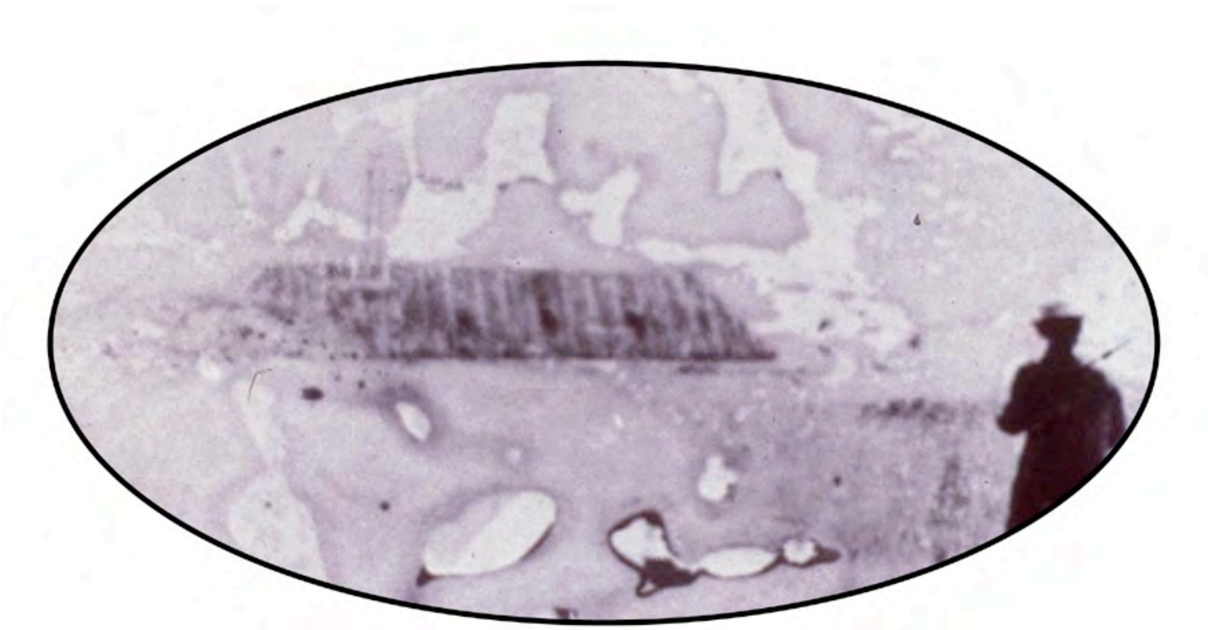
IN SITU ARCHAEOLOGICAL EVALUATION OF THE CSS *GEORGIA* SAVANNAH HARBOR, GEORGIA

Final Report



PREPARED FOR:

U.S. Army Corps of Engineers
Savannah District
Savannah, Georgia

UNDER SUBCONTRACT TO:

Gulf South Research Corporation
Baton Rouge, Louisiana

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Washington, North Carolina

February 2007

Final Report

In Situ Archaeological Evaluation of the CSS *Georgia* Savannah Harbor, Georgia

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ABSTRACT

The U.S. Army Corps of Engineers, Savannah District, operates and maintains the Savannah Harbor Navigation Project and, in partnership with the Georgia Ports Authority, is examining the feasibility of deepening the Savannah Harbor navigation channel. To ensure compliance with various federal and state statutes, the Savannah District has re-initiated studies of the CSS *Georgia* shipwreck, a National Register of Historic Places listed site. Locally built in 1862 and originally designed as an ironclad gunboat, *Georgia* was moored in the Savannah River opposite Fort Jackson approximately five miles down river from the City of Savannah. Designated a “Floating Battery,” the vessel served as an integral element of Confederate defenses that protected Savannah until General W. T. Sherman’s Union Army captured the city. After a 20-month operational life, *Georgia* was scuttled in December 1864 to prevent capture by advancing Union troops.

Performed under subcontract to Gulf South Research Corporation of Baton Rouge, Louisiana the current investigation of the wreck site was conducted by the joint team of Panamerican Consultants, Inc. of Memphis, Tennessee and Tidewater Atlantic Research, Inc. of Washington, North Carolina. Conducted under Contract No. DACW21-98-D-0019, Delivery Order No. 0059, and under Department of the Navy Archaeological Research Permit No. PCI-2003-002, the focus of the contract was to determine the effects of past, present, and future activities associated with the existing navigation project on the remains. Perhaps the most critical issue was assessing the potential effect of future channel deepening on the surviving remains of the CSS *Georgia*.

The current investigation clearly established that the surviving remains of the Civil War ironclad are limited, and that the lower hull of the vessel no longer exists. Two large sections of iron casemate and a third smaller section are present along with the vessel’s propulsion machinery including steam cylinders and at least one propeller and shaft, three cannon, a possible boiler, and miscellaneous, small, as of yet unidentified components and artifacts. The absence of lower hull and the impacts to the existing components are a direct result of historic salvage and to a much greater degree operation and maintenance dredging operations associated with the Savannah Harbor Navigation Project. With respect to dredging impacts, the previous dredging activities, especially the 1983 box cutting of side slopes and excavation of 4 vertical feet of channel bottom for advance maintenance dredging at the wreck site, have had an extreme and ongoing adverse effect on the property. Besides cutting or “chewing” into the wreck, dredging impacts have destabilized the site by removing protective sediments and have resulted in the continuous and ongoing degradation of the wreck through exposure (i.e. teredo damage, erosion, etc.). Furthermore, the proposed channel deepening as planned will most certainly have a further adverse effect on this National Register property and will result in its destruction.

Owing to a dearth of information about this ironclad’s design and construction, every surviving element of the structure must be considered historically significant. Therefore, because of past adverse project effects from maintenance dredging, and prior to any future project activities that will also impact the site, mitigation of these adverse effects in the form of a comprehensive investigation and recovery of remains is necessary and is recommended. Because of the limited amount of structural remains and the level of disturbance to the archaeological record, it is recommended that data and material recovery be designed as a systematic archaeological salvage

including systematic site testing, and partial and full excavation and data recovery that builds cumulatively on the results of the current project. It should be stated that the employment of a cofferdam is not recommended for any future work. Rather, the site environment is such that it is both feasible and cost effective to conduct the data and material recovery operation with archaeological divers working from a fixed platform (i.e. barge).

ACKNOWLEDGEMENTS

As with all projects of this magnitude, the successful completion is the result of the input and hard work of numerous individuals. First, the authors would like to extend their sincere appreciation to the U.S. Army Corps of Engineers, Savannah District, and specifically Ms. Judy Wood, Savannah District Archaeologist and Project Manager, as well as Ms. Suna Knaus, President of Gulf South Research Corporation, for allowing us the opportunity to conduct this investigation, the type of which only comes along a few times in life.

Dr. Gordon Watts of Tidewater Atlantic Research, and Mr. Stephen James of Panamerican Consultants, acted as Co-Principal Investigators and on-site Project Directors. While both co-authored the report, Dr. Watts was responsible for the AutoCAD drawings and Structural Analysis chapter. His knowledge of ironclads and naval architecture are second to none.

The archaeological diving crew was composed of Dr. Gordon Watts and Cmdr. David Whall (USN Ret.) of Tidewater, as well as Mr. Stephen James, Mr. Michael Krivor, Mr. Matt Elliot, Mr. James Duff, and Mr. John Rawls of Panamerican. Cmdr. Whall also performed on-site computer operations and data input (i.e. GIS, Sector Scan Sonar). A seasoned group of professional maritime archaeologists, they persevered through the sweltering summer days of Coastal Georgia and the swift dark waters of the Savannah River. All are thanked for their hard work, endurance, and especially for keeping it safe.

Also associated with diving aspects of the project, a Savannah District Diving Safety Officer was present at all times to both observe and ensure safe dive operations. Diving Safety Officers Gary Sego, Donnie Boswick, William Lane, and Glenn Bacon are thanked for keeping the crew on their toes.

The crew of the project vessel is also thanked. The RV *Nautilus* was crewed by Captains Keith Plaskett and Mike Lavender, who were assisted by mates Jason Raupp and Paul Shortle. Hypack® Representative John Lindberg, Corps Surveyors Ned Durden and Mike Ainsley, and survey vessel Captains Donny Bostwick and Eddie Culp are also thanked for their help with the survey that preceded diving operations.

Finally, the good people of Savannah, Georgia and the surrounding Low Country area are thanked for the southern hospitality shown to the field crew during our stay. We hope to return in the future to sample that hospitality once again.

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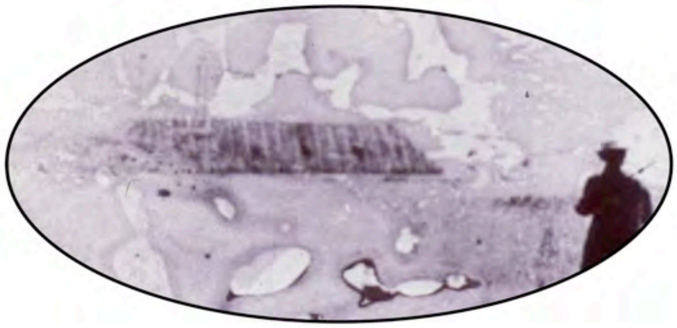


CSS *GEORGIA* INTRODUCTION

The U.S. Army Corps of Engineers, Savannah District, operates and maintains the Savannah Harbor Navigation Project (existing navigation project) and, in partnership with the Georgia Ports Authority, is examining the feasibility of deepening the Savannah Harbor navigation channel (deepening project). To ensure that the existing navigation project and the potential deepening project comply with the National Historic Preservation Act (P.L. 89-665, as amended) and the Advisory Council on Historic Preservation's regulations implementing this Act (36 CFR, Part 800), Savannah District is re-initiating studies of CSS *Georgia*, to determine the effect of past, present, and future activities associated with the existing navigation project and the effects of the potential future deepening project.

Locally built in 1862 and originally designed as an ironclad gunboat, CSS *Georgia* was soon designated a "Floating Battery," likely the result of being seriously underpowered. In use, *Georgia* was moored to cribbing in the Savannah River opposite Old Fort Jackson, where the river is restricted to a single channel. At her mooring, *Georgia* was maneuvered with anchor lines to bring the ironclad's broadside battery to bear on the channel below Fort Jackson. Although the ironclad apparently lacked the power necessary for offensive action, the vessel served as an integral element of Confederate defenses that protected Savannah until General W. T. Sherman's Union Army captured the city. After a 20-month operational life, *Georgia* was scuttled in December 1864 to prevent capture by advancing Union troops. Located in the Savannah River approximately five miles down river from the City of Savannah, the wreck site of CSS *Georgia* lies offshore of Old Fort Jackson, specifically on the north edge of the Savannah Harbor navigation channel at the intersection of the Back River Channel (Figure 1).

SIGNIFICANCE OF CSS GEORGIA

Very little is known about the design and construction of CSS *Georgia*. No plans documenting the vessel have been located to date, and construction details are minimal and often contradictory. For example, vessel length has been variously described in six contemporary references as being from 150 feet to 250 feet. Contemporary illustrations of CSS *Georgia* provide limited insight into the warship. From those sources it is apparent that the vessel was fitted with an armored casemate similar to that of other Confederate ironclads but substantially different in proportions. Virtually no indication of the size and configuration of the hull is apparent. Contemporary references to CSS *Georgia* reveal little specific information about design and construction and generally imply that the vessel was poorly designed, under powered and lacked maneuverability. The most specific information regards *Georgia*'s ordnance, railroad iron armor, and fundraising efforts that financed construction.

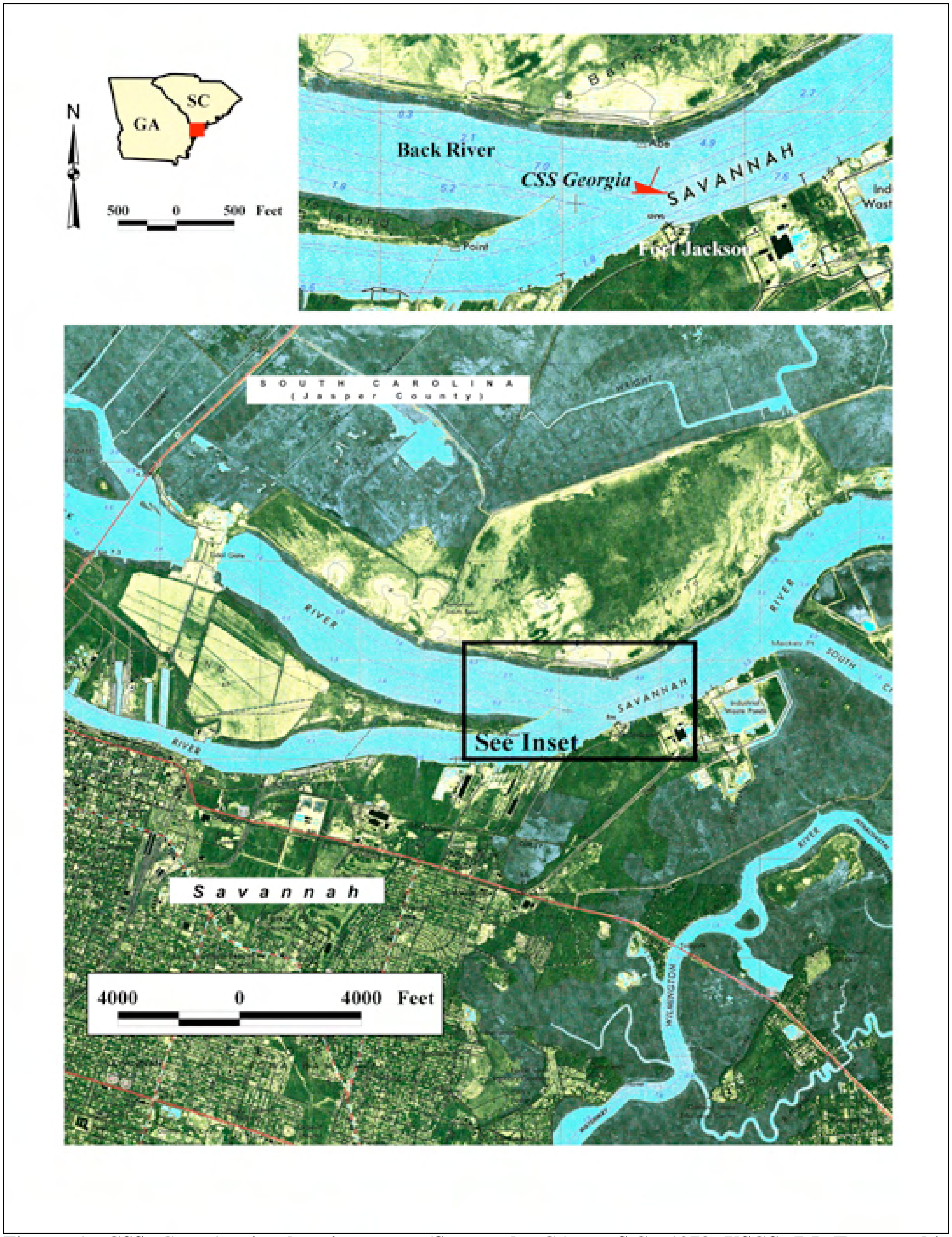


Figure 1. CSS *Georgia* site location map (Savannah, GA. – S.C. 1978 USGS 7.5 Topographic Quadrangle).

PREVIOUS ON-SITE ACTIVITY

Since her scuttling, post-depositional impacts have affected the *Georgia*'s remains. Contemporary documents indicate the wreck was dynamited in 1866, and 80 tons of iron, most likely "T" rail used for casemate armor cladding, were removed and sold. She lay forgotten until her remains were rediscovered in 1968 when a dredge operating in the vicinity of the wreck site encountered structural remains during a navigation channel-widening project. Although the location of the wreck was avoided, maintenance dredging continued in the vicinity of CSS *Georgia* in 1969, 1970, 1974, and again in 1982. In early 1982, a ship fouled the USCGS buoy with a 10-ton anchor used to mark the site. The ship dragged the anchor downstream, possibly impacting the site.

In 1979, Texas A&M University conducted an archeological investigation of the wreck site for the Savannah District and prepared an archeological and engineering assessment. This study produced a best estimate of site extension as a rectangle 300 feet by 150 feet. Bottom probing at this perimeter produced no contacts. Wreck relief was estimated at 7 to 9 feet above the bottom, with articulated casemate fragments greater than 200 square feet reported, and related shoaling and scouring observed. Armor plate was reported on the southeast side of the site. Investigators posited that the west side of the wreck might be the bow. Intact hull and deck areas were reported buried in cross-bedded sand and clay, and good artifact preservation was reported (Garrison et al. 1980). During the Texas A&M investigations and subsequent Savannah District diving operations at the wreck site in 1986, ordnance was identified and some was recovered. Two cannon, a 32-pounder reworked into a rifled gun and a 24-pounder howitzer, were removed from the wreck site. A number of Brooke projectiles, percussion fuses, and spherical shot including "strap shot," were also recovered.

CURRENT INVESTIGATIONS

Building on these previous investigations, the Savannah District contracted with Gulf South Research Corporation of Baton Rouge, Louisiana to conduct additional investigation of the wreck site in 2003. The focus of the 2003 research was to determine the effect of past, present, and future activities associated with the existing navigation project on the remains of CSS *Georgia*. Perhaps the most critical issue was assessing the potential effect of future channel deepening on the surviving remains of CSS *Georgia*. The 2003 investigation was conducted under Contract No. DACW21-98-D-0019 and Delivery Order No. 0059. Panamerican Consultants, Inc. of Memphis, Tennessee (Panamerican) and Tidewater Atlantic Research, Inc. of Washington, North Carolina (Tidewater) were jointly subcontracted to perform the research and on-site investigations. Conducted under Department of the Navy Archaeological Research Permit No. PCI-2003-002, and a Scope of Work entitled *In Situ Archaeological Evaluation of CSS Georgia, Savannah Harbor, Georgia* (SOW, see Appendix A), the objectives of the current project were to:

- Characterize and delineate the CSS *Georgia* wreck site incorporating remote sensing data and environmental context;

- Ascertain the current state of preservation of the wreck site;

- Account for the current state of the site in terms of natural and cultural site formation processes and rates;

- Compare the present site distribution and state of preservation to that of past investigations and accounts for the variation;

- Provide an interpretation of site features that incorporates historical documents and comparative historical and archeological analysis of contemporary ironclads;

- Identify current and future site impacts from the existing navigation project, vessel traffic, natural processes, and the potential deepening project. Additional potential impacts resulting from either project will be identified;

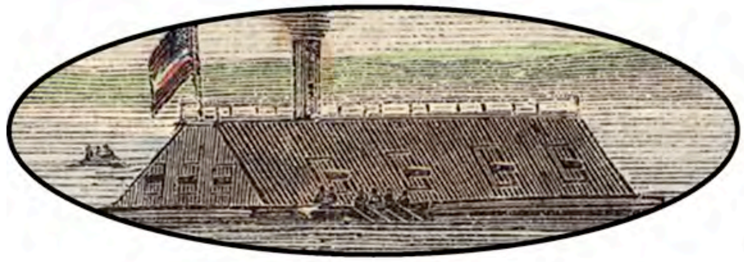
- Review alternatives and recommend a course of action and methodology for mitigating impacts from the existing navigation project and the potential deepening project. This should include recommendations for future phases of intensive investigation and documentation of the wreck site, including systematic site testing as well as partial and full excavation and data recovery that will build cumulatively on the results of this project.

