vitae bearing
- The lignum vitae bearing will be in strips, the bearing being on end wood
- A brass key on the upper side will lock the wood in place
- At forward end the bearing behind the stuffing box will be made similar to the stern bearing and 12 ½ inches long
- The stuffing box gland will have six 1 ½ inch studs
- This whole work will be carefully fitted

Eccentrics and Straps

- The eccentrics will be of close grained cast iron in two parts, 21 inches diameter and 3 ¼ inches thick
- The two parts will be neatly fitted together and secured by two turned bolts 1 ¼ inches diameter
- The parts will be bored out to a snug fit on the shaft and turned accurately on the outside to an eccentricity of 3 inches
- The two parts will be scored on each side for the flanges of the eccentrics' straps
- Each eccentric will be securely keyed on the shaft and all eccentrics will be interchangeable
- The straps will be of close grained cast iron made with flanges to fit the recesses of eccentrics and lugs for the clamping bolts and for the eccentric rods
- The two parts of each strap will be held together by two turned bolts 1 ¼ inches diameter with lock nuts and fitted with channeled brass distance pieces
- Each strap will be accurately and smoothly bored to fit the eccentrics both on face and recesses and properly channeled for oil
- All the straps will be interchangeable

Eccentric Rods

- They will be of forged steel, finished all over
- Each rod will have a T head secured to its eccentric strap by two forged steel stud bolts with nuts locked in place
- The upper end of each rod will be forked to span the link and fitted with adjustable brasses
- The brasses on each side of the rod must be fitted accurately in line with each other and smoothly bored to fit the link pins

Main Links

- They will be of double-bar pattern of forged steel, finished all over
- They will have pins for eccentric rods forged on and finished to 19 inches between centers
- They will also have center pins for the suspension rods
- Each pair of bars will be secured together by through bolts and thimbles all accurately fitted

Link Blocks

- They will be forged steel, finished all over
- They will consist of a wrist pin terminating at each end in a pair of jaws that span the corresponding bar of the link
- The jaws will be fitted with bronze gibs, finished to the curve of the links and with set screws to hold them in place and to secure adjusting liners

Suspension Links

- Each link will be suspended from the corresponding arm of the reversing shaft by forged and finished suspension links
- The ends of these links will be fitted with bronze bushes

Valve-Stem Guides

- The valve-stem guides will be of forged steel, the working part being 4 ¼ inches square and 15 inches long
- The valve stem will screw into the upper end of these guide pieces and the lower end will be fitted with adjustable brasses that fit the link block
- The guide brackets will be of cast iron securely bolted to facings on the cylinder bottoms
- The guides will have slipper brasses fitted to receive the working faces of the guide bar

Reversing Gear

- The reversing gear will consist of a reversing shaft carried in suitable bearings on the front columns
- There will be keyed on the shaft an arm for each reversing link
- These arms will have slots in their ends with sliding blocks fitted to carry the pin for the suspension links
- They will be operated by a screw capstan head
- The slots will be so designed as to draw up the link on the go-ahead side while the position would not be changed on the go-astern side
- There will be a fourth arm on the reversing shaft connected with a direct-acting stern-reversing cylinder fitted with the usual differential operating gear

Turning Gear

- The worm wheel will be fitted on the forward end of the engine shaft with an operating worm worked by a ratchet lever
- The bracket carrying the worm will be arranged so as to throw the worm in or out of gear as required
- An iron guard will be fitted over the worm wheel

Air Pump

- The air pump will be placed behind the condenser and will be operated by levers worked from the intermediate engine crosshead
- The levers will be steel plate and all connections and journal will have adjustable brasses
- The air pump will be 18 inches diameter and 18 inch stroke
- The working barrel, bucket, head and foot valve plates, studs and guards will be of bronze and all fitted in the substantial manner
- The pump rod will be of hammered bronze
- On each side of the air pump and operated from its crosshead will be a bilge pump have a 3 ½ inch plunger with an 18 inch stroke
- These pumps will connect with the bilge-suction boxes and deliver overboard
- The iron casings surrounding the air pump will form a hot well, and will have and overboard discharge with a non-return valve

Circulating Pump

- There will be an independent centrifugal circulating pump operated by a balanced engine
- The runner and shaft will be of bronze
- The connecting pipes with the sea and delivery valves will be 8 inches diameter

Main Exhaust Pipe

- The main exhaust pipe will be of cast iron of square section
- It will be flanged on top of the condenser and onto the low-pressure cylinder valve chest

Boilers

- There will be two Scotch boilers set side-by-side as shown on plans with their backs to the engine and fired forward
- The boilers will be 11 ft 6 inches diameter and 11 ft long having three corrugated furnaces each
- The furnaces will be 36 inches diameter
- The boilers will be built for a working pressure of 160 lbs per square inch

- There will be an auxiliary boiler of about 240 feet heating surface located as shown and connected to the main stack
- Two Scotch boilers to be fitted with Howden's Forced Combustion
  - Sufficient power to propel vessel at 12.5 knots per hour

Boiler Material

- All plates used in the construction of the boilers will be open-hearth steel and all materials will be in accordance with the United States inspection requirements

Boiler Shells

- The shells will be made of 1 1/8 inch plates for the main boilers
- Each shell in two courses and each course in two plates
- The shells will be butted for the longitudinal seams and lapped for the circular seams
- There will be inside and outside butt straps each ¾ inch thick
- All seams will be double riveted
- The shell plating of the auxiliary boiler will be 9/16 inch thick in two courses
- Each course will be in one plate
- The auxiliary boiler will be 6 ft 6 inches in diameter
- All seams will be double riveted

Boiler Heads

- The boiler heads for the main boilers will each be in two plates, the upper half ¾ inch thick
- The seam in the front head will be below the line of the tubes
- The tube sheets will be drilled for 246, 2 ½ inch tubes including the stay tubes
- The heads for the auxiliary boiler will each be in one plate 5/8 inch thick

Combustion Chambers

- There will be one combustion chamber for each of the main boilers being common to each of the three furnaces
- The water space between the combustion chamber and back head to be 7 ½ inches at the bottom and 11 ½ inches at the top
- The tube sheets will be 11/16 inch thick
- The other portions of the combustion chambers will be 5/8 inch thick
- The tops of the combustion chambers will have girder braces
- The plates will be flanged where necessary and all parts joined by single riveting
- The holes for the screw stay bolts in plates of combustion chambers and shells will be drilled and tapped together in place
- Combustion chamber for auxiliary boiler will be of ½ inch plate except the tube sheet

- The tube sheet will be 5/8 inch plate
- It will be fanged together and fitted as shown

Boiler Tubes
- The tubes will be of iron, lap welded and drawn the best that can be obtained
- All tubes will be 2 ½ inches external diameter
- The ordinary tubes will be of No. 10 B.W.G. in thickness
- They will be expanded into the tube sheet and beaded at both ends
- The stay tubes will be No. 6 B.W.G in thickness and at the front end will be reinforced in thickness to 2 5/8 inches outside diameter
- They will be threaded parallel at the combustion chamber end and taper at the front ends to fit thread in tube sheets
- They will be screwed into tube sheets to a tight joint at the front ends and will be made tight at the back ends by expanding and beading
- All tubes will be spaced 3 5/8 inches vertically and 3 ¾ inches horizontally