The 2003 investigation of CSS *Georgia* generated considerable insight into the nature and scope of the surviving vessel structure and the archaeological record associated with those remains. The most significant issue addressed by the current on-site research was determining the amount and condition of the surviving vessel structure at the wreck site. Based on previous investigations at the wreck site it had been assumed that a significant portion of the hull of the vessel survived underneath the sections of extant and exposed armored casemate, or was in fact buried in bottom sediments.

The current investigation clearly established that the surviving remains of the Civil War ironclad are limited, and that the lower hull of the vessel no longer exists. Two large sections and a smaller third section of iron casemate are present along with the vessel's propulsion machinery including steam cylinders and at least one propeller and shaft, three cannon, a possible boiler, and miscellaneous small, as of yet unidentified components and artifacts. The absence of lower hull and the major impacts to the existing components are a direct result of historic salvage and to a much greater degree operation and maintenance dredging operations associated with the Savannah Harbor Navigation Project. With respect to dredging impacts, the previous dredging activities, especially the 1983 box cutting of side slopes and excavation of four vertical feet of channel bottom for advance maintenance dredging at the wreck site, have had an extreme and ongoing adverse effect on the property. Besides cutting or "chewing" into the wreck, dredging impacts have destabilized the site by removing protective sediments and have resulted in the continuous and ongoing degradation of the wreck through exposure (i.e. teredo damage, erosion, etc). Furthermore, the proposed channel deepening will most certainly have an adverse effect on this National Register property and will result in its destruction.

Owing to a dearth of information about this ironclad's design and construction, every surviving element of the structure must be considered historically significant. Exhaustive historical research has demonstrated that the most important surviving source of information we have regarding the design, construction, and operation of CSS *Georgia* is the wreck itself. Therefore, because of past adverse project effects from maintenance dredging, and prior to any future project activities that will also impact the site, mitigation of these adverse effects in the form of a comprehensive investigation and recovery of remains is necessary and is recommended. Because of the limited amount of structural remains and the level of disturbance to the archaeological record, it is recommended that data and material recovery be designed as a systematic archaeological salvage including systematic site testing, and partial and full excavation and data recovery that builds cumulatively on the results of the current project. The archaeological salvage of data and material from the CSS *Georgia* wreck site will mitigate past impacts and continued deterioration of the surviving structural remains and the loss of valuable historical and archaeological data preserved in the wreckage and associated artifacts. In addition, the Savannah River channel will be cleared of obstructions to navigation and explosive ordnance that constitutes a threat to both navigation and dredging in the vicinity of the wreck site. It should be stated that the employment of a cofferdam is not recommended for any future work. Rather, the site environment is such that it is both feasible and cost effective to conduct the data and material recovery operation with archaeological divers working from a fixed platform (i.e. barge). Regardless of the form mitigation takes, before recovery can proceed, funding must be in place to provide proper documentation and conservation of recovered materials.

Divided into chapters on the natural and historical setting of the site, site formation processes, field methods, findings, structural analysis, and conclusions and recommendations, the following report reviews alternatives and recommends a course of action and methodology for mitigating impacts from past and existing navigation project activities and the potential deepening project. This includes recommendations for future phases of intensive investigation and documentation of the wreck site, including systematic site testing as well as partial and full excavation and data recovery that builds cumulatively on the results of this project.



CSS *GEORGIA* HISTORICAL BACKGROUND

NATURAL SETTING

Located in the Savannah River approximately five miles down river from the City of Savannah, the wreck site of CSS *Georgia* lies offshore of Old Fort Jackson, specifically on the north edge of the Savannah Harbor navigation channel at the intersection of the Back River Channel. The Savannah Harbor comprises the lower 21 miles of the Savannah River as well as 11 miles of channel across the entrance bar to the Atlantic Ocean. Forming the boundary between Georgia and South Carolina, the wreck is situated in both state's waters, and each state has an interest in the resource.

Generally divided into two channels by a series of islands, at mile 11 (from the Atlantic Ocean) the Savannah River diverges into the Front and Back rivers, the location of the *Georgia* wreck site. The navigation channel is maintained in the Front River to the upper limits of the harbor and past the City of Savannah, which is located on the river's southern bank.

At the wreck site, the northern, South Carolina side of the harbor or river is undeveloped. However, it consists of modified marshland that now serves as dredged material disposal areas maintained by the Savannah District. The immediate opposite or Georgia side of the river is characterized by heavy industry and shipping facilities both up and downstream from the site, while Old Fort Jackson is located immediately opposite the wreck site. Located just upstream from the wreck site and entrance or mouth of the Back River is Fig Island, while just downstream from the site is Elba Island.

Characterized by a temperate climate, with warm, humid summers and mild winters, temperatures during fieldwork in July and August ranged in the mid-to-upper 90s (Fahrenheit) during the day and in the mid 70s during the nights. Precipitation averages just less than 50 inches per year, with about half occurring during summer thunderstorms (U.S. Army Corps of Engineers, Savannah District 1992). Afternoon thunderstorms did occur during the fieldwork and these were often quickly forming and violent both in wind and rain amounts. Several demanded cessation of diving activities and even abandonment of the site for the day.

The tidal fluctuations within the Savannah Harbor are "semidiurnal, averaging 6.8 feet at the mouth of the harbor and 7.9 feet at the upstream limit of the harbor, with tidal influences extending upriver approximately 45 miles" (U.S. Army Corps of Engineers, Savannah District

1992). During the current investigation, July had a mean tidal range of 8.1 feet with lows of -0.4 feet to highs of 8.7 feet. August had a similar mean tidal range with lows of -0.3 feet to highs of 8.8 feet. Because of the extreme tides, substantial currents exist over the site, and data obtained by the Savannah District indicate velocities at ebb flow in excess of 5 feet per second, a speed constant with depth.

HISTORY OF CSS GEORGIA

Built in Savannah in 1862 and scuttled two years later with the fall of the city she was tasked to protect, CSS *Georgia* lay forgotten for just over 100 years after the Civil War when she was inadvertently "rediscovered" during dredging operations. Since her discovery, recent hands-on investigations of the wreck site have triggered a surge of interest. However, subsequent research on the vessel has revealed more questions than answers concerning her construction and brief life span. The most extensive and most recent of these research endeavors was the archival study conducted by New South Associates of Stone Mountain, Georgia, a study which preceded the current archaeological investigation (Swanson and Holcombe 2003). While incorporation of historical documents and comparative analysis of other ironclads was to be performed during the present analysis and report phase of this project, because of the previous Swanson and Holcombe study, extensive archival research was not an aspect of the current undertaking. Rather, historical information from the Swanson and Holcombe study relevant to our findings has been incorporated and employed in an effort to provide an interpretation of site features and ultimately the vessel itself. Predominantly taken from this archival study, the following is a brief historical background and context of the vessel. For specific historical documents and an expanded vessel history and context please refer to the Swanson and Holcombe report.

CONSTRUCTION

As reported in the Swanson and Holcombe report, in all likelihood, the ironclad *Georgia* was constructed at Harding's Shipyard along the southern bank of the Savannah River. Located near Alvin Miller's foundry on the eastern edge of Savannah, the location was where Major General Henry Jackson was tasked by General Robert E. Lee to build boats in early March 1862 for the transport of troops. Much of what is known concerning *Georgia*'s early phase of construction comes from Jackson's order books, and as stated in Swanson and Holcombe, "Jackson ordered the *Georgia* built based on the plan proposed by the gunboat's building committee, which had been appointed by a citizen's meeting" (2003:48). Supposedly, plans were drawn up for the vessel after commencement of construction, but these have not been found or do not exist. Her design has been credited to A.N. Miller, the foundry owner, who was likely involved with *Georgia* until completed.

Georgia was built with funds raised primarily by the Ladies Gunboat Association. Established in Savannah in early March 1862 and with chapters throughout the state, the Ladies Gunboat Association was formed specifically to raise funds for the construction of a gunboat. Although the Association was established just after start of construction, the vessel would be known as the Ladies Gunboat. It was not until after March 22 that serious efforts for building the vessel were put into place. Built in large part by Confederate soldiers, but under the direction of the Building Committee and ultimately General Jackson, during the construction hundreds were employed including carpenters, engineers, and blacksmiths. Launched on the 19th of May, by the end of month at least one side of her casemate had been armored with rail. By mid-July, the vessel was tied up at the Exchange Dock and was far enough along to allow public viewing. On July 24, the floating battery made a trial run, and by late October, she had taken up her position opposite Ft. Jackson. She would stay at this location for just over two years until her scuttling late on the night of December 20, 1864.

DESCRIPTION

Swanson and Holcombe state, "because there are no extant plans of the *Georgia*, and because she sank during the war and was not brought to the surface afterwards, all descriptions of the vessel have to rely on contemporary accounts, which were surprisingly few, and contemporary illustrations, which were either sketchy or contradictory" (2003:74). One of the best contemporary descriptions of the ironclad was made by a Northern correspondent who stated, "Beyond lay the Georgia – to a sailor's eye a monstrous creature, something like, in appearance, to the pictures we have of the Merrimac; with sides and ends sloping to the water at an angle of, I should think, 45 degrees, and covered with long slabs or strips of railroad iron; with a long box on top of the deck, which also appeared to be armored; and with her ports open" (Swanson and Holcombe 2003:76).

We do know that at least four contemporary engravings and an apparent photograph exist of *Georgia*, as well as five eyewitness descriptions, including the one above. Differing from one another in varying detail, the four engravings from northern periodicals show a vessel with four sloping, iron-plated sides. Three of the illustrations depict the vessel with a single smoke-stack of a boiler projecting from the top of the casemate near one end, while the fourth image erroneously does not portray this stack. Two of the images depict the vessel with no projecting decks, the cladding meeting the upper edge of the hull at a hard chine at or just above the waterline (Figures 2 and 3). Illustrated in Figure 4, the third engraving is similar to the first two in depicting the vessel with no projecting decks, the cladding meeting the upper edge of the hull at a hard chine at or just above the waterline. However, there appears to be a bollard on her right end suggesting some form or length of deck extension. This image also correctly depicts the cladding as lengths of railroad iron placed vertically on sloping sides. A fourth engraving depicts the vessel with short deck extensions, both for and aft, and (erroneously?) shows multiple guns projecting from the casemate end in the area of the deck extension (Figure 5).

All four engravings depict the sides of the casemate meeting the clad ends at a hard angle. It is unclear, however, if the faces of the angled ends were flat or rounded, although at least one contemporary description states the vessel had flat ends. While the four contemporary images depict the floating battery's armored sides meeting the upper edge of the hull at a hard chine at or just above the waterline, one of the earliest known descriptions of the *Georgia* states, "the slant of her roof reaches below the water's edge, the design of which you will readily perceive" (Swanson and Holcombe 2003:74).

Presented in Figures 6 and 7, the single existing photograph thought to be of *Georgia*, although somewhat damaged, suggests that all four engravings were generally true depictions. The photograph shows an ironclad vessel with sloping sides and ends. The vessel has a single stack near one end, and has no projecting decks, the cladding meeting the upper edge of the hull at a hard chine at or just above the waterline. The vessel appears to have a boat on a davit opposite or below a single stack. Taken off the photograph, the angle of the sloping ends is approximately 45 degrees. While the most valid contemporary reference states that the angle of the casemate as built was "31 degrees even though the intended inclination was 26 degrees" (apparently from the vertical), a soldier who visited the vessel estimated the casemate angle "at about 45 degrees" (Swanson and Holcombe 2003:60). This estimate agrees with our measurement taken from the photograph.

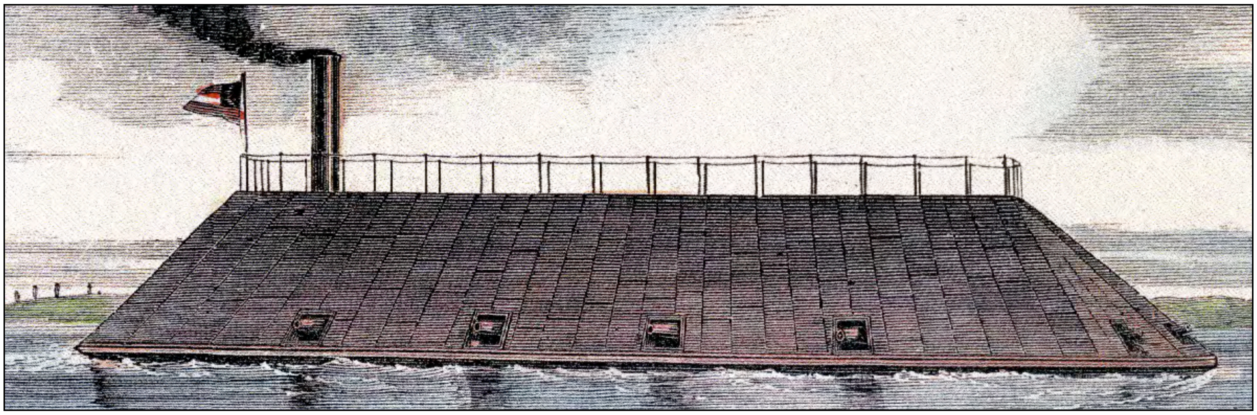


Figure 2. 1862 illustration of CSS *Georgia* that depicts the vessel with no projecting decks, the cladding meeting the upper edge of the hull at a hard chine at or just above the waterline (as presented in *Frank Leslie's Illustrated History of the Civil War 1862*).

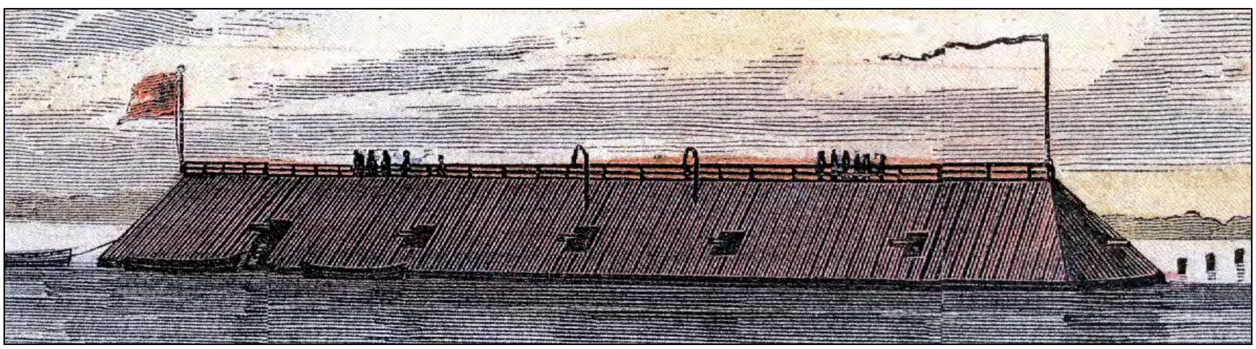


Figure 3. 1862 illustration of CSS *Georgia* that depicts the vessel with no projecting decks, the cladding meeting the upper edge of the hull at a hard chine at or just above the waterline. Note the lack of a stack (as presented in *Frank Leslie's Illustrated History of the Civil War 1862*).

Figure 4. One of four contemporary engravings of CSS *Georgia* presented in northern periodicals. This illustration is from Frank Leslie's *Illustrated Newspaper*, March 14, 1863 (As presented in Swanson and Holcombe 2003:59).

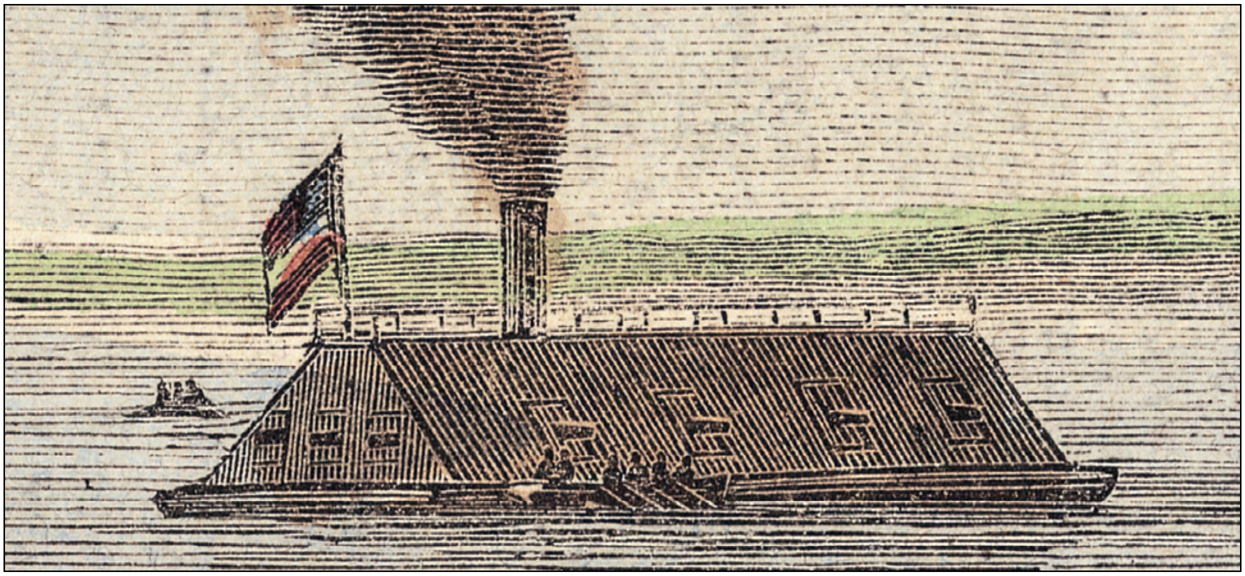


Figure 5. 1863 Lithograph of CSS *Georgia* that depicts the vessel with short deck extensions, both fore and aft, and (erroneously?) shows multiple guns projecting from the casemate end in the area of the deck extension (as presented *Frank Leslie's Illustrated Newspaper* February 21, 1863).

Figure 6. Photograph of a framed glass photograph believed to be CSS Georgia. Located and photographed at a "garage sale," the current location of the original photo is unknown (Courtesy of Bob Holcombe).

Figure 7. Excerpt of the above photograph believed to be CSS *Georgia*. Note what is thought to be a launch hanging from davits adjacent to and below the stack. Also note the three gun ports (Courtesy of Bob Holcombe).

Built without a keel, nothing else is known of her lower hull. Swanson and Holcombe suggest that the quickness with which the vessel was built suggest a simplified hull form or conversion of an existing vessel such as a rice flat. While virtually nothing is known of her hull configuration, dimensional information exists, but it is contradictory. Estimates on the vessel's length range from 150 to 250 feet and are based on contemporary accounts. A Confederate soldier stationed at Savannah wrote that the vessel was 150 feet long and 50 feet wide, while a Unionist South Carolina newspaper reported the vessel's dimensions as 250 feet in length, with a 60-foot beam and a 12-foot high casemate. An 1872 survey conducted by the Corps of Engineers of the wreck site, then a navigation hazard, indicated the vessel's length was 150 feet by 60 feet. Presented in Figure 8 is Robert Holcombe's reconstruction of the ironclad based on the four images and in part on contemporary Confederate ironclad designs. Employing the lower end of the dimensional possibilities for the vessel, the reconstruction has an overall length of 160 feet, a beam of 55 feet and a draft of 10 feet.

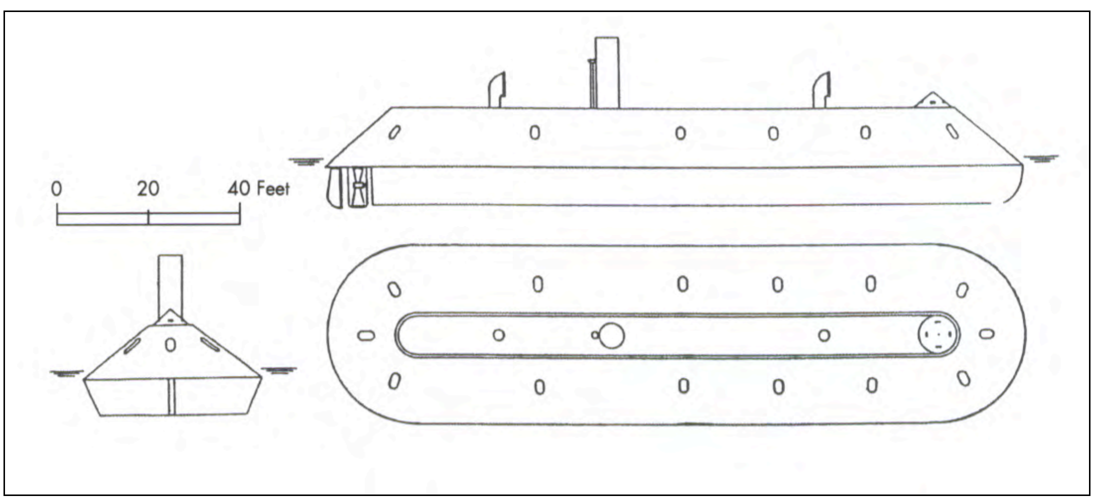


Figure 8. Robert Holcombe's reconstruction of the CSS *Georgia* (As presented in Swanson and Holcombe 2003:77).

Based in part on John Porter's proposed but never constructed 150-foot harbor defense ironclad, Holcombe's reconstruction employs a 20-foot long (high) casemate wall. We know now through archaeological data gleaned from the current investigation that the casemate walls were 24 feet in length (high). Assuming a 45-degree slope for the casemate walls (based in part on the photo) with a 24-foot long casemate side, a minimum beam of 30 feet is obtained. This would imply or argue for a weather deck or roof width of 20 feet (between the tops of the casemate sides) if the vessel had a maximum beam of 50 feet, and a weather deck or spar deck width of 30 feet if the vessel had a maximum beam of 60 feet. This would suggest that the present reconstruction requires modification.

ARMOR

Launched on May 19 without some if not all of her armor plating, a description by Gazaway Lamar, who served on the Ladies Gunboat Steering Committee, states that by the end of month at least one side of her casemate will be armored with rail. The best description of her armor is given some two weeks later in a June 11 letter by John Elliot in which he states, "her woodwork is composed of about 15 inches of solid timber, upon which is a double layer of railroad iron fitting into each other, and then a composition of iron filings and some kind of cement is to be laid upon the irons so as to cover the inequalities and to make it solid and keep it from shaking" (Swanson and Holcombe 2003:74). The use of railroad track iron was not specific to *Georgia* but was employed on several ironclads. Although plate proved superior in shot penetration tests, interlocked layers of rail were tested with success and were subsequently employed on the ironclads *Arkansas*, *Louisiana*, and *Missouri*.

Evidently railroad iron was not originally intended as the armor of choice for *Georgia*. However, it appears that a search for rolled iron plate was unsuccessful and railroad "T" iron seized locally by General Jackson had to be utilized. Covered with long slabs or strips of railroad iron, the "T" iron with which the vessel was eventually covered was evidently fraught with controversy surrounding seizure and payment. A bill submitted for the seized iron to the Ladies Gunboat Association indicates the railroad iron came to "2784 bars weighing 1098.034 lbs, rendered at 5 plb" (Swanson and Holcombe 2003:72).

ORDNANCE

Designed to carry 10 heavy guns within her casemate, four guns were to be mounted on each broadside and one at each end of the vessel's casemate (suggesting 10 gun ports?). However, surviving historical evidence indicates that *Georgia* had only four heavy and two light guns on her at the time of her sinking (Swanson and Holcombe 2003:60-61). During Savannah District diving operations at the wreck site in 1986, a 32-pounder reworked into a rifled gun as well as a 24-pounder howitzer were removed from the wreck. Leaving three heavy guns and a 6-pounder on the site, of these remaining guns, Cannons 2 and 3 (discussed below) represent two of the three remaining heavy guns, and Cannon 1 represents the 6-pounder located during the current investigation. If historical evidence is correct, the third remaining heavy gun has still to be relocated.

PROPULSION SYSTEM

It is not known what kind of engine was employed by *Georgia*, but it is known that the steering committee searched for one far and wide. In a letter written on June 11, 1862, John Elliot states that the vessel had a double engine and twin propellers. Swanson and Holcombe suggest that the engine obtained for the vessel came from the *William Jenkins*, a sidewheeler. However, recent archaeological evidence indicates the engines do not represent a beam engine, as was present on the *William Jenkins*.

Only able to make about two knots under full steam, regardless of where the engines were obtained or what type they represented, all agreed they were inadequate for propelling the vessel against the swift currents or tides of the Savannah River. The engines did, however, serve a functional purpose, as one writer in 1862 states, "Our iron floating battery is a splendid failure. She has been taken down between the forts and they are obliged to keep her engines at work the whole time to prevent her sinking, she leaks so badly" (Swanson and Holcombe 2003:75). It is thought that the vessel's leaking was most likely a result of building her with unseasoned wood, a common practice in Confederate vessel construction.

SINKING & SALVAGE

Scuttled late on the night of December 20, 1864, the *Georgia* wreck site went unmarked until struck by a ship in 1866. Subsequently, the wreck was buoyed and notice given to mariners that the vessel "now lies submerged on the northern margin of the main ship channel, Between Fort Jackson and Battery Cheves…" (Figure 9). The same year, two contracts were entered into between the Treasury Department and Henry Welles to remove the *Georgia* wreck site and other sunken vessels and obstruction. In 1868, Welles used dynamite to remove the vessel, and while his efforts are thought to have ultimately proved unsuccessful, some salvage was conducted (Swanson and Holcombe 2003:93-95). The 1872 report of the Chief of Engineers states:

> The wreck of the *Georgia* next claims attention. It lies on the north side of the channel abreast of Ft. Jackson and has occasioned accident. It has now 11 feet over it at low water, with a sand-bar forming around it on the north side and west end. The *Georgia* was an iron-clad ram about 150 feet in length by 60 feet wide, intended to carry 10 guns in casemates covered with a heavy armor of railroad iron. It has been blasted, but not throughly [sic], about eighty tons of iron having been removed. The engines and machinery are still in her, and including the value of the machinery probably obtainable, it should not cost more than $10,000 to remove the wreck entirely [Garrison et al. 1980:35].

No other information has been located that would indicate additional salvage of the vessel, and Corps' records say little concerning this subject. Vanishing from the public record, mention of the wreck is found only on occasional survey maps of the river, and then even these cease to identify her through time.

PREVIOUS INVESTIGATIONS

Forgotten over time, the wreck lay ignored until impacted in 1968 by the contract dredge *St. Louis*. In 1969, Navy divers examined the site after it was "relocated" by the dredge and a total of 5.5 man-hours were spent on bottom. It was estimated that the vessel size was 200 feet by 60 feet wide, and that "the superstructure and upper works had deteriorated and collapsed; the gun deck had collapsed and the engines were determined to be in the same approximate position as when the Georgia was scuttled. The vessel was covered with 12 to 16 feet of silt and the hull was believed to be intact" (Garrison et al. 1980:35). No further work was conducted on the wreck site.

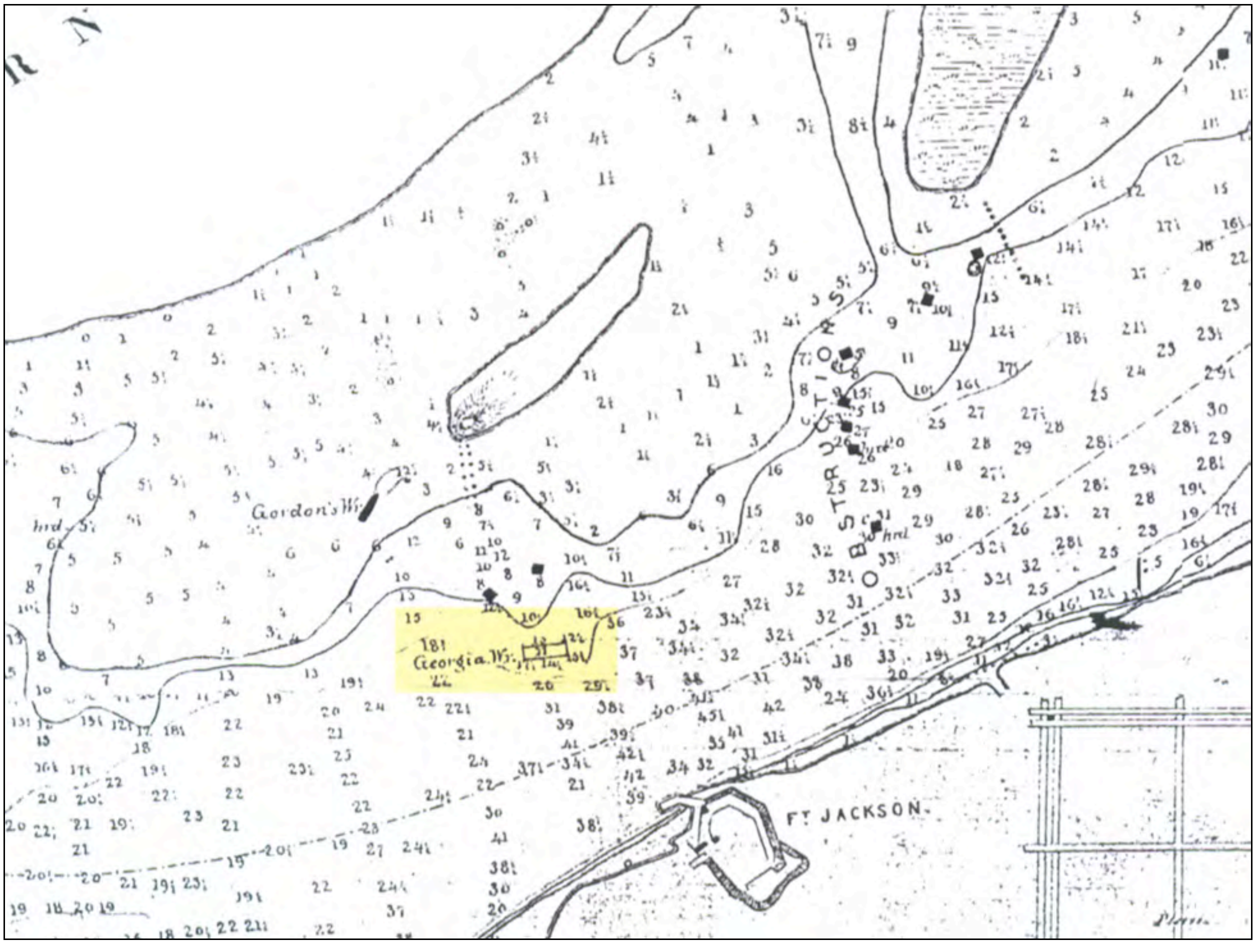


Figure 9. 1871 Gillmore and Ludlow map showing the wreck site located on the edge of the channel, opposite Ft. Jackson, in approximately 20 feet of water (As presented in Swanson & Holcombe 2003:96).

In 1979, some 10 years later, Texas A&M University conducted an archeological investigation of the wreck site for the Savannah District and prepared an archeological and engineering assessment. This study produced a best estimate of site coverage as a rectangle measuring 300 feet by 150 feet, and bottom probing within this perimeter produced no contacts. Wreck relief was estimated at 7 to 9 feet above the bottom, with articulated casemate fragments greater than 200 square feet reported and related shoaling and scouring observed. Armor plate was reported on the southeast side of the site. Investigators posited that the west side of the wreck might be the bow. Intact hull and deck areas were reported buried in cross-bedded sand and clay, and good artifact preservation was reported. During the Texas A&M investigation, ordnance was identified and some was recovered, including a number of Brooke projectiles, percussion fuses, and spherical shot, including "strap shot" (Garrison et al. 1980).

An assessment of the Preliminary Site Plan (Figure 10) presented in a subsequent 1983 Design Memorandum and produced with data from the 1979 archaeological study, indicates that the site plan is mostly conjecture and seems to highlight the paucity of hands-on site data obtained during this early study. Interestingly, large sections of above-sediment wreckage that appeared on an acoustic image of the site and presented in the 1979 fieldwork report are not represented on the site map (Figure 11).

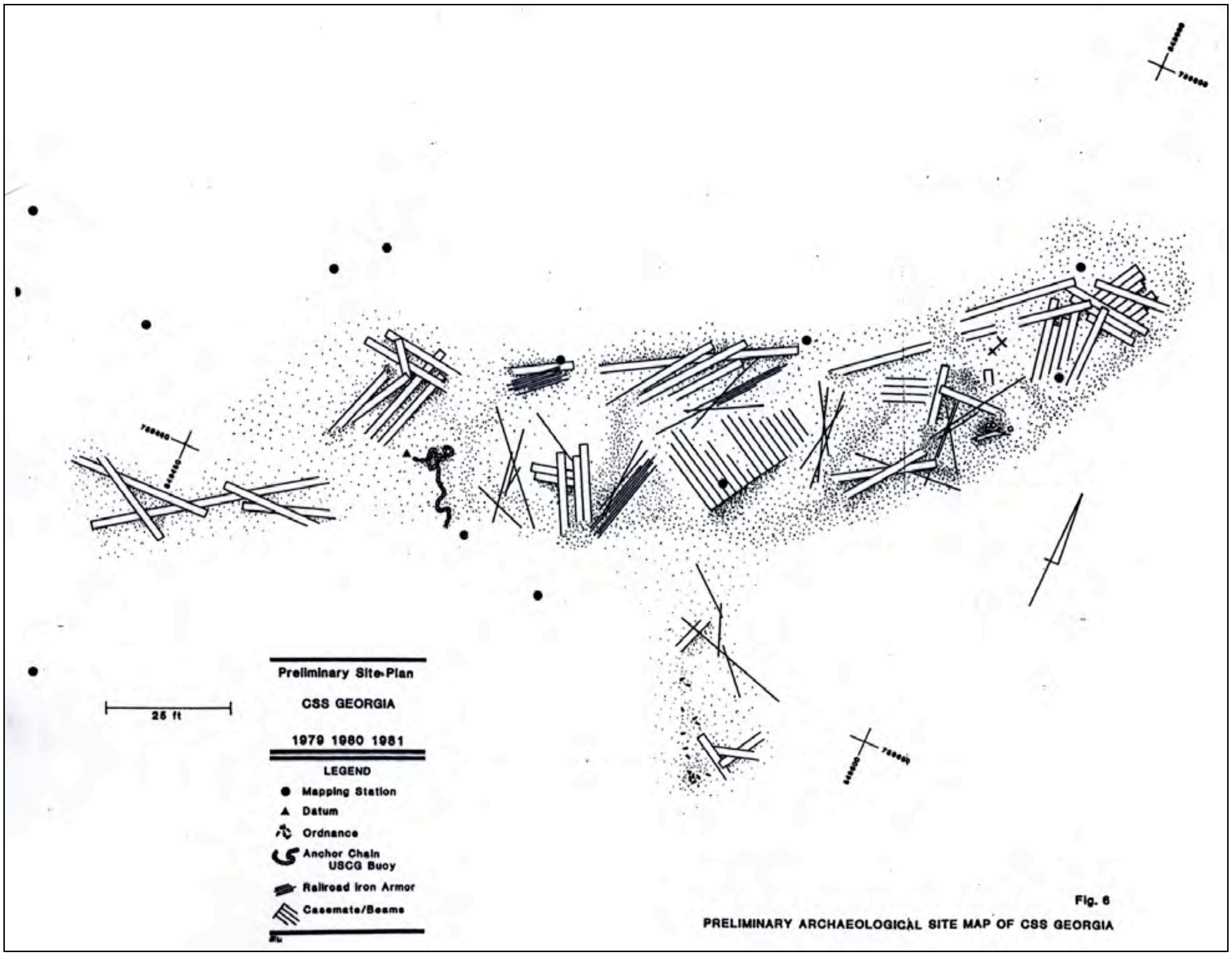


Figure 10. Preliminary *Georgia* site plan (As presented in U.S. Army Corps of Engineers 1983:VI-9).

Both the site plan and sidescan image from the investigation provide little useful information with regard to comparisons of current acoustic images and site morphology. However, contour maps produced with data from the 1979 acoustic survey do provide good comparative data. Presented in Figure 12, the gray-tone contour map of the site shows depths in shades of gray with the deepest depths in black and the shallowest depths as white. Interestingly, the site appears to be pedestaled with respect to dredging. Figure 13, a standard bathymetric contour map, indicates that the South Carolina side of the wreck is 32 feet deep and the channel side is 40 feet deep. What appears or is thought to be the top or highest point of the West Casemate is 28 feet deep (mlw) while the top or highest point of what is most likely the East Casemate appears to be 28 to 27 feet deep (As presented in Garrison et al. 1980: Figure 35).

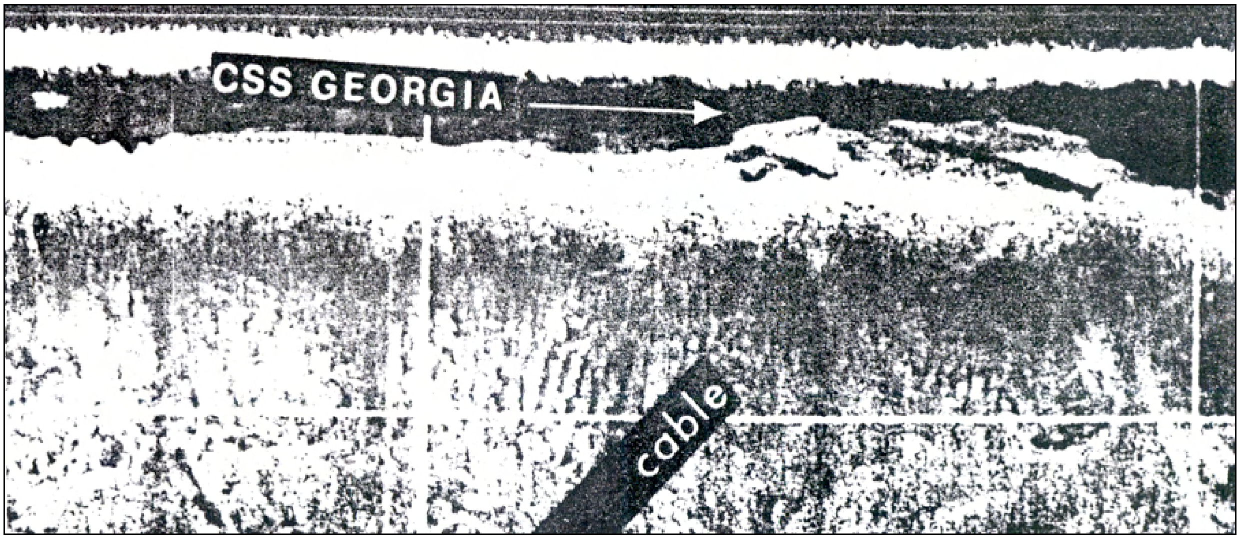


Figure 11. Acoustic image showing large sections of wreckage thought to be the West and East Casemate sections. These, however, are not represented on the 1980 site map (As presented in Garrison et al. 1980:Figure 39).