Furnaces
- Each furnace will be in one piece 7/16 inch in thickness and to be of the form known as a Morrison Suspension Furnace, 36 inches diameter
- They must be perfectly circular in cross-section at all points and fit snugly in the flanged openings of the front heads and combustion chambers

Bracing
- The bracings will be as shown in the drawings
- The combustion chambers will be stayed to the boiler shells by screw stays, crewed into both sheets and fitted with nuts
- The holes for the screw stays will be tapped in both sheets in place
- All screw stays and all screwed braces will have raised threads
- All braces will be made without welds

Riveted Joints
- The longitudinal joints of the boiler shells will be butted with inside and outside straps and double riveted as shown
- Joints of heads with shells will be double riveted
- Joints in furnaces and combustion chambers will be single riveted
- Edges of all plates in cylindrical shells and all flat plates where not flanged and where flanged if practical will be planed
- Edges of flanged plates that cannot be planed will be faired by chipping
- At least one half of the thickness of plates to be allowed for planning

- All rivet holes in shell plates will be drilled in place after bending
- Hydraulic riveting will be used wherever possible
- In parts where hydraulic riveting cannot be used, the rivet holes will be coned and conical rivets used
- Seams will be caulked in both sides in an approved manner
- All joints will be as shown in drawings

Manholes and Hand Holes

- There will be manholes in each boiler, placed and of the sizes shown in the drawings
- The manhole covers or doors will be of mild steel stamped in dished form having two 1 ¼ inch studs with square nuts
- Each plate will have a convenient handle
- All plates, yokes, dogs and nuts will be properly marked to show to what holes they belong

Grates and Furnace Fronts

- The grates will be of cast iron 5 feet long, closely fitted together and with air-tight side bars fitting the corrugations of the furnace
- The bridge wall the furnace fronts with the air valves and distribution boxes for hot air with the doors and hand fitting all to be according to the latest designs for the Howden system of forced combustion

Uptakes and Smoke Pipe

- The uptakes will be arranged to receive the Howden heater tubes which will be arranged so as to effectively abstract the heat from the escaping gases
- The smoke pipe will be made of sufficient area to permit the auxiliary smoke pipe and galley pipe being inside
- The rake and height of the smoke pipe to be as shown on the rigging plans

Fittings

- There will be a main stop valve with auxiliary branch on each boiler
- Two gauge glass stands and six gauge cock on each boiler
- Surface and bottom blow valves
- Main and auxiliary feed check valves
- A salinometer pot
- Steam gauge
- Spring loaded safety valves as required by law
- Other fittings used on boilers of this type

Securing Boilers

- The boilers will have forged saddle legs securely bolted to the shells and resting on the longitudinal keelsons fitted in the vessel to receive them

Auxiliary Boiler Feed Pump
- A steam feed pump will be fitted to supply the auxiliary boiler and will draw from the fresh water supply tank

Ash Hoist
- There will be a steam ash hoist working through the fire room ventilators with all the necessary fitting and ash chute overboard

General Clause
The engines boilers and all auxiliary machinery will be complete in every respect and adapted to the requirements of a passenger and freight vessel on the Pacific Coast. All the necessary hand tools, wrenches, handling gear, etc. will be supplied and properly stowed.

The vessel to be complete in all respects, both as to the hull and machinery with the exceptions as noted herein.

On completion she will be tried by a run at sea of 6 hours' duration, the owner's crew operating the vessel and machinery with the contractor's representative on board, who will be responsible for the working of the machinery, etc.

The speed of the vessel to not less than 12 ½ knots per hour average for the 6 hours

Any defects in material or workmanship discovered during the trial will be made good by the contractor.

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[1] Union Iron Works 1896 Specifications for a Steel Screw Passengers and Freight Steamer of the Pomona Type for the Pacific Coast Steamship Company, Press of H.S. Crocker Company, San Francisco, CA

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

Additional Documentation

Appendix 2 – Photographic Information:

Figure #1

3. Unknown
4. 1888
5. San Francisco National Maritime National Historic Park (SAFR)
6. *Pomona* at Eureka, CA

Figure #2

3. Unknown
4. 1888
5. California State Archives
6. Potrero Point 1888, Birdseye view of San Francisco

Figure #3

3. Unknown
4. Unknown
5. California State Archives
6. Irving Murray Scott

Figure #4

3. Unknown
4. Unknown
5. World Book Encyclopedia
6. Triple-expansion steam engine

Figure #5

3. Unknown
4. 1888
5. California State Archives
6. Pacific Steamship Company 1888 Schedule

Figure #6

3. Messer

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

4. 1908
5. SAFR
6. Port view of the sinking *Pomona* with *Greenwood*.

Figure #7

3. Unknown
4. 1908
5. SAFR
6. Bow view of the Greenwood salvaging Pomona

Figure #8

3. Unknown
4. March 1908
5. SAFR
6. Passengers in life saving boats leave the sinking Pomona

Figure #9

3. Unknown
4. 1908
5. San Francisco National Maritime National Historic Park (SAFR)
6. Salvage of *Pomona*

Figure #10

3. Sheli Smith
4. August 10, 1998
5. Underwater Science Program, Indiana University
6. *Pomona* site map

Figure #11

3. John Foster
4. 2004
5. California Department of Parks and Recreation, Archaeology, History & Museums Division, Sacramento, Ca
6. Spar buoy marking the historic wreck site

Figure #12

3. John Foster

United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

4. 2004
5. California Department of Parks and Recreation, Archaeology, History & Museums Division, Sacramento, Ca
6. Bull kelp beds over the *Pomona* shipwreck

Figure #13

3. John Foster
4. 2000?
5. HDC 345, UIW Roll #1466, J. Porter Shaw Library, San Francisco Maritime Museum
6. Original engineer sketch of the *Pomona*'s scotch boiler printed on linen

Figure #14

3. John Foster
4. 2004
5. California Department of Parks and Recreation, Archaeology, History & Museums Division, Sacramento, Ca
6. Carnegie brick

Figure #15

3. John Foster
4. 2004
5. California Department of Parks and Recreation, Archaeology, History & Museums Division, Sacramento, Ca
6. T-connection