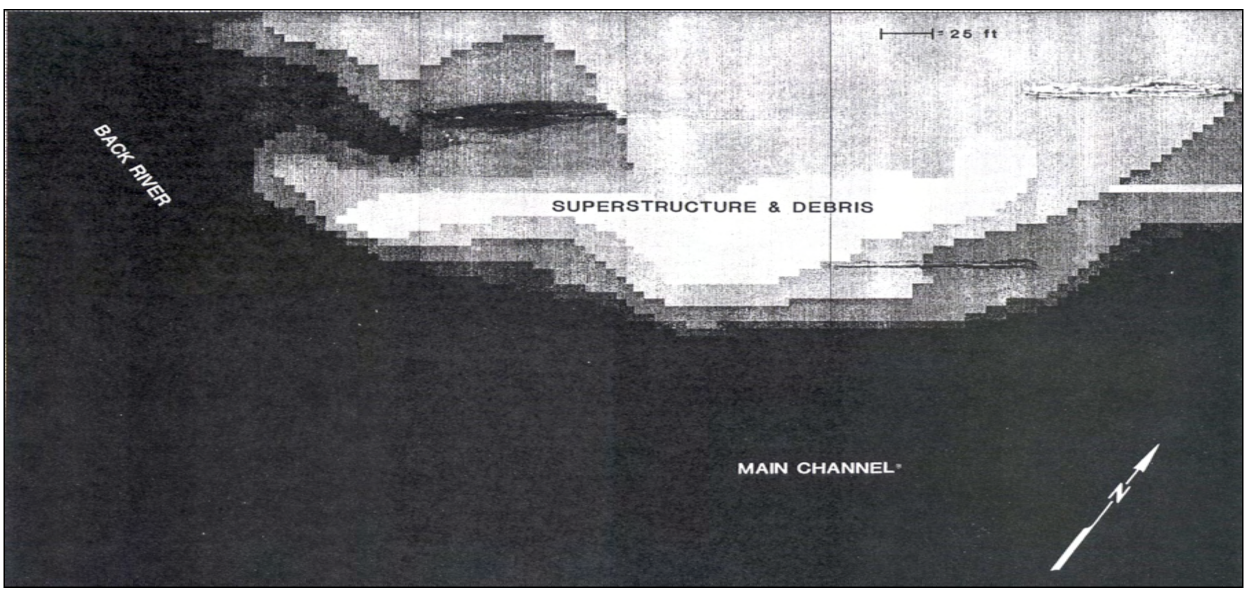


Figure 12. Gray-tone contour map of the *Georgia* site (As presented in U.S. Army Corps of Engineers 1983:VI-8).

Mentioned above, a Design Memorandum was authorized in 1983 to "determine the most reasonable and acceptable method to impound the sunken vessel and to identify the methods and procedures to be used in performing an archaeological investigation of the vessel's salvageability" (U.S. Army Corps of Engineers 1983). Produced by the Savannah District and based on the results, conclusions, and recommendations of the 1979 fieldwork, the Memorandum concludes that:

- The wreck lies parallel to the main shipping channel for 200 ft. The overall width of the scatter is approximately 50-55 ft.

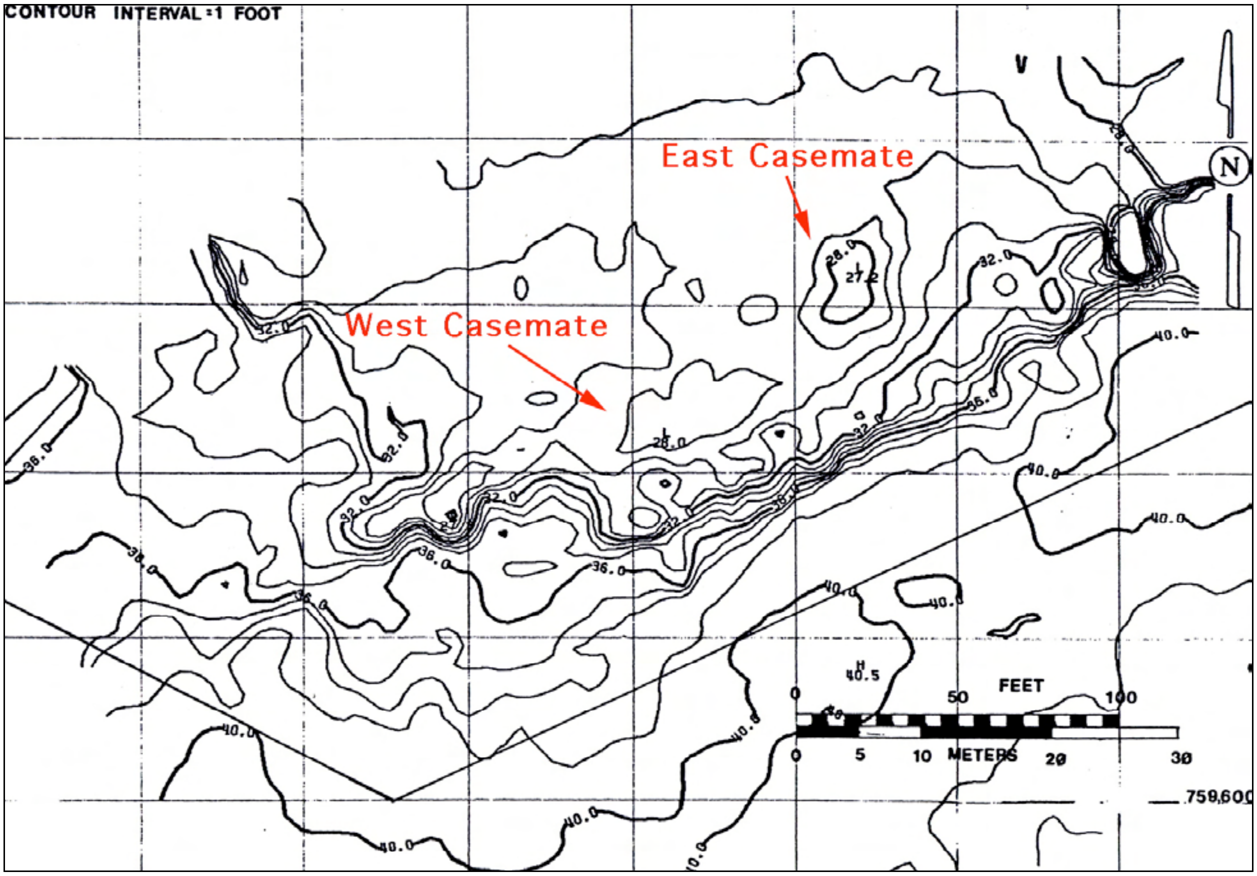


Figure 13. A standard bathymetric contour map; the top or highest point of what appears to be the West Casemate is 28 feet deep (mlw) while the top or highest point of what is most likely the East Casemate appears to be 28 to 27 feet deep (As presented in Garrison et al. 1980: Figure 35).

- Massive pieces of the casemate (greater than 200 sq. ft) extend up to 7.5 – 9.0 ft. above the bottom. No remains of the hull were found above the bottom.
- The wreckage is badly damaged along the channel side of the vessel. Debris and cultural material spread west and south from amidships into the main shipping channel. The preponderance of this debris is ordnance. Fourteen unexploded projectiles were recovered in this area.
- The survey surrounded over 90 percent of the vessel perimeter. One area along the extreme southeast side was not mapped although debris was noted throughout the area. It is crucial to note that the armor plate had been recovered near this area.
- Convergence of instrumental results with the archaeological survey indicates almost total correlation of wreckage features with this data. Magnetometric survey results indicate a concentration of mass near the eastern end of the wreck while sidescan sonar targets correlate precisely with structural features and bathymetric relief.
- Based on the survey and instrumental results, the vessel axis appears slightly off parallel with the shipping channel. The west end is most probably the bow area; magnetic data near the east end indicate what may be machinery or propellers.
- The hull and decks of the vessel are buried under cross-bedded sand and clays to an unknown depth. All armament, ships' gear, and machinery are in this context.

- The vessel gives no evidence of having been destroyed by fire. Documentary sources report sinking by scuttling and subsequent blasting. All damage appears to be due to nineteenth- and twentieth-century maintenance and harbor clearing activities, and by teredos (ship worm).
- All recovered artifactual materials are in an excellent state of preservation, due in part to the brackish environment but mostly because of burial in the sediment.
- The wreck is a dynamic environment with strong scour and siltation processes operative, particularly on the Back River Channel aspect.
- The wreck is in a stable configuration relative to lateral or bulk movement, except in areas where dredging activity has possibly undercut or allowed scour or undercut the wreckage.
- The materials recovered are of sufficient strength to assure raising or recovery component pieces of the casemate without further damage.
- The recommended alignment of the cofferdam provides for minimum adverse impacts to the wreck site (U.S. Army Corps of Engineers 1983:VI-10 - 13).

Based on these conclusions, the Design Memorandum presents the following alternative courses of action for consideration:

a. *No action or deferred action*. Although the wreck site appears to be physically stable, current trends toward larger ships coupled with the future need to dredge for removal of shoals in the channel as the site and the unknown potentials of unexploded ordnance in the channel make deferral or no action a nonviable alternative.
b. *Continued study without an impoundment structure or cofferdam*. Continued study of the wreck in its present condition is neither cost efficient nor professionally acceptable due to factors associated with the Savannah River: zero visibility, currents, and marine traffic. To make a rigorous archaeological study of the vessel is impossible. The simplest measurement or task requires detailed planning and execution. Accurate directional and topographical measurement is impossible for the diver. Large-scale recovery is unscientific and dangerous due to currents and zero visibility. Recovery in the environment would result in loss of a large amount of significant information. Due to lack of cost effectiveness, lack of archaeological precision, and safety, alternative 2 is not recommended.
c. *Removal of the wreck without regard for its historical significance*. The wreck is a cultural resource that has been determined eligible for inclusion on the National Register of Historic Places. Removal of the wreck without regard for its historical significance would result in a permanent adverse effect to a significant cultural resource. Alternative 3 is not recommended.
d. *Continued study with an impoundment structure or cofferdam*. Impoundment of the wreck site offers the advantages of still water, reasonable expectations of water clarity, and increased safety for divers, but does not restrict the shipping channel beyond its present configuration. With such a structure, detailed archaeological study and excavation could determine the exact condition of the vessel. Informed planning recommendations could be offered with which to structure operations. Alternative 4 is recommended (U.S. Army Corps of Engineers 1983:VI-13).

As indicated by No. 4, the Design Memorandum argued for or recommended a cofferdam over all other alternatives. Some 300 feet long by 150 feet wide (Figure 14), detailed construction plans and costs were developed and presented in the Memorandum.

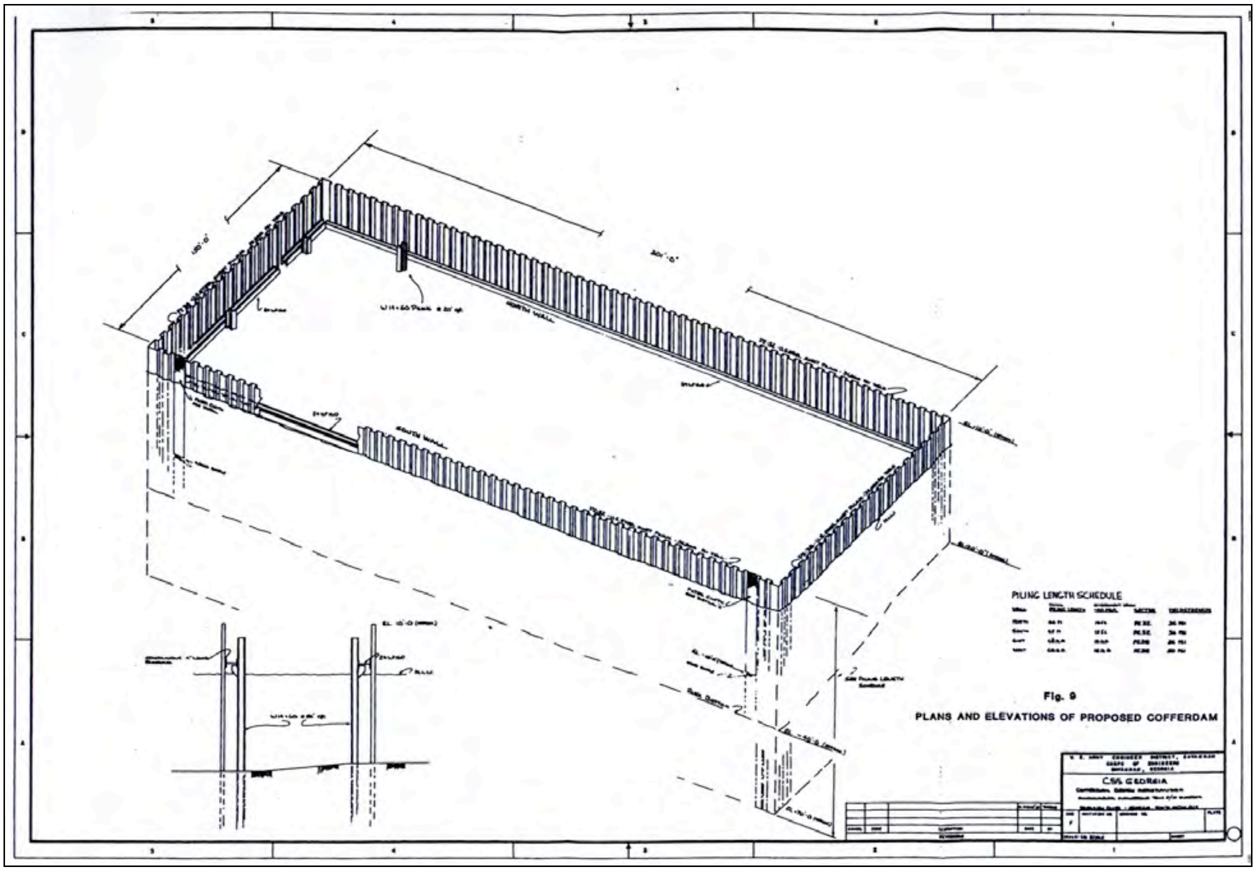


Figure 14. Schematic of proposed site cofferdam (as presented in U.S. Army Corps of Engineers 1983:VII-4).

In 1986, diving operations were conducted by the District during which time four cannon were located on the site. Two of these cannon and numerous projectiles were recovered from the wreck site and others were located but not removed (Judy Wood, Personal Communication 2003). Presented in Figure 15, a site plan was produced that shows the locations of the cannon and ordnance. However, based on our own findings (see Findings chapter below), the preliminary site plan produced from the 1986 study appeared inaccurate relative to location information for the guns, and made recreation of their 1986 locations problematic at best.

While the map is less than accurate, an acoustic image taken of the site during the 1986 investigation clearly depicts two casemate sections and an area of debris (Figure 16). Discussed below, the figure mirrors current images of the site but shows the casemate sections much more intact than they are today, indicating site degradation in the last 20 years.

It should be stated that all the artifacts recovered by both Texas A&M and COE are curated at the Coastal Heritage Society. They exhibit some of the artifacts at their historic sites--Fort James Jackson National Historic Landmark and the Savannah History Museum. The remainder are in the curation room at the Savannah History Museum.

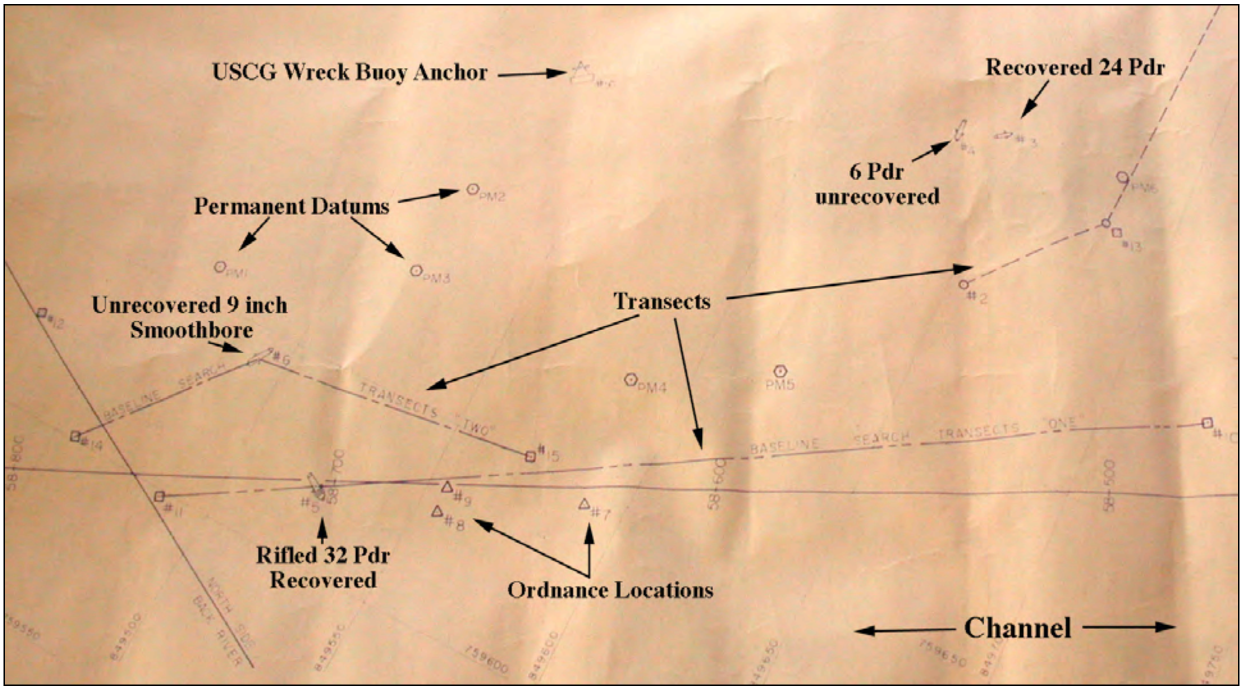


Figure 15. Excerpt from the 1986 site plan produced by the Savannah District during diving operations at the *Georgia* wreck site. Not depicted on the map, the East Casemate section would be generally located at the upper right near the unrecovered 6 pdr, and the West Casemate would be generally located above the unrecovered 9-inch smoothbore, above and adjacent the "Permanent Datums" (Courtesy of the U.S. Army Corps of Engineers, Savannah District).