Figure #16

3. Unknown
4. Unknown
5. California State Archives
6. Peter Donahue

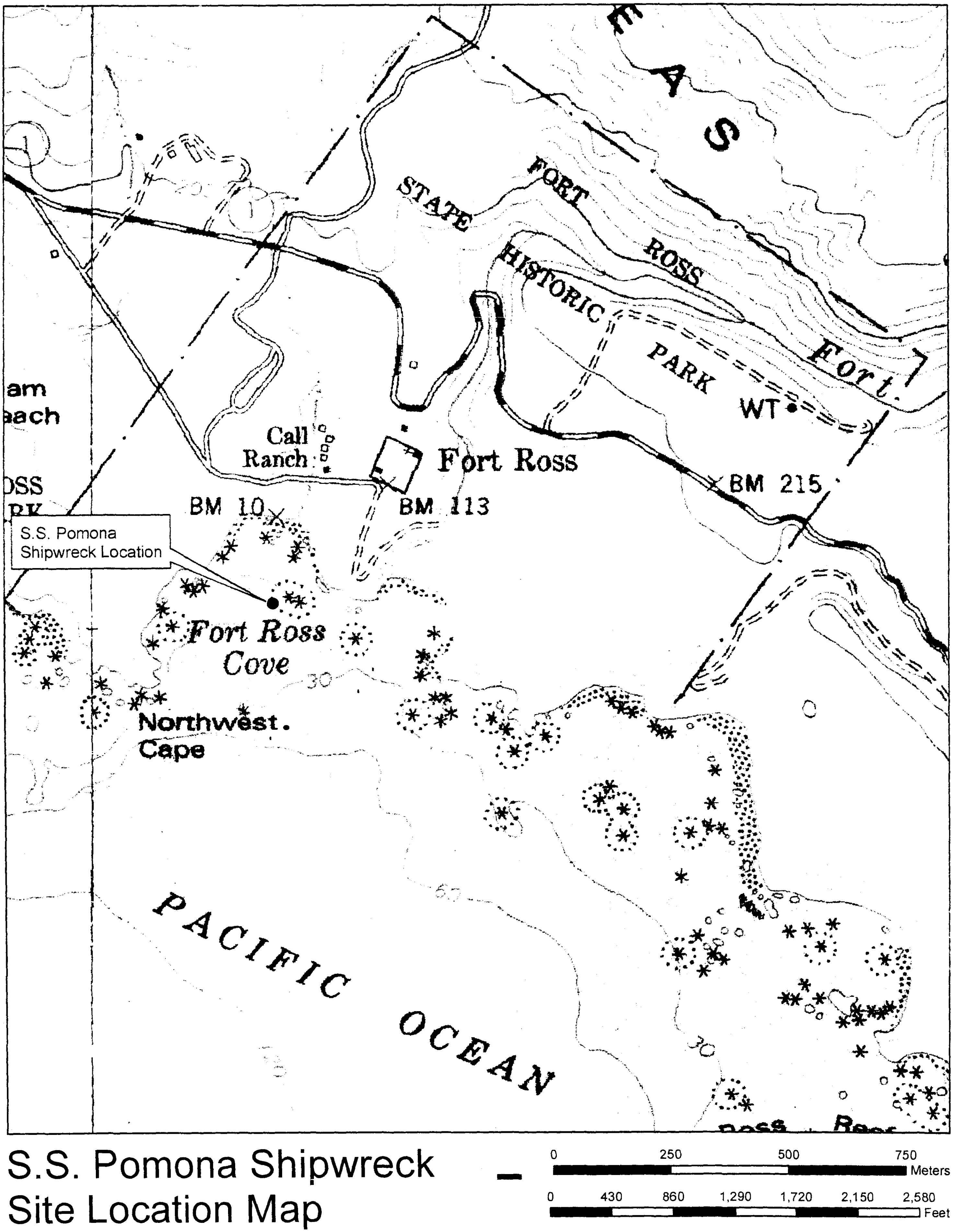
Figure #17

3. Unknown
4. Unknown
5. California State Archives
6. James Donahue

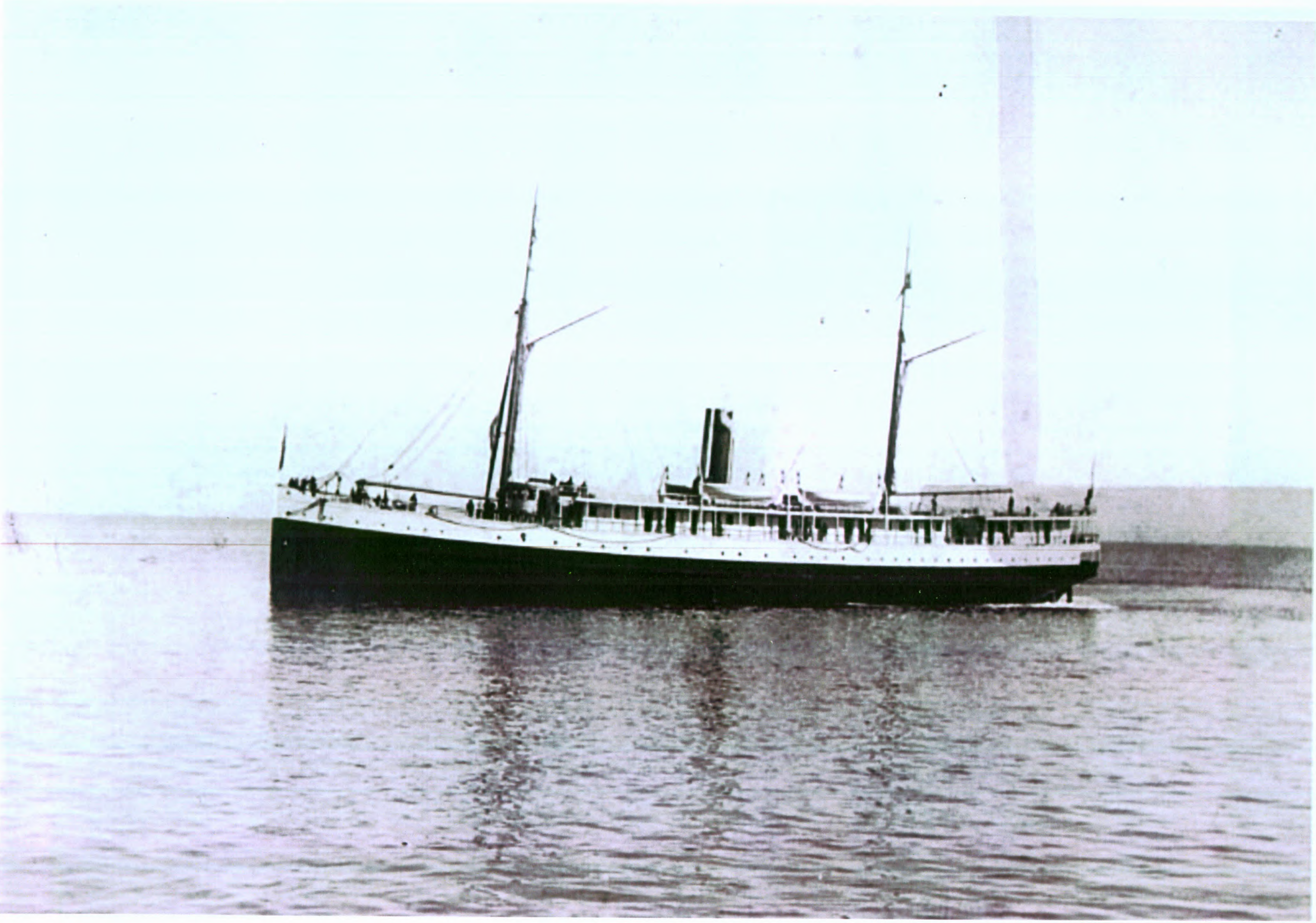
Figure #18

3. Unknown

4. Unknown
5. California State Archives