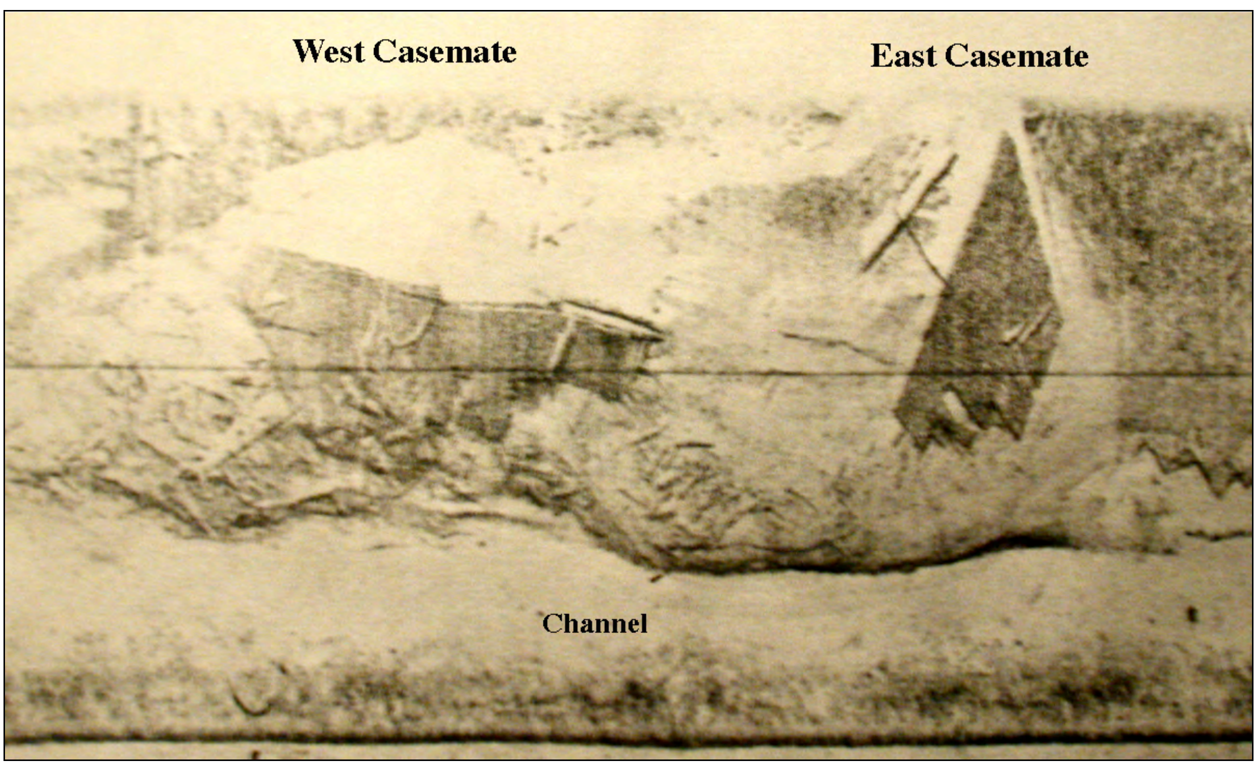


Figure 16. 1986 sidescan image of the *Georgia* wreck site. Labels have been added (Courtesy of the U.S. Army Corps of Engineers, Savannah District).

CSS *GEORGIA* METHODS

PROJECT PERSONNEL

The project team consisted of seven individuals from both Tidewater Atlantic and Panamerican. Dr. Gordon Watts of Tidewater Atlantic, and Mr. Stephen James of Panamerican acted as Co-Principal Investigators and on-site Project Directors. They were assisted by five archaeological divers, Cmdr. David Whall (USN Ret.) of Tidewater, and Mr. Michael Krivor, Mr. Matt Elliot, Mr. James Duff, and Mr. John Rawls of Panamerican. Cmdr. Whall also performed on-site computer operations and data input (i.e. GIS, Sector Scan Sonar). The dive vessel was crewed by Captains Keith Plaskett and Mike Lavender, who were assisted by mates Jason Raupp and Paul Shortle.

PRE-DIVING REMOTE SENSING SURVEY

The 2003 investigation, which took place from July 18 to August 29, was preceded by a remote sensing survey of the site. On July 1, a multibeam hydrographic survey was performed with a RESON Seabat 8125 multibeam system aboard the Districts' survey vessel *Ossabaw*, and on July 2, a sidescan sonar and magnetometer survey was performed with a Klein 3000 sidescan (100/500 kHz) and a Geometerics Cesium 880 magnetometer aboard the Corps' survey vessel *Downs*. The recorded survey data served as comparative data in the analysis of previous survey data and served to familiarize the project directors with the site. More importantly, the data were employed to direct diving operations in the safest manner possible, especially with regard to assessment of the sidescan record. Along with Gordon Watts and Stephen James, survey personnel included Ms. Judy Wood, Savannah District Archaeologist and Project Manager, Hypack® Representative John Lindberg, Corps Surveyors Ned Durden and Mike Ainsley, and boat captains Donny Bostwick and Eddie Culp.

UNDERWATER ARCHAEOLOGICAL INVESTIGATION

DIVING VESSEL

The vessel employed as the dive platform was the RV *Nautilus,* a 54-foot steel-hulled research vessel leased from the University of West Florida in Pensacola. With ample, air-conditioned cabin space to accommodate passengers, computers and assorted electronics, the vessel's large aft deck space made for an excellent dive station. Furthermore, the dive platform off the stern and the dual port and starboard ladders made ingress and egress from the water relatively easy (Figures 17 and 18). Conforming to all U.S Coast Guard specifications according to class, the vessel had a full complement of safety equipment and carried appropriate emergency supplies including lifejackets, spare parts kit, tool kit, first-aid supplies, flare gun, and air horns. Moored just upstream at the Weston Resort Hotel for the duration of the project, the RV *Nautilus* met the crew prior to each dive day at the Corps of Engineers Depot. Just a short distance upriver from the project site, the Depot served as the mobilization site for dive equipment, air, and personnel.

Figure 17. University of West Florida's R/V *Nautilus* tying up to mooring ball on the East Casemate to begin dive operations. Note Fort Jackson in the background.

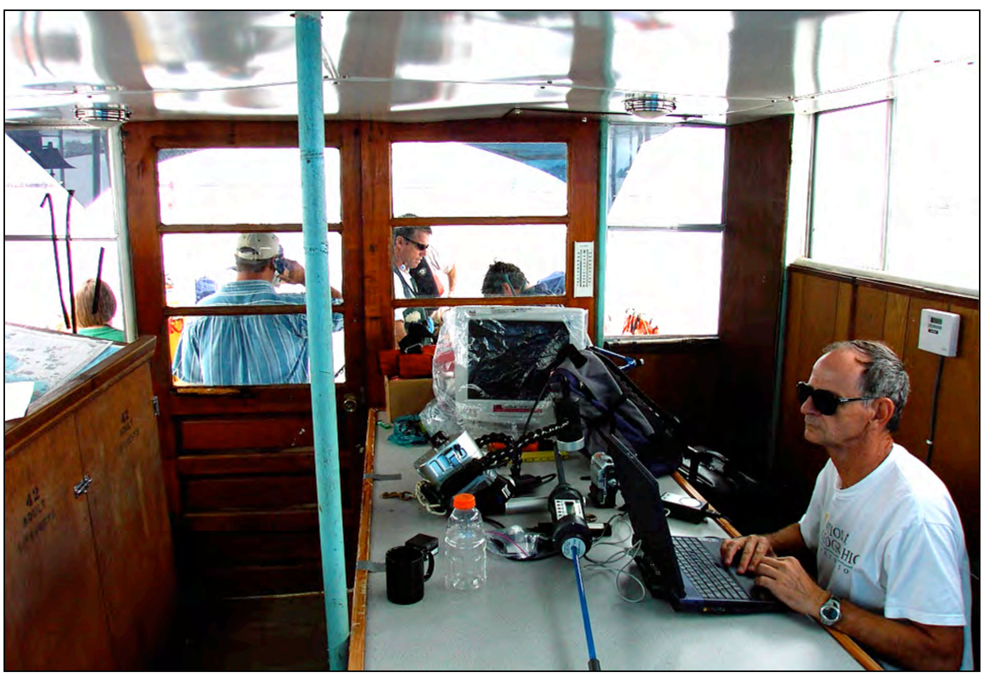


Figure 18. University of West Florida's R/V *Nautilus* cabin employed for computer operations, looking aft. Note David Whall entering site information into the GIS database.

Aiding the *Nautilus* during the project, especially with regard to setting anchors and moorings each day, was Tidewater's 25-foot *Parker*. This vessel was also employed in a brief remote sensing survey of the area between the wreck site and the South Carolina shore in an effort to ascertain if the hull from *Georgia* existed apart and away from the main site. Findings from this survey suggested that portions of the vessel do not exist apart from the wreck site.

DIVING OPERATIONS

The most efficient and safe method of conducting diver investigations in strong currents, and poor visibility, environmental conditions at the wreck site mandated that Surface Supplied Air (SSA) be employed for the investigation. Divers employed Kirby-Morgan Superlite-17 dive helmets connected to a surface-supplied air source, radio communications cable, safety tether, and pneumo hose (Figure 19). On the surface various individuals and pieces of equipment ensured safe diving operations. A dive tender was required to aid the diver in donning and doffing equipment and to tend the diver while submerged. A radio communications operator kept in constant contact with the diver and relayed messages between the diver and the surface support team. In addition to recording dive and wreck data (i.e. measurements) on the dive log, he was responsible for recording communications from each dive electronically; the data from which would be employed in the post-investigation analysis and write-up. A suited, standby diver was required on site in the advent of any situation that would require aid to the primary diver. A dive supervisor was present at all times to coordinate the activity of the diver and surface support team to achieve the project goals. Additionally, a Savannah District Diving Safety Officer was also present at all times to both observe and ensure safe dive operations. Diving Safety Officers included Donnie Boswick, William lane, and Glenn Bacon.

Figure 19. Co-Principal Investigator Gordon Watts suiting up in surface supply dive equipment, assisted by tenders James Duff and Matt Elliot. Note Back River in the background left, and South Carolina shoreline at right.

Preceded by a dive safety meeting with all participants in attendance on July 18th, diving operations commenced. All diving was conducted under published non-decompression limits and a total of 80 dives were conducted with the first dive occurring on Saturday July 19th and the last dive taking place on August 29th. Due to the shallowness of the majority of the project area, less than 46 feet at high tide, 40 and 50-foot tables were employed, allowing up to 100 minutes of no decompression bottom time employing U.S. Navy Dive Tables. With dives generally averaging one hour, the 80 dives had a cumulative total bottom time of 73 hours and 19 minutes (Appendix B).

Resting in a “blackwater,” tidal river, the site is in a relatively hostile environment with a tidal variation of approximately 9 feet. During the current investigation, July had a mean tidal range of 8.1 feet with lows of -0.4 feet to highs of 8.7 feet. August had a similar mean tidal range with lows of -0.3 feet to highs of 8.8 feet. Because of the extreme tides, substantial currents exist over the site, and data obtained by the Savannah District indicate velocities at ebb flow in excess of 5 feet per second, a speed constant with depth. Owing to these prohibitive currents, dives were conducted or attempted to be conducted at minimum current flow, a time that generally mirrored the peak of either flood (high) or ebb (low) tide. The time of day diving operations occurred was predicated on this tide “window,” and the majority of dives were conducted at ebb tide with diving disallowed once the increasing incoming current (flood) velocity precluded safe operations. On several occasions dives had to be aborted or shortened due to excessively strong or increasing currents. Several days, both the ebb and flow “windows” fell during daylight hours, offering two periods of diving. Of the 31 days on which diving operations took place, 20 days saw diving during the ebb window, five days during the flood window, and on 6 days during both windows.

Employing helmet or wrist-mounted lights, visibility ranged between 0 and 3-feet, and was generally best on slack current and beginning incoming tides. And while some visibility could be expected on all dives, visibility often changed dramatically during a single dive, going from good to nonexistent in several minutes, or changing from poor to excellent over the course of the dive. Water temperatures averaged 80°, and wetsuits were worn by some and protective coveralls by others.

ANCHORING AND MOORINGS

The initial objective for the investigation was the placement of moorings on the wreck site. Two semi-permanent anchors were first set, one up and one down-river from the wreck site. Anchoring atop the wreck with these anchors, the first four dives of the project were employed to set the moorings. Employing acoustic site images as guides as to where to place the moorings, and how to direct divers to those locations, one mooring was placed on the furthest upriver end of the West Casemate, and one on the down-river or East Casemate section (see Figures 26 and 27 in Finding Chapter). As opposed to anchoring, on-site moorings allowed the dive vessel to be quickly placed each day atop the wreck site in the same location. They also acted as the focal point in the investigation relative to diver orientation and mapping. At a later point in the investigation, a third mooring was placed on Cannon No. 2 to afford better access to this area of the wreck (see below). At the conclusion of the field investigation, all three moorings were removed from the wreck site.

With the moorings set, as well as the semi-permanent anchors, the project vessel could be placed over any section of the wreck. The direction of the tidal current and area of the wreck to be investigated determined mooring configuration each day (i.e. a bow anchor and stern mooring tie-up with the bow either upriver or downriver, or a bow and stern mooring tie-up with the bow either up or downriver). The bow of the vessel was generally positioned into the current so that the current would not sweep the diver, who was entering and exiting the stern, under the vessel.

The majority of the wreck site (i.e. large casemate sections) sits just outside the navigation channel so commercial vessel traffic, while transiting relatively close, was never an issue with respect to setting moorings and anchors at the wreck site, or with respect to diver safety (Figures 20 and 21). A "Notice to Mariners" of dive operations at our location was broadcast each day by radio, and the *Nautilus'* Captain communicated with each approaching vessel. While most of the wreckage sits just outside the navigation, portions of the wreck, such as cannon and propulsion machinery, were located on the channel slope near or in the channel. Divers investigated this area when there was no vessel traffic.

Figure 20. View of Upbound freighter adjacent to Project Vessel that has just anchored and is backing to the mooring ball. Ft. Jackson is just out of view to the right of the freighter's bow.

BASELINE AND DATUMS

With the moorings for the dive support vessel set on the East and West sections of casemate, archaeologists established a primary baseline between the two moorings. Using the baseline as a reference, additional datum stations were established in conjunction with major wreck site features. Each of those datums was connected to the primary baseline by lines that facilitated diver navigation and mapping. From those datums, additional lines were run to wreck site features. Using the datum web, features of the wreck structure and associated material exposed on the bottom surface were mapped using tape and/or acoustic triangulation, which generated sufficient data to support development of a georeferenced map of the wreck site. All datum lines, including the primary baseline, were left on site after completion of the fieldwork to facilitate future on-site research.

Figure 21. View of downbound freighter. Note the proximity of the West Casemate mooring ball just to the right of the red channel marker near the freighter's bow.

A series of seven (7) datums were placed at varying locations on the wreck site. Labeled Nos 1 through 5 and East Casemate and West Casemate datums; the datums consisted of 4- to 6-foot sections of 2-inch diameter galvanized pipe hammered into the Miocene clay bottom with a slide hammer (Table 1). The datums projected above the bottom generally three feet, and were extremely stable in the hard compact clay. The datums were in turn tied by lines to focal points where the baseline attached at the mooring or to just the baseline itself (i.e. Datum 2). Two of the datums, Datum 1 and Datum 4 were placed off the site to the north some distance and were employed as the base station for the Aqua Meter's "christmas tree," an ultra-short baseline transducer array (discussed below). An eighth datum, "Datum 0," was also employed for several measurements. Originally placed during the Districts' 1986 operation just south of the West Casemate, it was relocated during the current investigation.

Once features of the wreck and associated artifacts were located using the baseline web, archaeologists documented each feature using measured drawings. Each section of casemate was documented and samples of the wood structure were removed for identification. The pattern of railroad iron armor and associated fastenings was recorded in areas cleaned of concretion for that purpose. Major diagnostic artifacts such as the propeller and shaft, steam cylinders, boiler fragments and cannon were drawn and measured. Where possible, underwater video was employed to enhance documentation.

Table 1. Geo-Referenced Datum location information

Datum	Northing*	Easting	Wreck Location
West Casemate Datum	759776	1005674	West or upriver end of West Casemate
East Casemate Datum	759833	1005835	Northeast corner of East Casemate
Datum 1	759853	1005764	Between and north of casemates
Datum 2	759794	1005798	Between and south of casemates
Datum 3	759798	1005735	East or downriver end of West Casemate
Datum 4	759810	1005651	North of upriver end of West Casemate
Datum 5	759725	1005646	Adjacent propeller in Debris Field
Datum 0 (USACE 1986)	759753	1005689	South of West Casemate

*State Plane NAD83 (Georgia East)

PROBING

In an effort to determine burial depth of the wreck site and sediments types, both manual and hydroprobing was conducted during the investigation. Hand probes consisted of a 3-foot and a 6-foot section of T-handled stainless steel rod. The hydroprobe consisted of a 6-foot length of .5-inch steel pipe linked to a 5-hp Honda water pump with 50-foot lengths of 2-inch fire hose. Pressurized water was forced through the steel pipe as the diver inserted it into bottom sediments at a perpendicular angle. Theoretically, the force of the water would help the water probe to be inserted easily into the bottom sediments. However, the Miocene clay encountered across the wreck site, made probing extremely difficult. With that said, several sections of the wreck site were successfully probed. However, when it was determined that little if any overburden (i.e. sand) was present, and that the wreck sat predominantly atop the Miocene clay and was not buried, hydroprobing was discontinued. Hand probing was continued in areas of light overburden (i.e. Debris Field).

MESOTECH 1000 SECTOR SCANNING SONAR

In accordance with the Scope of Work a sector scanning sonar was employed to facilitate locating wreck related debris and tracking divers. The model used was a Mesotech MS 1000. The MS 1000 system is a computer-based sonar that operates through a Telemetry Interface/Power Supply. Using a Windows based operating system, the MS 1000 scale and resolution can be varied to suit conditions. A submersible digital head contains a transducer capable of 360-degree rotation or focused sector scanning (Figures 22 and 23). The MS 1000 has sufficiently high resolution to identify and define targets and can be used to guide divers to objects selected for inspection.

During the CSS *Georgia* investigation the MS 1000 could not be effectively employed. Because diving methodology permitted only one diver in the water at a time, to avoid utilizing dive time for deploying and recovering the hard-wired sonar, a tripod was constructed to position the transducer approximately 5 feet off the bottom. Even with weights on the tripod legs, water column currents frustrated operations during anything but dead slack water. As those periods were limited and divers quickly developed a web of baselines that aided navigation on the wreck, use of the MS 1000 was limited. Had there been sufficient time for divers to mount the transducer on a datum at the beginning of each dive and recover it at the end, the sonar could have been utilized much more effectively.