6. Birdseye view of Union Iron Works



S.S. Pomona Shipwreck
Site Location Map



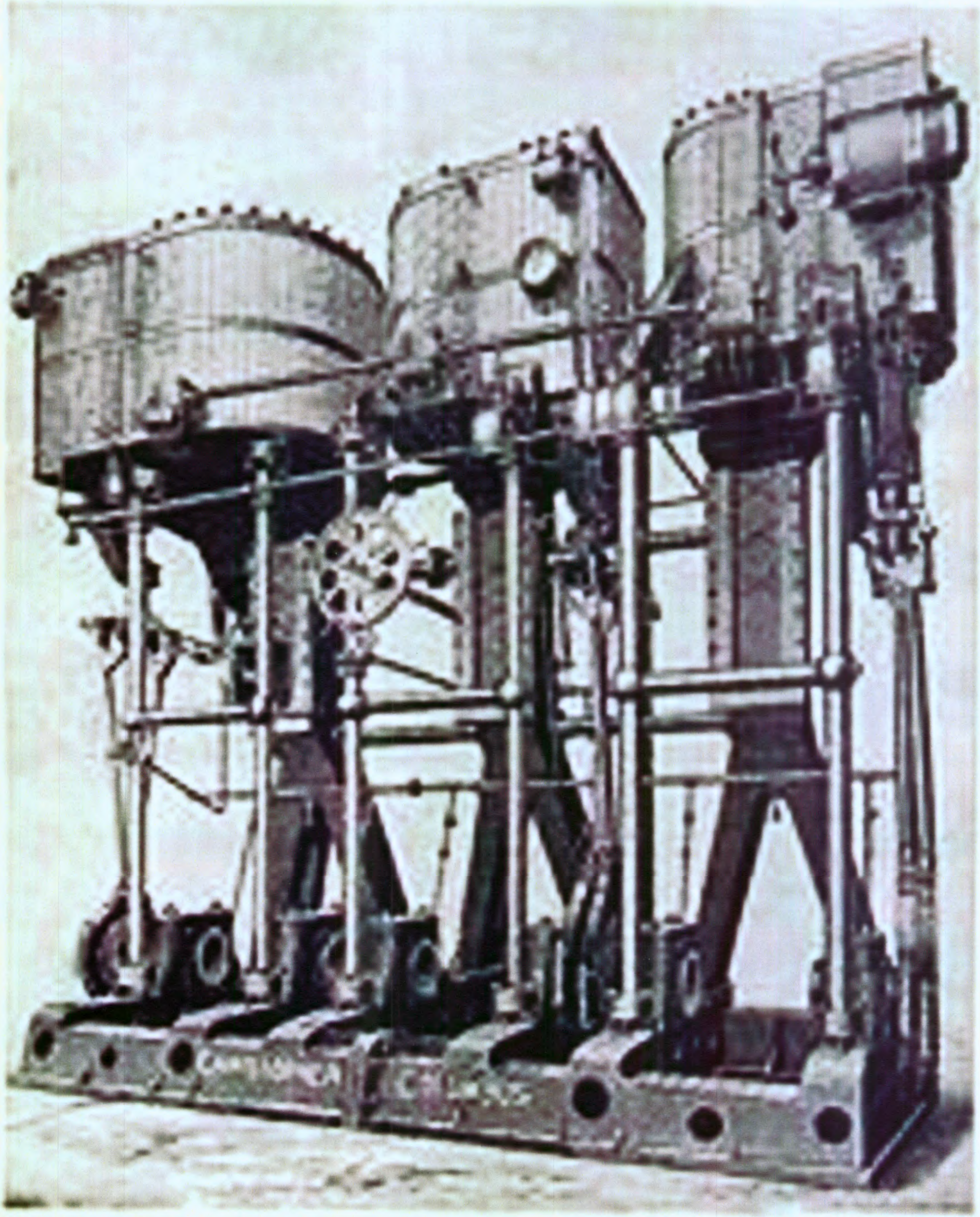
1. SS. Pomona. Shipwreck
2. Sonoma. CA
7. Figure #1

1. S.S. Pomona, Shipwreck
2. Sonoma, CA
7. Figure #2

—Courtesy of Mr. Laurence I. Scott.

Mr. Irving Murray Scott, California's Pioneer Locomotive Designer and Builder.

1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure #3

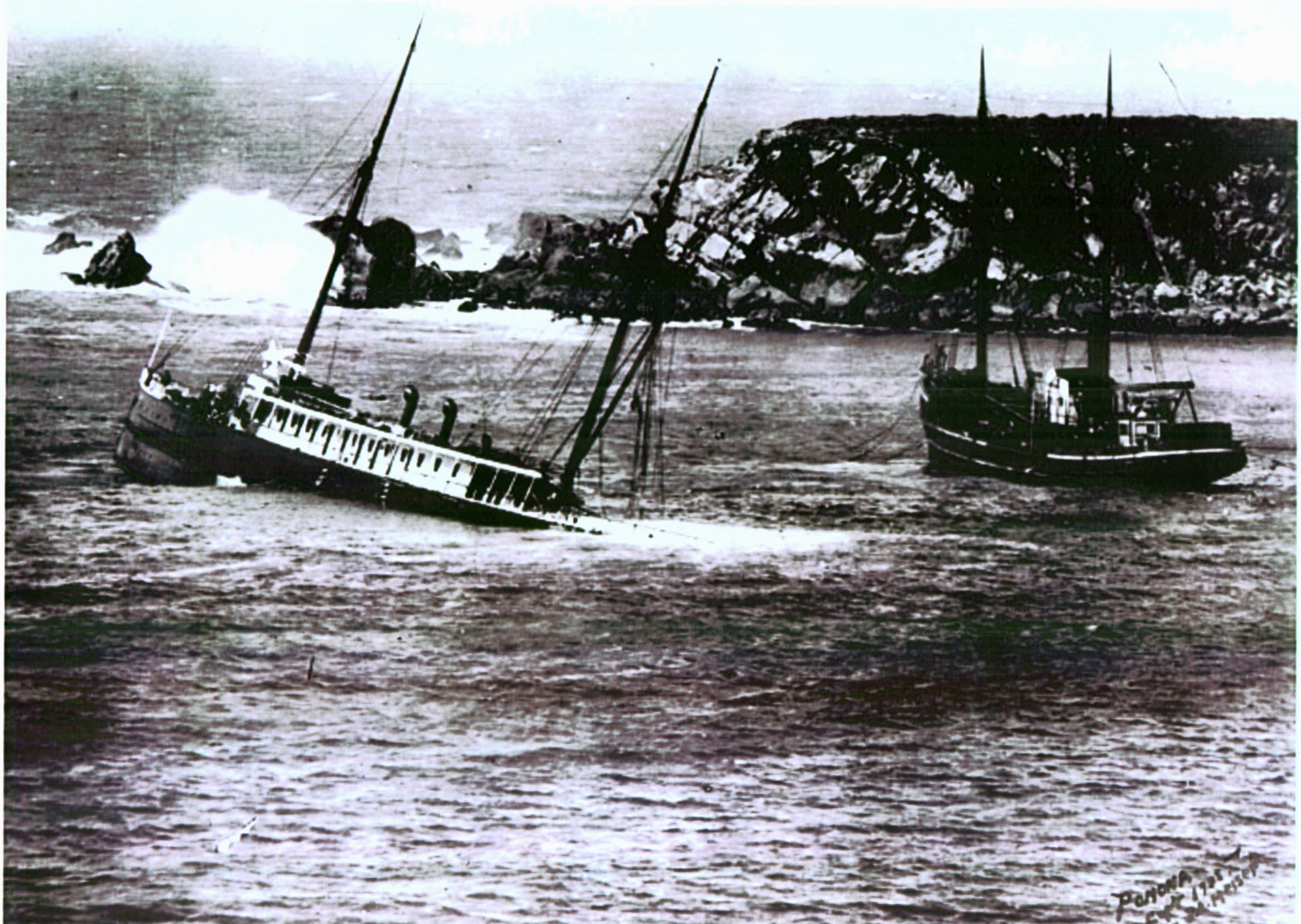


Triple Expansion Engines of the Christopher Columbus

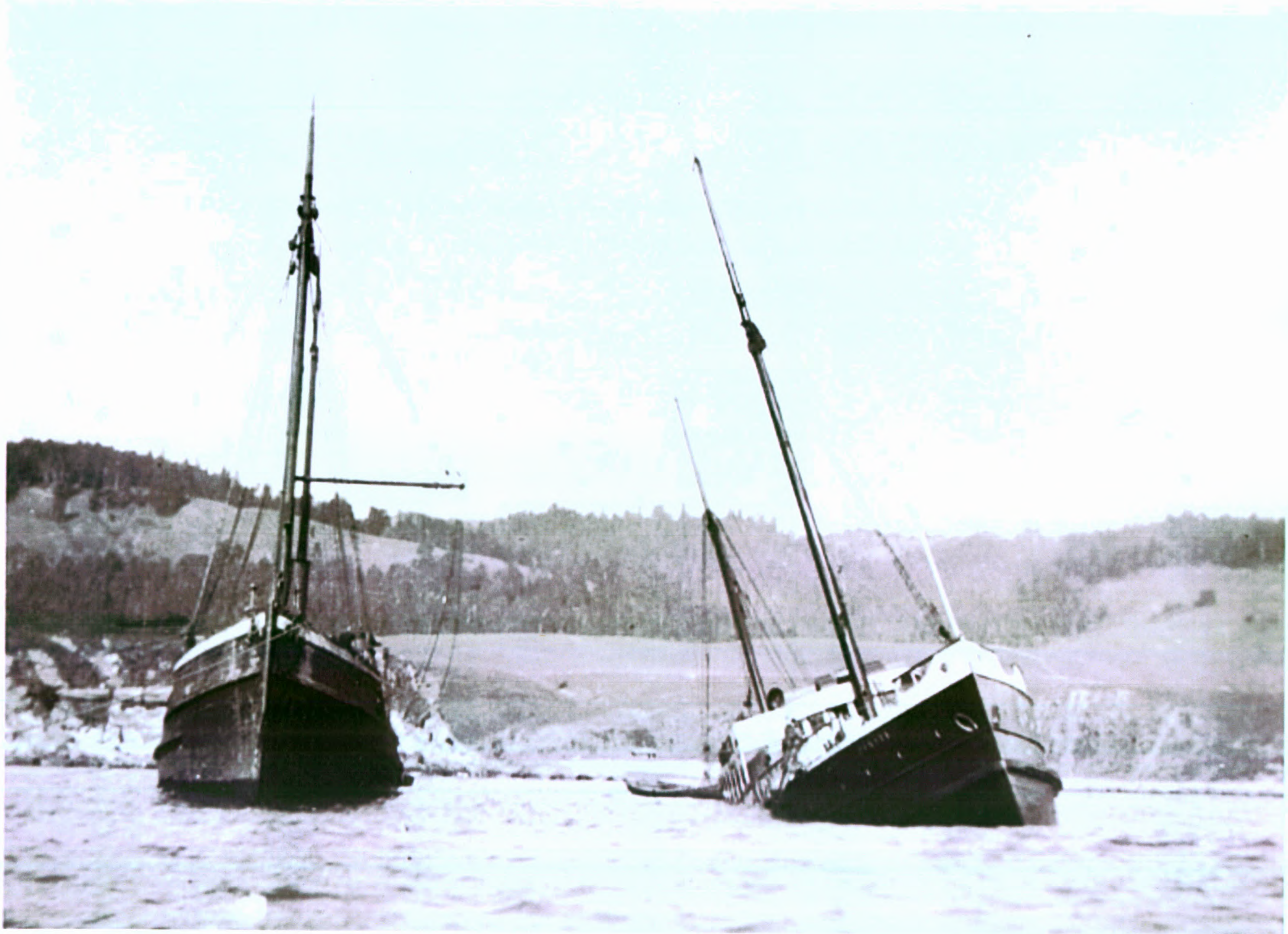
1. S.S. Pomona, Shipwreck
2. Sonoma, CA
7. Figure # 4