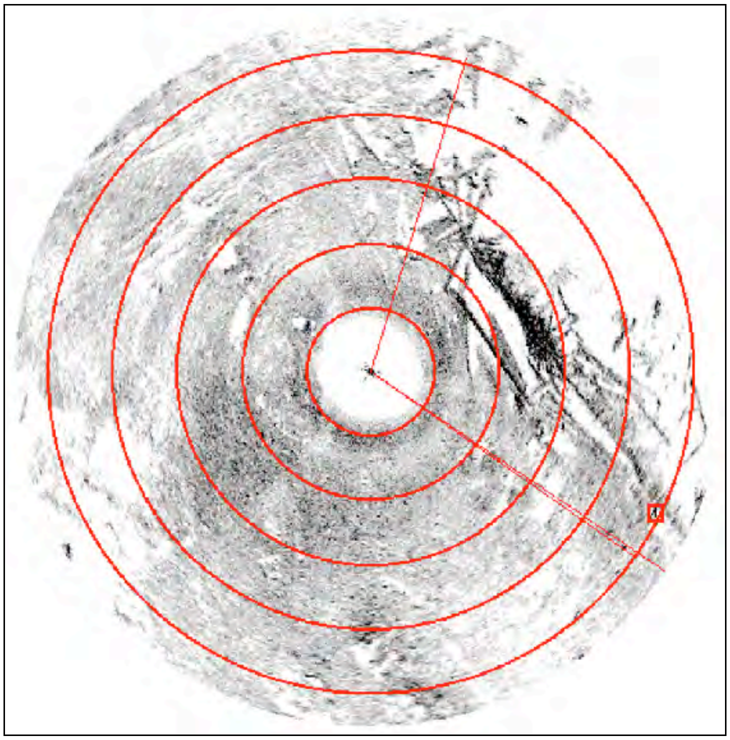


Figure 22. Acoustic image produced by the Mesotech 1000 and utilized during diving operations. Running in the 360 degree mode, the West Casemate section is in the upper right quadrant with the Mesotech 1000 positioned on the northern side of the wreck section. Red circular divisions indicate 12-foot intervals.

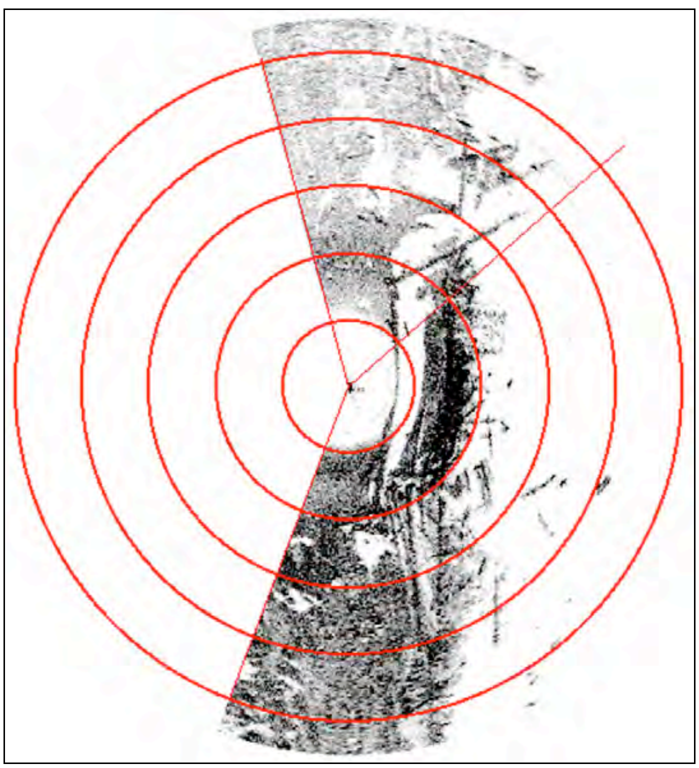


Figure 23. Running in the sector scan mode, the West Casemate section is again shown to the right with the Mesotech 1000 positioned on the northern side of the wreck section. Red circular divisions indicate 9-oot intervals.

AQUA METRE ELECTRONIC MEASURING SYSTEM

To facilitate mapping with one diver in low visibility water, efforts were made to employ an electronic measuring system. The Aqua Metre D100 was selected as it could be deployed, operated and recovered by a single diver. The Aqua Metre D100 utilizes a remote wireless, ultra short baseline transducer array that provides a reference Cartesian system that can be interrogated by a hand-held diver operated transducer (Figures 24 and 25). Using the speed of sound as corrected by the baseline system, the diver could produce a series of three-dimensional measurements documenting wreck site features without assistance. Each measurement was recorded and stored for downloading following the dive.

Unfortunately, a number of problems were encountered with the system. Water column noise that also impacted high-resolution towed sonars degraded the signal in spite of efforts to blank the interference. Difficulty in seeing the transducer display in reduced visibility also hindered operations. When problems were encountered with both the battery life and programming software, efforts to use the system were abandoned in favor of more traditional methods of mapping (i.e. triangulation with hand-held tapes). With that said, numerous measurements were obtained with the system, and when cross-checked with the more traditional methods, the measurements were found to be accurate in many cases but not all.

Figure 24. Photograph of the Aqua Metre D100's ultra short baseline transducer array that was positioned at the start of the dive on a selected datum.

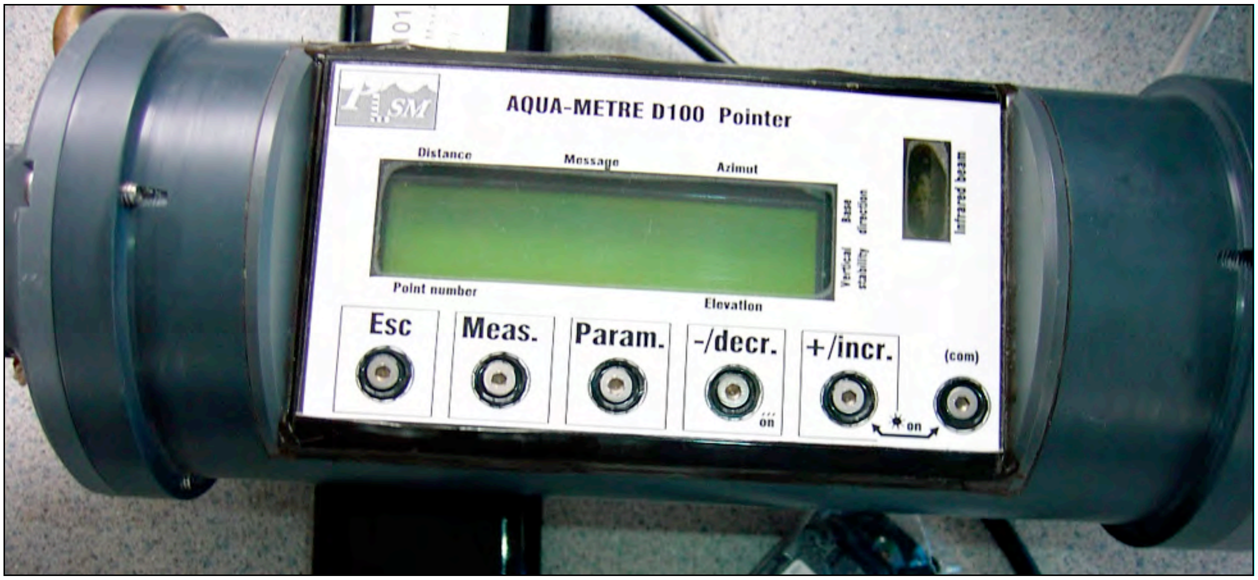
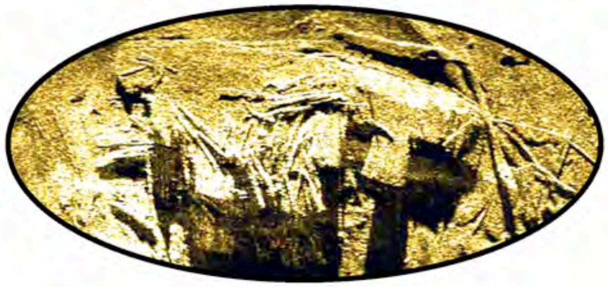


Figure 25. Photograph of the Aqua Metre D100's hand-held, diver-operated transducer. The LED tranducer display screen that would indicate when a reading had been obtained was often difficult to read by the diver in the low visibility conditions present on the wreck site.



CSS *GEORGIA* INVESTIGATIVE FINDINGS

Situated on the north side of the Savannah River channel immediately east of the confluence with the Back River channel, as indicated by both the side scan image and the site plan of the *Georgia* wreck site, the surviving remains of the ironclad are composed predominantly of two major articulated or intact sections of vessel structure (Figures 26 and 27). Identified as sections of the ironclads' casemate, the two sections sit in an East to West orientation parallel to, but just outside, of the navigation channel. The larger upriver or western section has been labeled the West Casemate, and the smaller downriver section to the east has been labeled the East Casemate. Visible on the acoustic images are various lengths of disarticulated railroad iron, which served as the vessel's casemate cladding. Considerable amounts of that material lie scattered between and around these two main components. Located adjacent to the southern or channel side of the West Casemate and spreading upriver from that larger intact section, is what has been described and labeled during the current investigation as the "Debris Field." Although containing various lengths of the railroad iron, miscellaneous timber fragments, and numerous uninspected pieces, the Debris Field contains the vessel propulsion machinery including steam cylinders, at least one propeller and shaft, and what appear to be boiler components (i.e. plating and tubing). Located east and down slope of the East Casemate, in channel dredge scars, sit a small section of structure that appears to be casemate but could also be a section of hull. South of that structure sonar records document an unknown object that is cylindrical in shape and might represent a boiler.

ARMORED CASEMATE

In all, three sections of casemate were identified and documented. Those sections lie in an East to West orientation parallel but just outside of the navigation channel. The larger upriver or western section has been labeled the West Casemate, and the downriver section to the east has been labeled the East Casemate. A smaller third section lies just downriver and in the channel from this latter section.

The West Casemate represents a large section of the vessel's timber-backed armored side. Unsupported by the no longer extant hull, this section generally lays flat on the hard clay bottom but is slightly pedestaled on both its northern and southern or channel side. The section is composed of railroad rail armor cladding attached to multiple layers of large backing timbers, this section has an overall length of 68 feet and is approximately 24 feet at its widest point. The northern or South Carolina edge of the West Casemate is relatively undisturbed and appears to reflect an as-built edge where it would have fastened to the deck or hull.

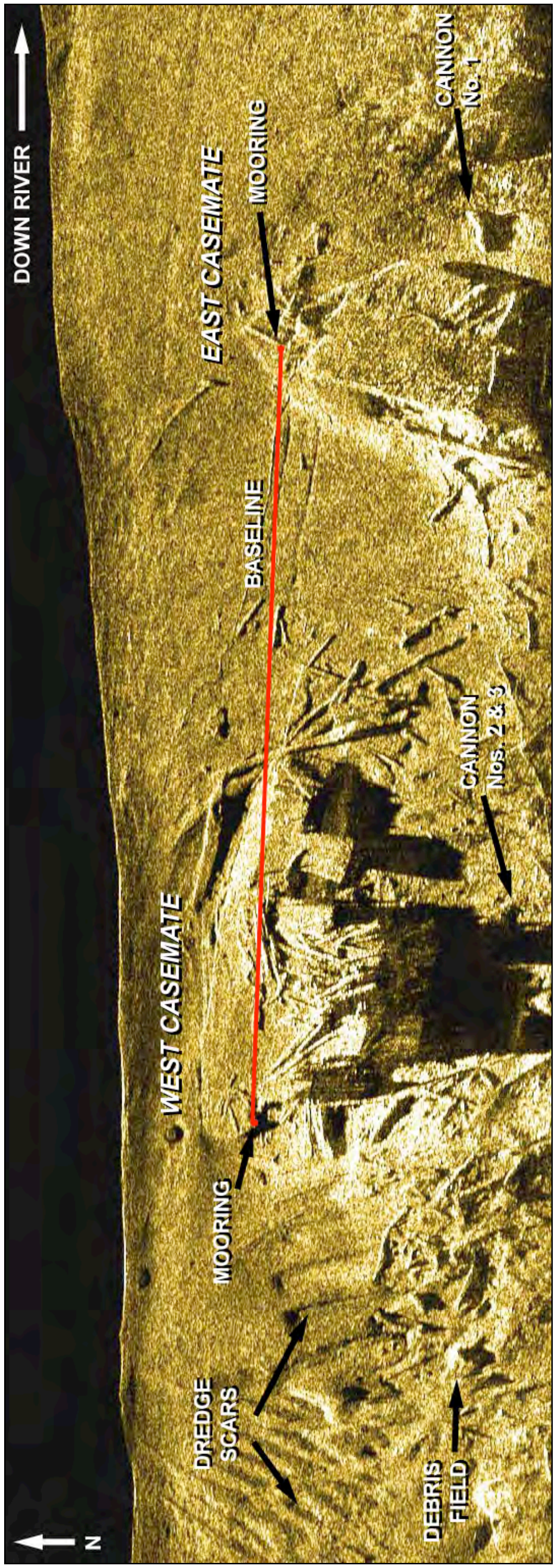


Figure 26. Acoustic image of the CSS *Georgia* wreck site.

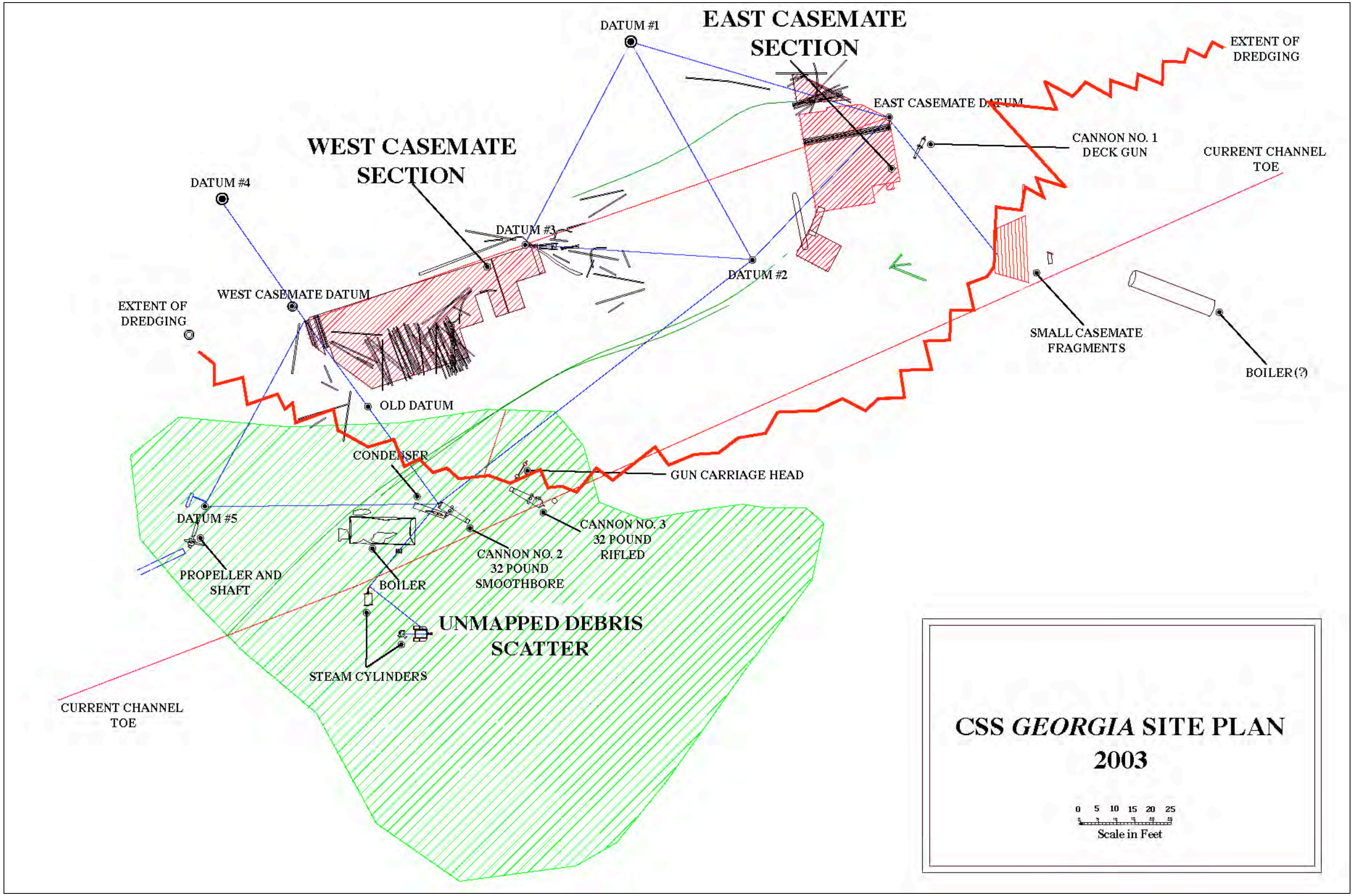


Figure 27. AutoCAD site plan.

The opposite southern side that faces the channel is heavily disturbed and fragmentary. That disturbance is most likely representative of impacts from past channel dredging. With the exception of several sections or lengths that can be seen lying loose on top, as indicated on the acoustic image in Figure 28, the upper surface of the northern half of this casemate section is smooth and represents intact armor that runs in lengths from north to south or along its width. Comprised of interlocking railroad track or “T” iron, the armor along the southern edge has a “splintered” appearance where the railroad iron is splayed apart. Not as wide as its upstream half, the channel side, downstream portion of the articulated section of casemate has several clean angular breaks appearing almost as-built to some degree. These have been tentatively identified as portions of gunports.

Figure 28. Acoustic image of the West Casemate.

The second most prominent feature of the *Georgia* wreck site is the East Casemate section. Like the West Casemate, it represents a section of the vessel’s timber-backed armored side. Again, like the West Casemate, it is unsupported by the no longer extant hull. The section is slightly pedestaled, and generally lays flat on the bottom. Its west and east sides appear to be as-built as does is angled northeastern edge. However, the extreme northern tip and the channel or southern side are somewhat disarticulated. Damage to the southern side is most likely representative of impacts from past channel dredging activities. The distance between the west and east as-built sides is 24.3 feet. The orientation of the rail iron is east and west, the rails and their orientation visible on the acoustic image in (Figure 29). The overall length of the section (north to south) is 37 feet.

The northeastern edge, seen as a short as-built 8-foot angular run on the acoustic image in Figure 29, is composed of the ends of rail placed in a descending stepped fashion that angle downward 45° from the as-built downriver edge. This construction characteristic argues that the vessel had angular faced or faceted ends, suggesting that this section of casemate would have formed one of the forward or aft corners, either representing the side of the casemate, or perhaps the forward or aft face. The remains of a feature identified as a gun port are present on the southern damaged edge of this section. With a squared base and a curved top, it is 4.1 feet in height (a remaining width measurement was not obtained). Co-Principal Investigator Gordon Watts dove on this section 15 years prior and since that time this gun port, which was complete at the time of his first dive and only shoulder-width wide, has all but disappeared. At that time, the two casemate gun ports identified during the dive measured 2 feet in width and 5 feet in height.