Ports.	Steamers and Time.		Aug.	Sept.	Oct.
San Francisco, Broadway Wharf, No. 2.	Sta Rosa	2 P	8-16-24	1-14-28	11-25
	Sta Rosa	**9 a**	Excur. trips ☞	**9-22**	**6-19**
	Queen	2 P		10-23	7-20
	Queen	**9 a**	Excur. trips ☞	**4-18**	**1-15-28**
	Puebla	2 P	4-12-20-28	5-19	2-16-29
	Puebla	**9 a**	Excur. trips ☞	**13-27**	**10-24**
	Eureka	8 A	2-10-18-26	2-11-20-29	8-17-26
	Pomona	8 A	6-14-22-30	7-16-25	4-13-22-31
Santa Cruz.	Eureka	4 P	2-10-18-26	2-11-20-29	8-17-26
	Pomona	4 P	6-14-22-30	7-16-25	4-13-22-31
Monterey.	Eureka	7:45 P	2-10-18-26	2-11-20-29	8-17-26
	Pomona	7:45 P	6-14-22-30	7-16-25	4-13-22-31
San Simeon.	Eureka	4 A	3-11-19-27	3-12-21-30	9-18-27
	Pomona	4 A	7-15-23-31	8-17-26	5-14-23
Cayucos.	Eureka	6 A	3-11-19-27	3-12-21-30	9-18-27
	Pomona	6 A	7-15 23-31	8-17-26	5-14-23
Port Hartford.†	Sta Rosa	7:35 A	9-17-25	2-15-29	12-26
	Queen	7:35 A		11-24	8-21
	Puebla	7:35 A	5-13-21 29	6-20	3-17-30
	Eureka	12 M	3-11-19-27	3-12-21-30	9-18-27
	Pomona	12 M	7-15-23-31	8-17-26	5-14-23
Lompoc.	Pomona,	P M	7-15-23-31	8-17-26	5-14-23
Gaviota.	Eureka,	6 P	3-11-19-27	3-12-21-30	9-18-27
	Pomona,	6 P	7-15-23-31	8-17-26	5-14-23
Santa Barbara.	Sta Rosa,	6 P	9-17-25	2-15 29	12-26
	Sta Rosa,	**5:30a**	Excur. trips ☞	**10-23**	**7-20**
	Queen,	6 P		11-24	8-21
	Queen	**5:30 a**	Excur. trips ☞	**5-19**	**2-16 29**
	Puebla,	6 P	5-13-21-29	6-20	3-17-30
	Puebla,	**5:30 a**	Excur. trips ☞	**14-28**	**11-25**
	Eureka,	11 P	3-11-19-27	3-12-21-30	9-18-27
	Pomona,	11 P	7-15-23-31	8-17-26	5-14-23
San Buenaventura.	Eureka,	5 A	4-12-20-28	4-13-22	1-10-19-28
	Pomona,	6 A	8-16-24	1-9-18-27	6-15-24
Hueneme.	Eureka,	6 A	4-12-20-28	4-13-22	1-10-19-28
	Pomona,	6 A	8-16-24	1- 9-18 27	6-15-24
	Sta Rosa,	11 A	10-18-26	3-16-30	13-27
	Sta Rosa,	**1 p**	Excur. trips ☞	**10-23**	**7-20**

1. S.S Pomona, Shipwreck
2. Sonoma, CA
7. Figure #5


Pomona

1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure #6

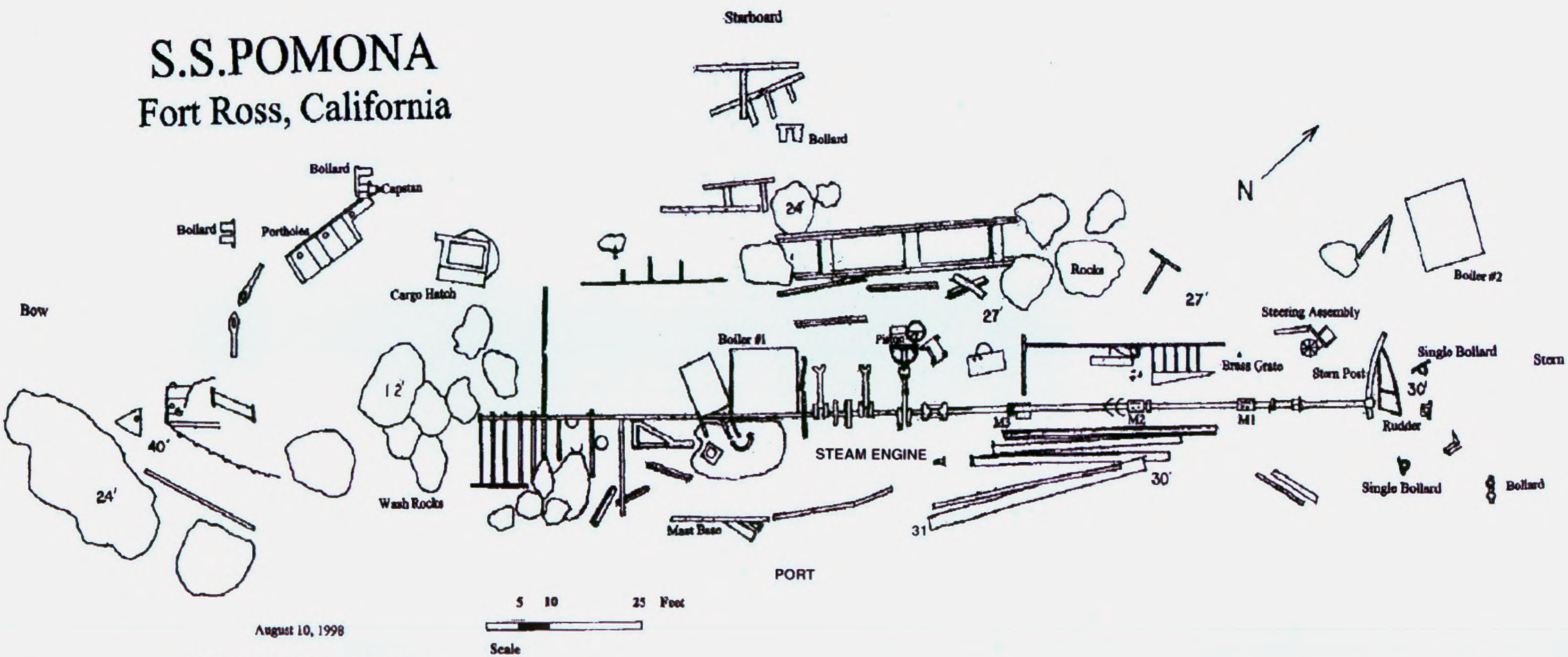


1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure #7

1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure #8

1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure #9

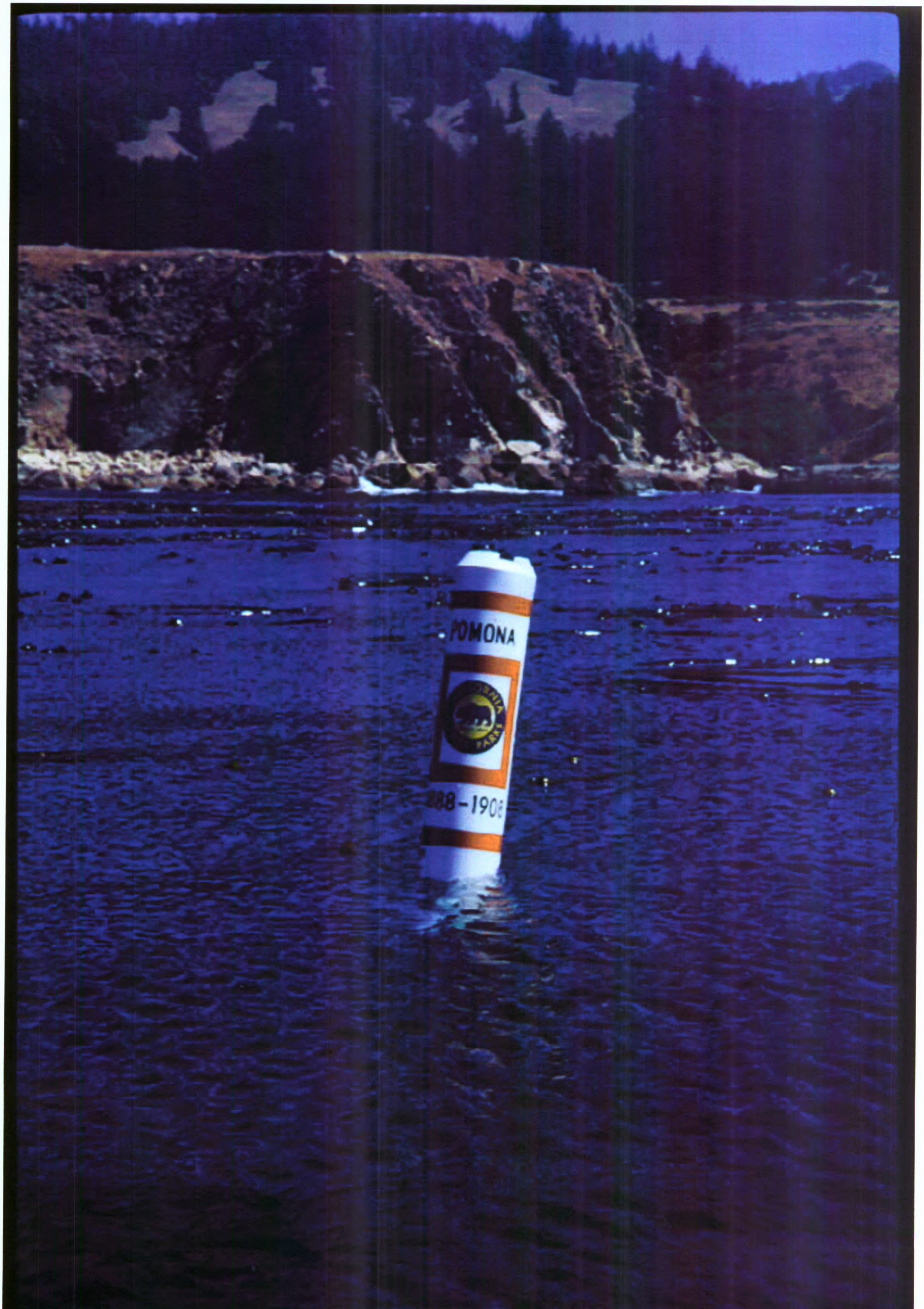
S.S.POMONA
Fort Ross, California



August 10, 1998

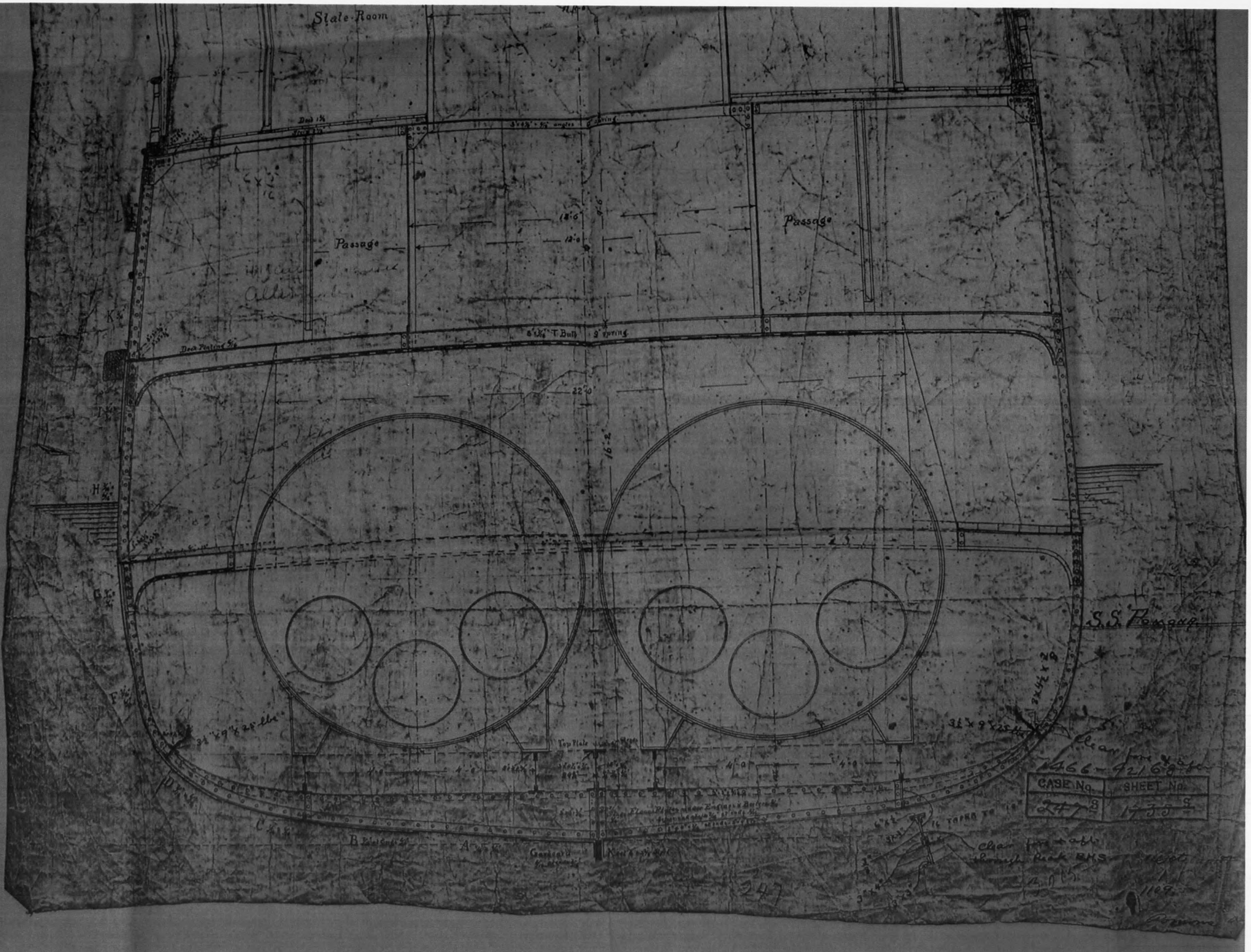
Underwater Science Program
Indiana University ©1998