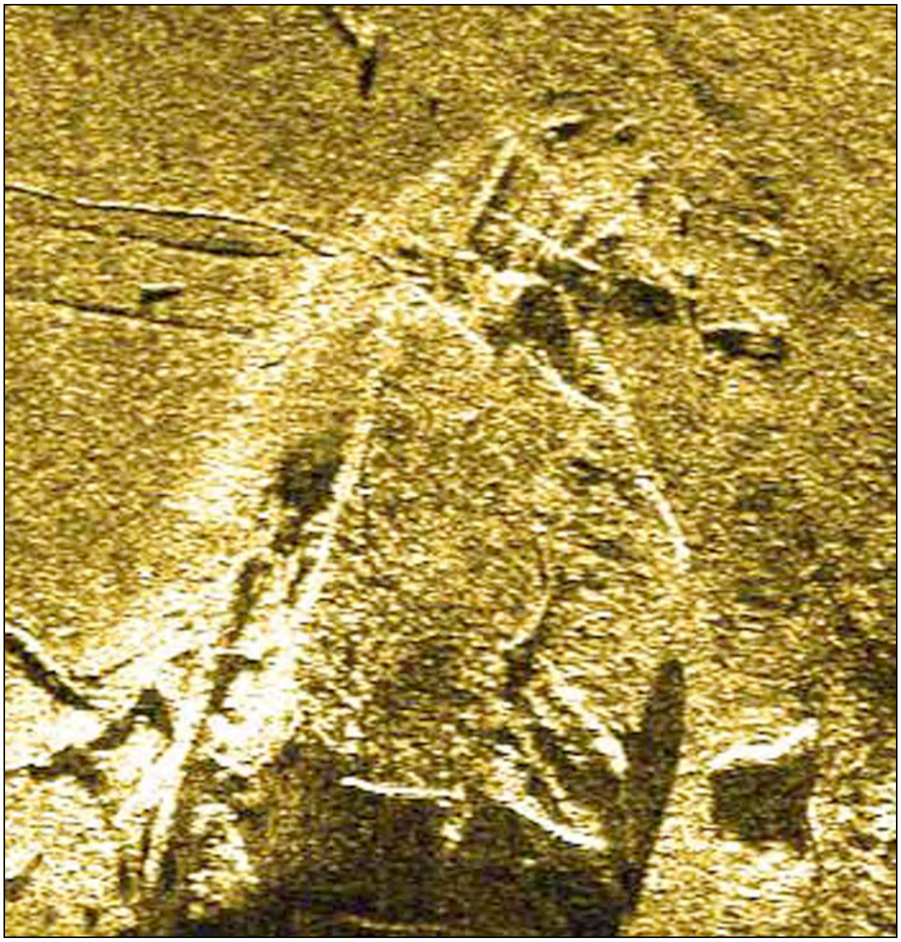


Figure 29. Acoustic image of the East Casemate. Note Cannon No. 1 at lower right corner.

A large area of armor cladding was cleared of concretion on the casemate in an effort to ascertain cladding arrangement and fastening patterns. Cleared with a chisel and small sledgehammer from the west to east edges and along a strip approximately 2 feet wide, it was observed that the 24-foot width is crossed by a single piece of rail. The cladding is actually composed of two layers of interlocked rail as is evidenced by Figure 30**.** The lower layer is fastened upright with the 3.5 inch wide T-shaped bases butting the wood backing. The second or outer layer is fastened base up with the T-shaped bases tight against one another and the bulbous tops interlocked below with the corresponding bulb of the lower rail (Figure 31). Fasteners can be seen on only the face of the upper layer, and the few that are present are placed in the center of the rail's base in rows. The fastener heads are just less than 1 inch in diameter and are flush with the rail indicating that that they are countersunk. Four fasteners are present on each length of upper rail, one adjacent each edge and another 8 foot in from each edge. A series of fasteners was recorded in the concretion-cleared area. The first set or row of fasteners is 6.5 inches from the upstream edge (end or edge of rail). The next or second row of fasteners is located 8.2 feet from the upriver edge or 7.7 feet from the first row of fasteners. With three fasteners exposed on this second row, they are 3.5 inches from one another (center to center). On the opposite downstream edge the first row of fasteners is 5.5 inches from the edge with another row 8.15 feet inboard of the edge.

Figure 30. Photograph of the lower edge of the East Casemate illustrating the interlocked rails of the armor.

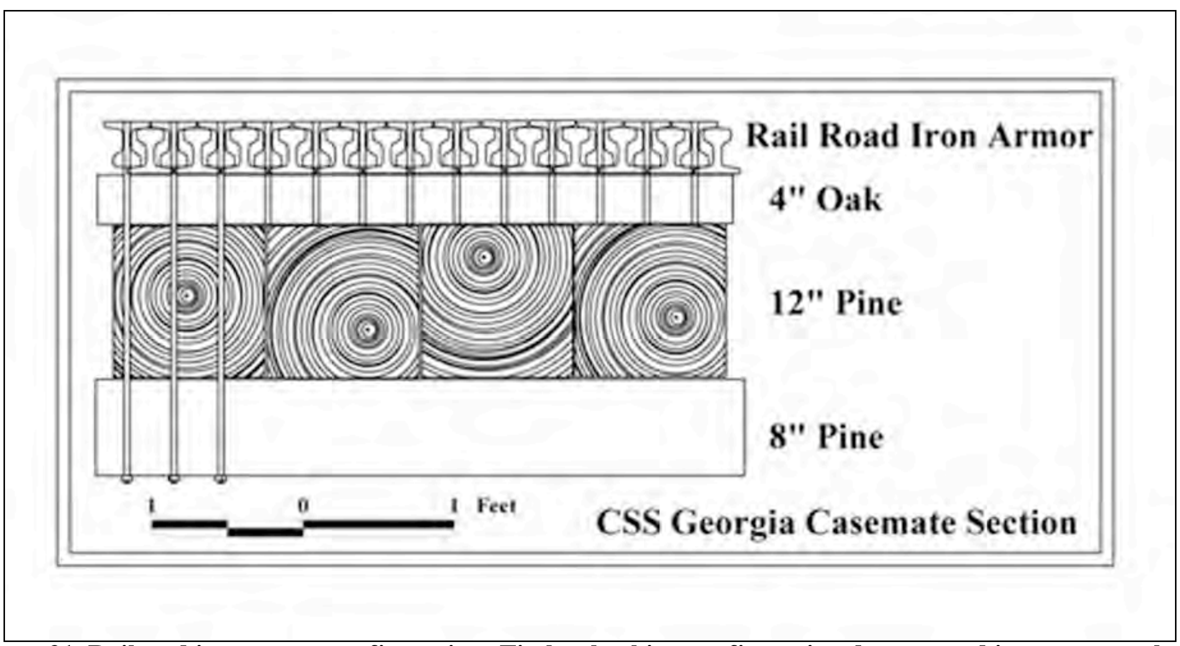


Figure 31. Railroad iron armor configuration. Timber backing configuration documented is present on the West Casemate.

A single sample of the railroad iron used to armor the sides of *Georgia* was also recovered (Figure 32). That sample proved to be a short section of rail that was split longitudinally or forged as a half-rail. The base width measured 2 inches and the height measured 3.4 inches. The length of the sample is 37.4 inches and its weight is 24 pounds.

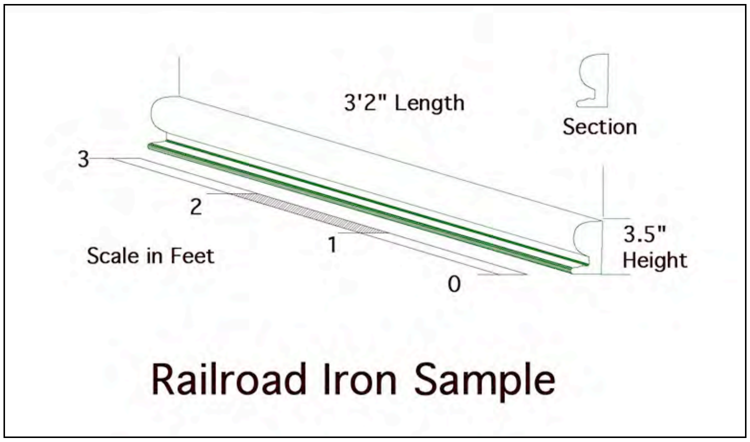


Figure 32. Sample of the railroad iron used to armor *Georgia*. Sample proved to be a short section of rail that was split longitudinally or forged as a half-rail.

Similar to that observed on the West Casemate, the cladding is backed by multiple layers of large timbers, and similar to the larger section their dimensions differ depending on location. Observed and measured on the edge of the western as-built side, two layers of timbers are present. The first layer attached to the cladding and which runs perpendicular is 9.5 inches thick. The second lower layer, which runs parallel to the cladding, is 9 inches thick (18.5 inches total). A width was not obtained for these timbers. Adjacent to the gun port discussed above, the timber scantling is slightly different. The first layer of wood attached beneath the cladding is 8.5 inches thick and runs perpendicular to the railroad iron. Resting on bottom sediments, the second or lower layer is 11.5 inches thick by 5.5 inches wide and runs parallel to the rail iron (20 inches total). The first layer of wood appears to be in good shape while the second layer is heavily damaged by the "shipworm," or more correctly by the Teredo, a wood burrowing clam. Illustrated in Figure 33, one fastener was observed at this location. It is thought to have originally been 23 inches in length and fastened the armor to both layers of wood. Recovered, recorded and redeposited, it has a square-headed bolt on its lower threaded end

Figure 33. Fastener recovered from East Casemate. Timber backing configuration is present on the West Casemate. Thought to have originally been 23 inches in length, it fastened the armor to both layers of wood.

The area directly south of the East Casemate and arching into the channel for a distance of 100 feet was searched for what appeared to be a third piece of casemate. Although not as large or visually pronounced on the acoustic images (Figure 34), it did appear as an articulated section of the vessel worthy of investigation. Located approximately 66 feet from the East Casemate Datum to the southeast and in an area of 4-foot deep dredge scars. This element of vessel structure lies flat on the bottom, is similar to the other casemate sections in that it has multiple edges of varying angle and length. Generally speaking, it currently has five edges (not as-built) and is approximately 11-feet wide and 18-feet long, with the timber backing facing up. Numerous fasteners project upward from the badly deteriorated timbers (several layers), which are in turn attached to rail cladding underneath. The rail lengths run in a direction from the channel to the north (aligned with the dredge scars). This section appears to have been directly impacted by dredging.

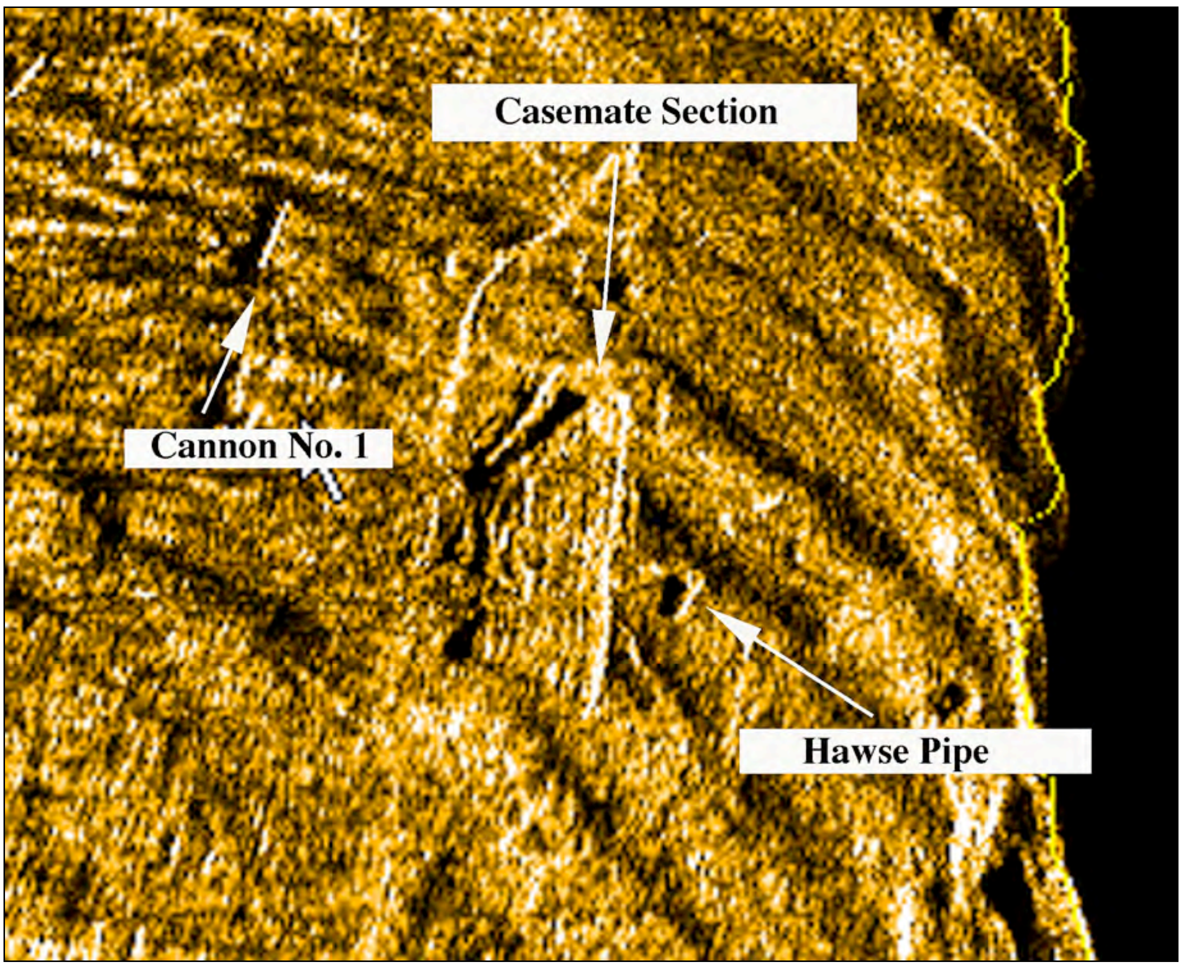


Figure 34. Acoustic image of the third and smallest Casemate section.

Located approximately 7 feet down-river from this section is a 3 foot 4 inch-long cylindrical iron object believed to be a hawse throat or pipe. Hollow, it is asymmetrical in that one end has a diameter of 12 inches while the opposite end has a mounting flange with a diameter of 17 inches. The mounting flange appeared to be cast at roughly 30 degrees off perpendicular to the longitudinal axis of the pipe (Figure 35).

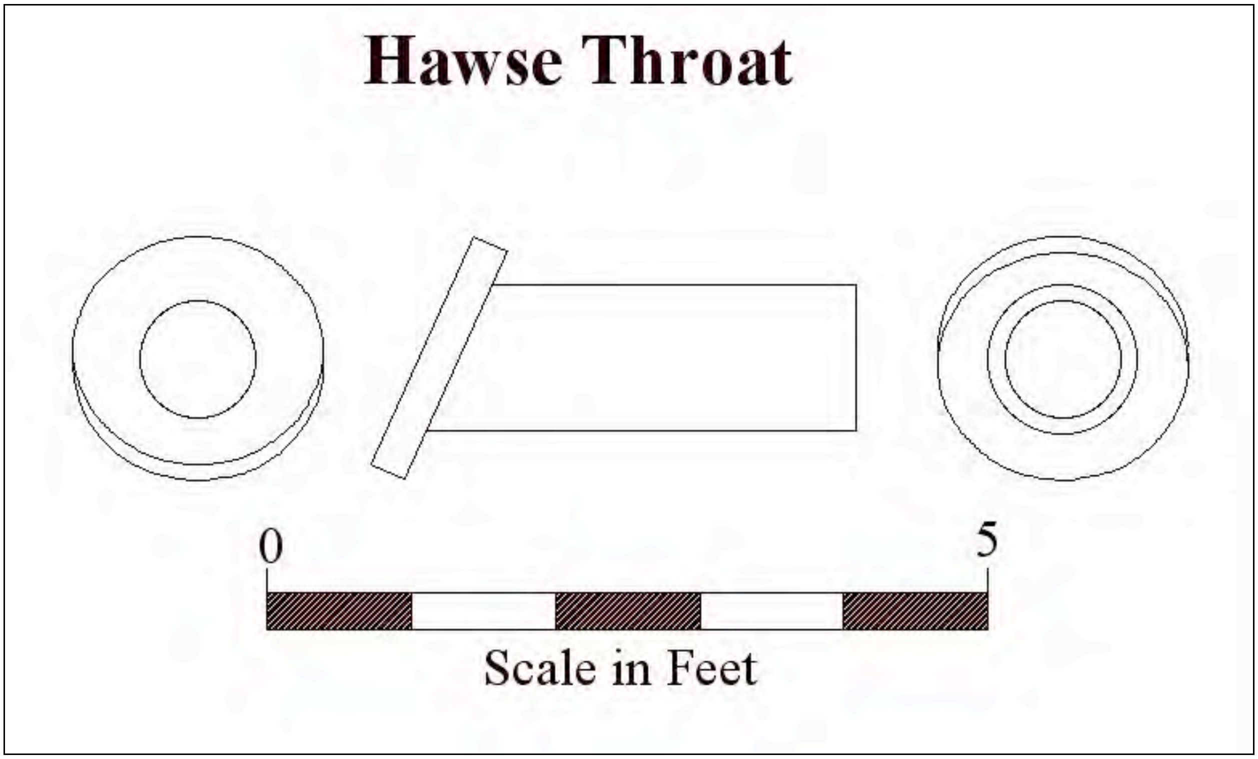


Figure 35. AutoCAD line drawing of long cylindrical iron object believed to be a hawse throat or pipe.

STEAM MACHINERY

Several elements of the vessel's propulsion machinery were located during the investigation. They included two steam cylinders, boiler components, and a propeller and shaft. These items are "clustered" on the channel side of the West Casemate, and comprise a large part of the Debris Field. Because this area was investigated during the latter part of fieldwork, it is quite likely that additional aspects of the vessel's steam machinery went unlocated, and that with additional investigations might identify additional material.

The 1980 Investigation Report states that "The west-end is most probably the bow area; magnetic data near the east-end indicate what may be machinery or propeller " (Garrison et al. 1980:112). However, the location of propulsion machinery adjacent to the West Casemate, especially with regard to the propeller and shaft, suggest that the upriver end of the wreck site may represent the stern and not the bow. This postulation, however, is problematic given the complete absence of the entire lower hull. Furthermore, the propulsion machinery appears somewhat displaced, and the boilers, if our identification is correct, are completely disarticulated. This would argue for an extreme post depositional impact or impacts to the site, with the possibility that nothing is in situ but rather the wreck has been "rearranged," at least in part by dredging activities. Additional archaeological investigations would be required to answer this enigmatic aspect of the wreck site.

The propeller and shaft are located 50 feet upriver and towards the channel from the West Casemate in the Debris Field (see Figures 26 and 27). A single propeller blade projects from the clay, a second blade extends, partially buried, along the bottom surface and a third is either broken off or extends into the bottom. Illustrated in Figure 36, the exposed blade has a height of 3-feet 9-inches from the shaft to its tip and a maximum width of 2 feet. The base of the blade is 20 inches in length where it projects from a 1-foot 8-inch long and 18 inch diameter hub. The shaft diameter is 6 inches and it has a remaining length of just over nine feet forward of the hub. Forward of the hub is a stuffing gland, and aft of the propeller is a 1.5-inch thick collar. Aft of this collar is a 2-inch diameter pin or key. Thought to have been a three-bladed propeller, the angle of the blade indicates that it turned clockwise, and the size of the screw would suggest that the vessel originally had two propellers as was indicated in the historical record (see Swanson and Holcombe 2003:74). If the vessel did indeed have two propellers, then it is safe to assume, like those found on other similar vessels, that the propellers turned outward on each side of the rudder. Our propeller would then be identifiable as the starboard propeller.