1. S.S. Pomona, Shipwreck
2. Sonoma, CA
7. Figure #10


POMONA

1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure # 11

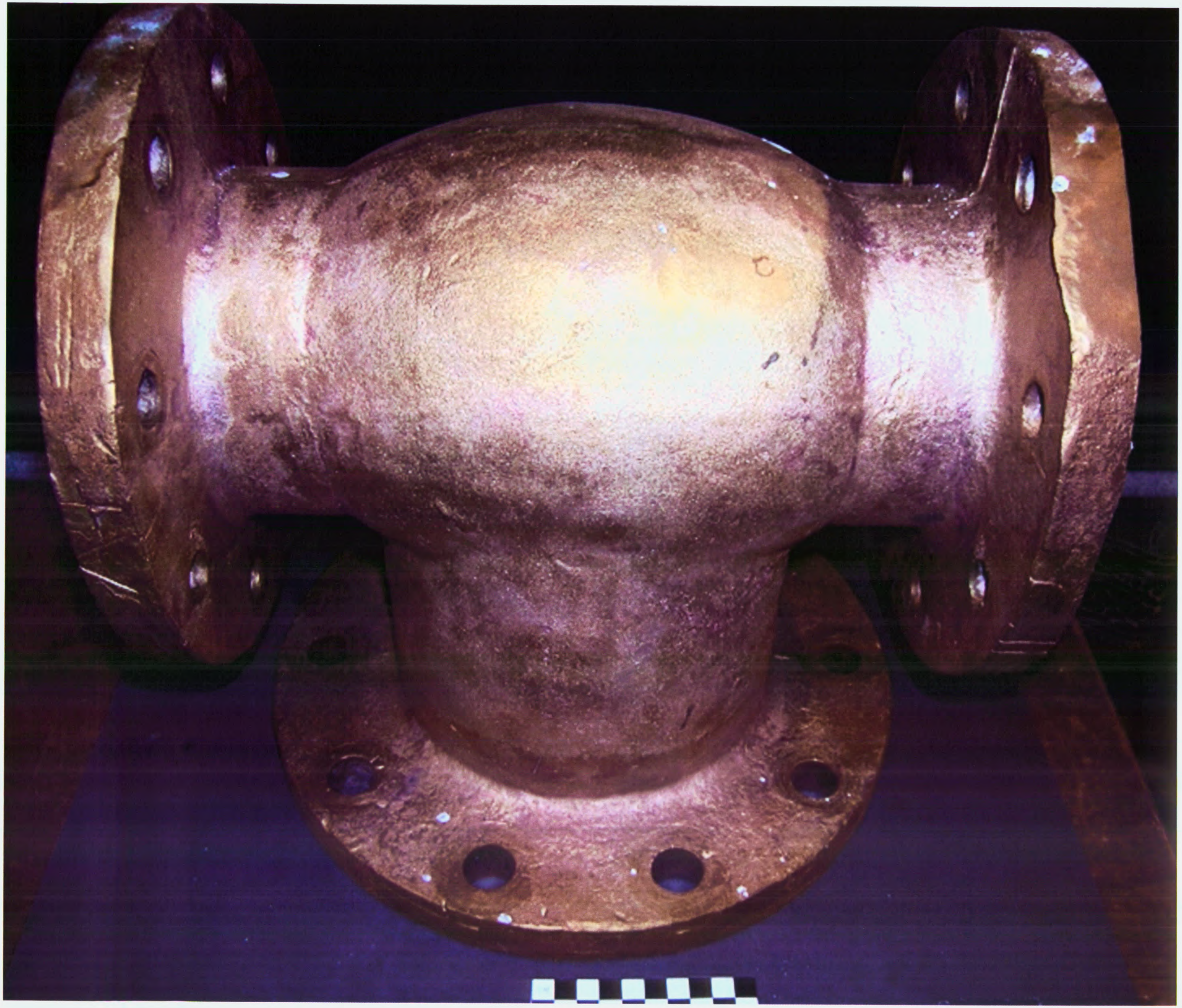
1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure #12



State Room
Passage
Passage
S.S. Pomona
CASE No.
SHEET No.
247

1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure #13

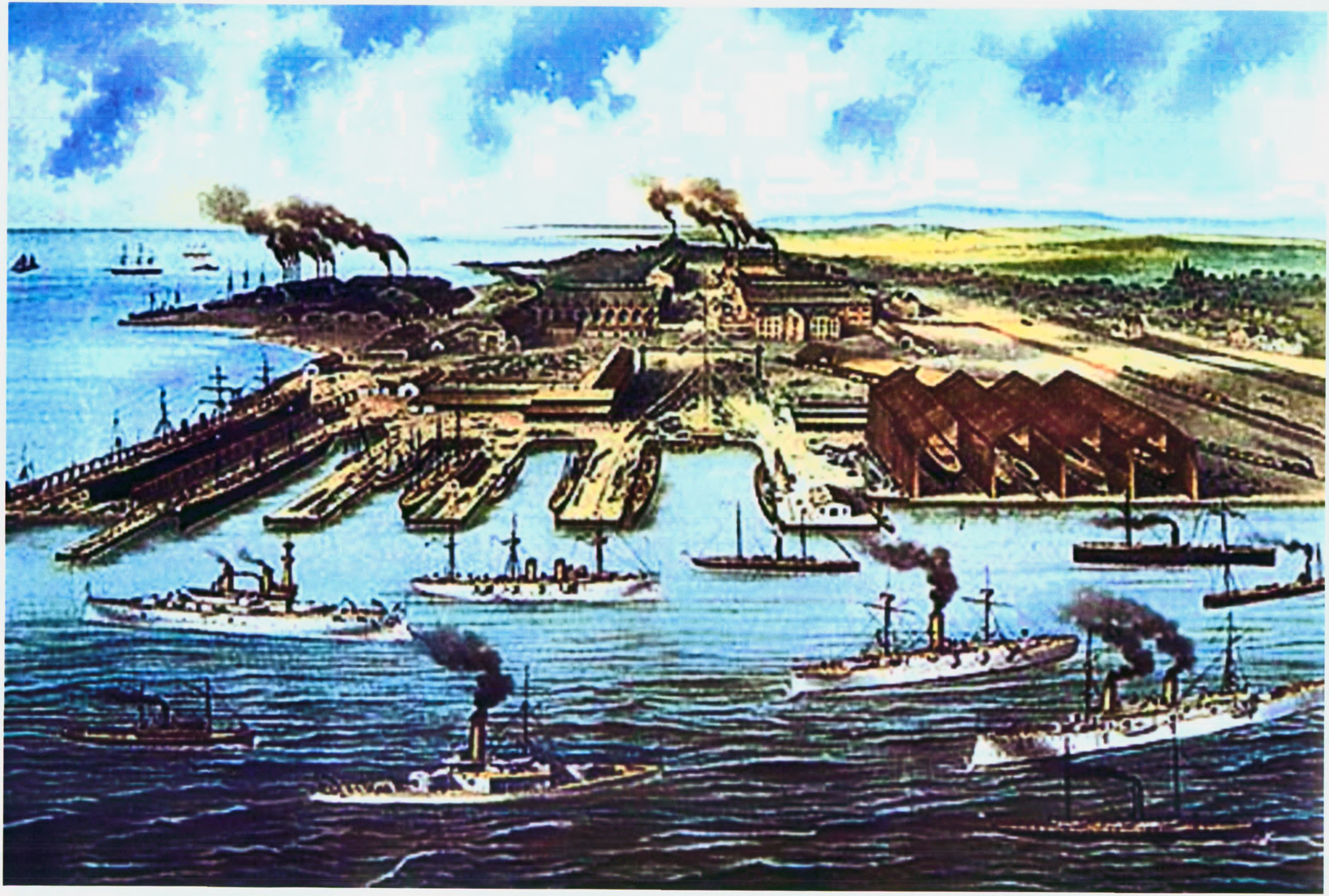
1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure #14



1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure #15

1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure # 16

1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure #17



1. S.S. Pomona Shipwreck
2. Sonoma, CA
7. Figure #18