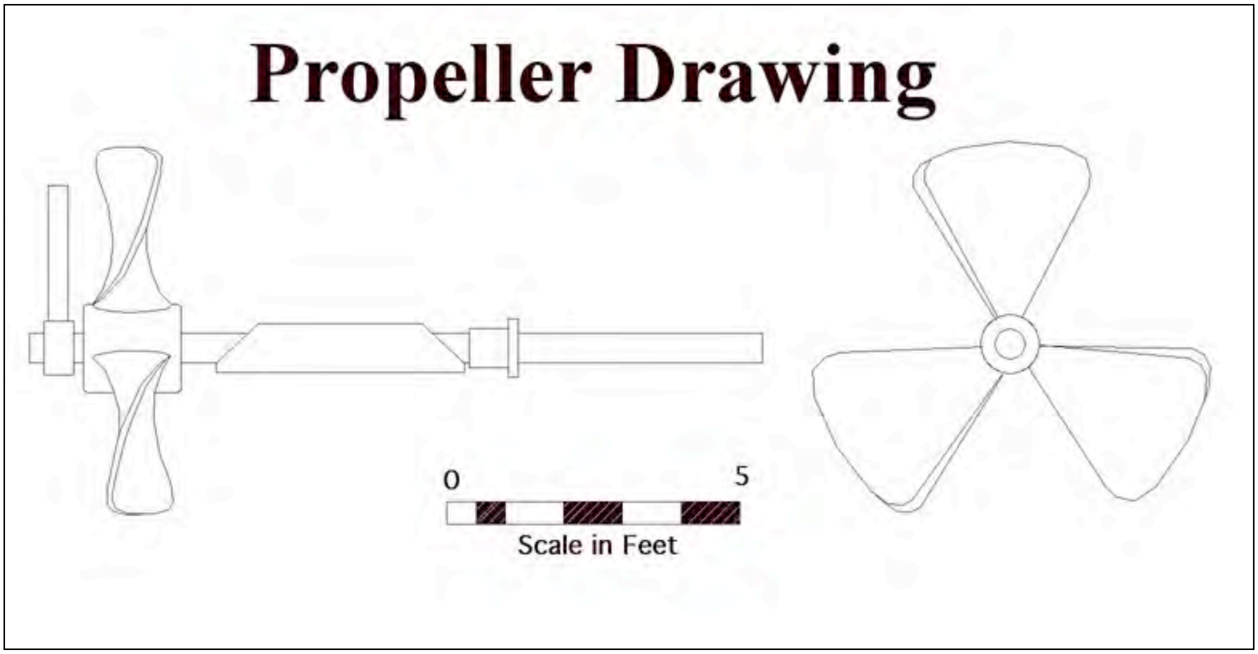


Figure 36. AutoCAD line drawing of propeller and shaft.

Archaeologists located what appear to be two steam cylinders. Both are clearly horizontal cylinders associated with CSS *Georgia*'s propulsion. The third cylinder is of decidedly different dimensions and design and is most likely a condenser or mud drum. Cylinder No. 1 was located slightly downriver and in channel 50.5 feet from Datum 5 (adjacent propeller) and 30.5 feet upriver from Cannon No. 2 (Figure 37). The design is clearly one of a horizontal direct acting engine. Sticking out of the bottom at approximately a 45° angle, the single cylinder has an overall length of 39.5 inches, and the ends have a diameter of 24 inches. Bent at a 90° angle where it comes out of the cylinder, a 3-inch diameter piston rod projects 26 inches (remaining length from the stuffing gland) on one end of the cylinder. The face of the opposite end has a 3.5-inch diameter, upward-projecting dimple suggesting this is the top of the cylinder. Both end caps are bolted along their outer rims with hex nuts spaced on 8-inch centers.

Cylinder No. 2 lies approximately 10 feet away and toward the channel in a noticeable dredge scar, Cylinder No. 2 is also thought to represent one of the vessel's steam engines. Similar in size and shape to Cylinder No. 1, this cylinder also has an overall length of 39 inches, and the ends have a diameter of 24 inches. It has a similar dimpled end opposite the piston rod end. Unlike Cylinder No. 1, this cylinder's piston rod is all the way in the cylinder. Projecting slightly from the now-broken stuffing gland, the piston rod end has an in situ "wrist pin," for attachment to the crosshead. Mounting brackets are located on opposite sides of the cylinder.

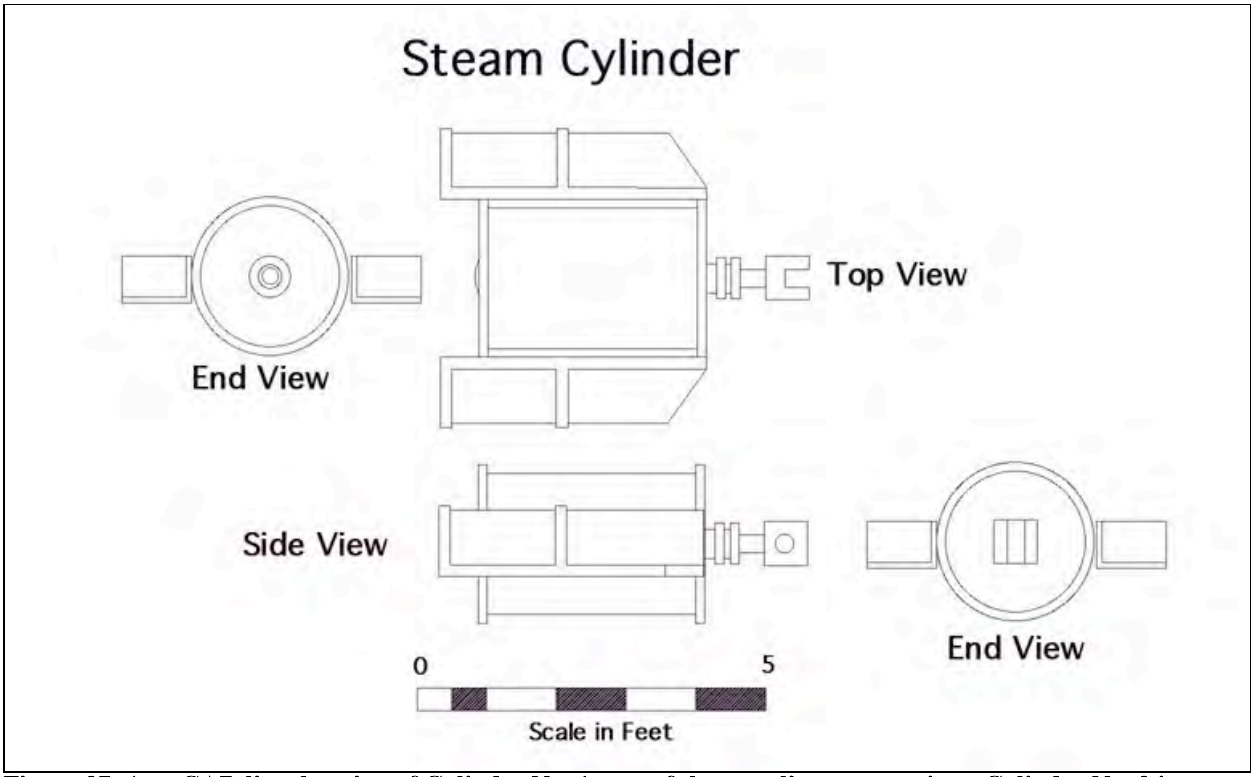


Figure 37. AutoCAD line drawing of Cylinder No. 1, one of the vessel's steam engines. Cylinder No. 2 is similar in size and shape.

Scattered around the No. 2 cylinder in the dredge scar are numerous other machinery parts, as well as wood timber fragments. Just over 3 feet from Cylinder No. 2, one of the larger pieces appears to be a steam valve or distribution fitting.

A third cylindrical object was located immediately adjacent to and slightly underneath the upstream side of Cannon No. 2. With a total overall length of 9 feet and a cylinder diameter of 20 inches, Cylinder No. 3 is much larger than the two steam cylinders. It has attached piping and a valve along its upper side. Although the flange is partially broken, the end adjacent the cannon has a 3-inch diameter hole in its center. In all likelihood this cylinder represents a condenser (Figure 38).

Adjacent to and upstream from Cannon 2 is a concentration of disarticulated iron plating. The configuration of the plating suggests that the material could be associated with the vessel's boiler(s). The plate may be misidentified, especially in light of the fact that boilers are extremely robust in construction and one would expect there to be some degree of remaining articulation. However, also located in this area are boiler staves and rods, as well as a heavy concentration or scatter of red bricks. While firebrick associated with boilers is generally beige or buff in color, the rods and staves are definitely boiler components, and therefore, argue or suggest that the plates are indeed associated with the boilers.

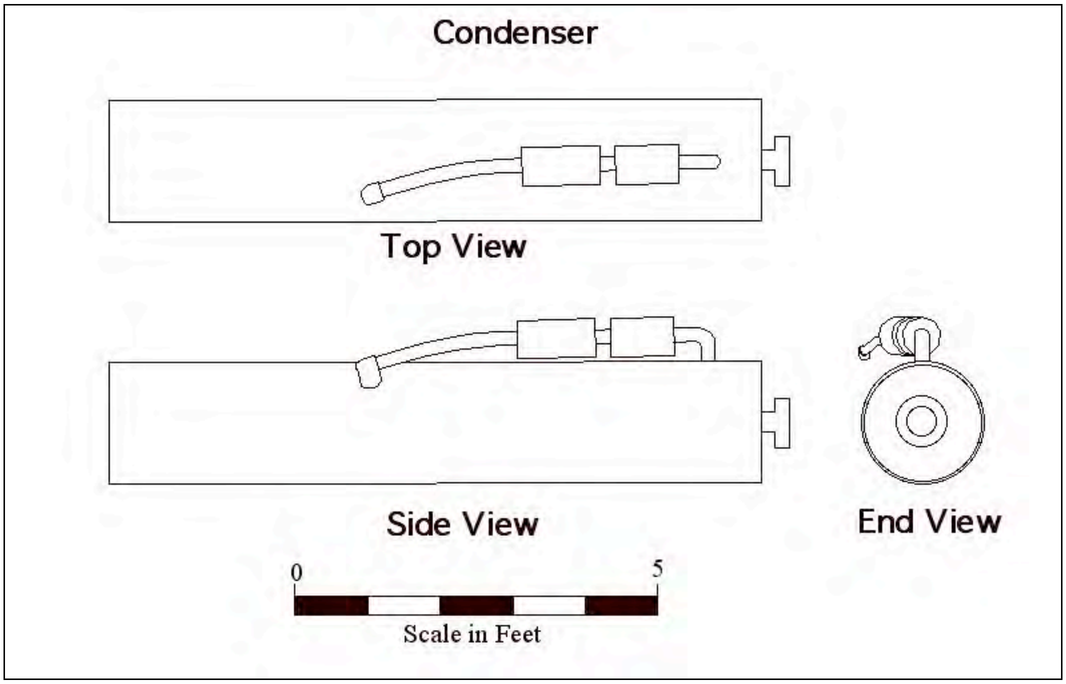


Figure 38. AutoCAD line drawing of "Cylinder No. 3" located adjacent to Cannon No. 2. Of decidedly different dimensions and design from Cylinders 1 and 2, it is thought to represent a condenser.

ASSOCIATED ORDNANCE

A total of three cannon were located during the current investigation, one downriver from and adjacent to the East Casemate, and two adjacent to, and on the channel side, of the West Casemate. It is believed that all three cannon were previously located during the District's 1986 diving operations during which time two other cannon and numerous projectiles were recovered from the wreck site and others were located but not removed. The preliminary site plan produced from the 1986 study appeared inaccurate relative to current location information for the guns. However, the 1986 site plan did indicate that at least two guns lay channel side of the large section of West Casemate. This information and high-resolution sonar data focused our attempts to search for or be cognizant of the possibility of guns in this area (i.e. Cannons No. 2 and No. 3, see Figure 39).

Readily discernable in the acoustic imagery shown in Figures 26 and 29, Cannon No. 1 is located 9 feet downriver from the East Casemate. Oriented with its flaring muzzle upriver and its cascabel downriver, the cannon sits on its side with one of its two trunions pointing upward (Figure 40). Most likely a 6-pounder, Cannon No. 1 is 6-feet 5-inches in total length, and has a bore diameter of 3.5 inches (cleaned of concretion). If our identification as a 6-pdr is correct, then it most likely represents the 6-pdr stated as being presented for use on *Georgia* by the Ladies of Rome, and originally positioned on the vessels' Spar Deck Aft (Swanson and Holcombe 2003:84-85). Although the bore indicates that the piece is a 6-pounder, the style resembles a 24-pounder Siege & Garrison Howitzer Model 1844 (Ripley 1970:49).

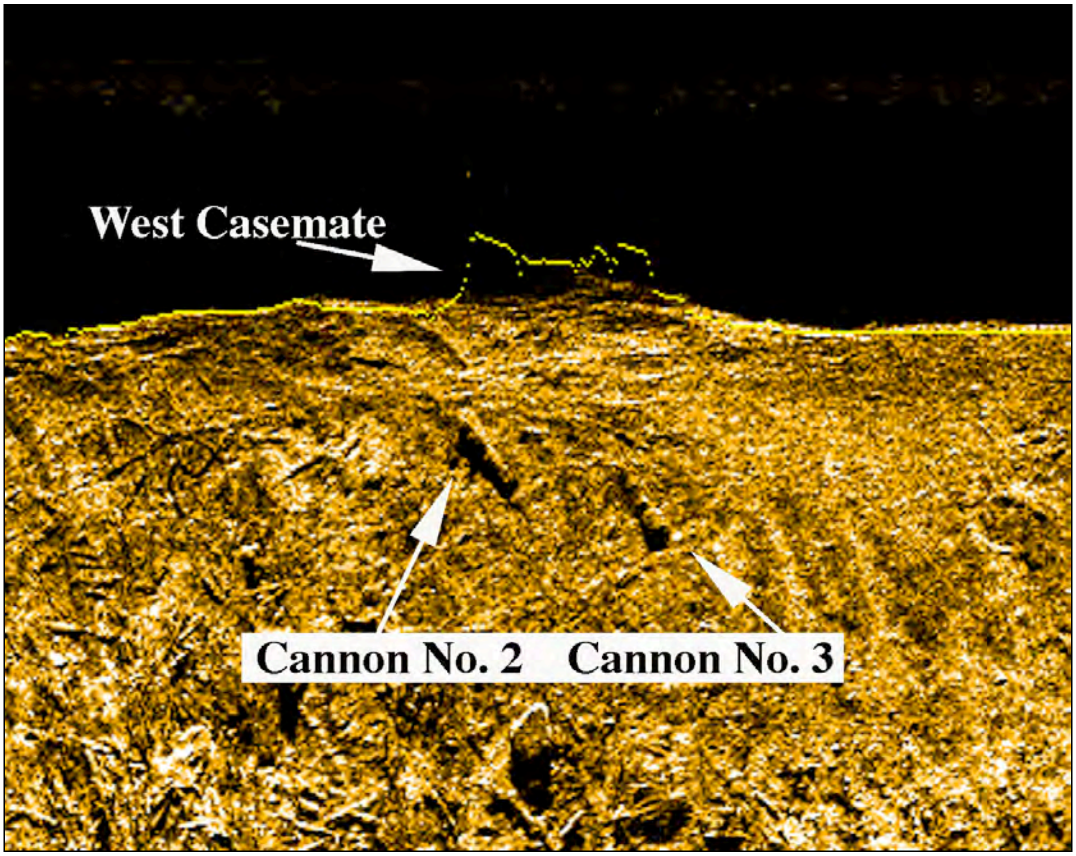


Figure 39. High-resolution sonar data of Cannon Nos. 2 and 3 that helped to focus search areas.

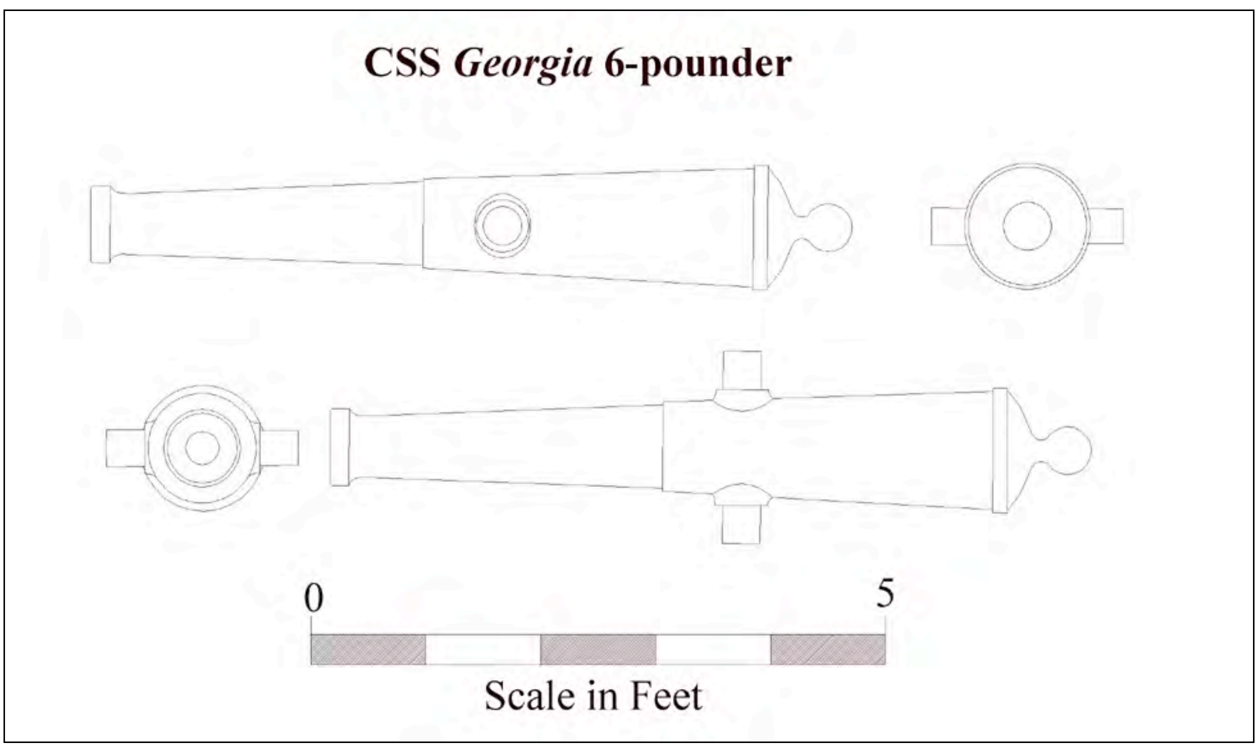


Figure 40. AutoCAD line drawing of Cannon No. 1, a 6-pounder.

Cannon No. 2 was located on the channel side of the West Casemate with its muzzle pointed toward the channel and slightly downstream. The cascabel of Cannon No. 2 is located 62.9 feet from the West Casemate Datum. The cannon has a total length of 11-feet 3-inches and a maximum diameter of 2 feet (Figure 41). The cannon has no reinforcing bands and its flaring muzzle has a bore diameter of 8.5-inches (cleaned of concretion). Comparing the design and bore diameter of Cannon No. 2 with historical references and Civil War ordnance suggests that the piece is an 8.5-inch shell gun similar to a Sea-Coast type. Three VIII shell guns were listed for *Georgia*, but they were noted as removed in the 1860s. The two remaining unbanded guns on the wreck were IX inch shell Dahlgren Pattern (Swanson and Holcombe 2003:84-85). The shape of the piece does not correspond to a Dahlgren, especially with regard to the ring located above the cascabel.

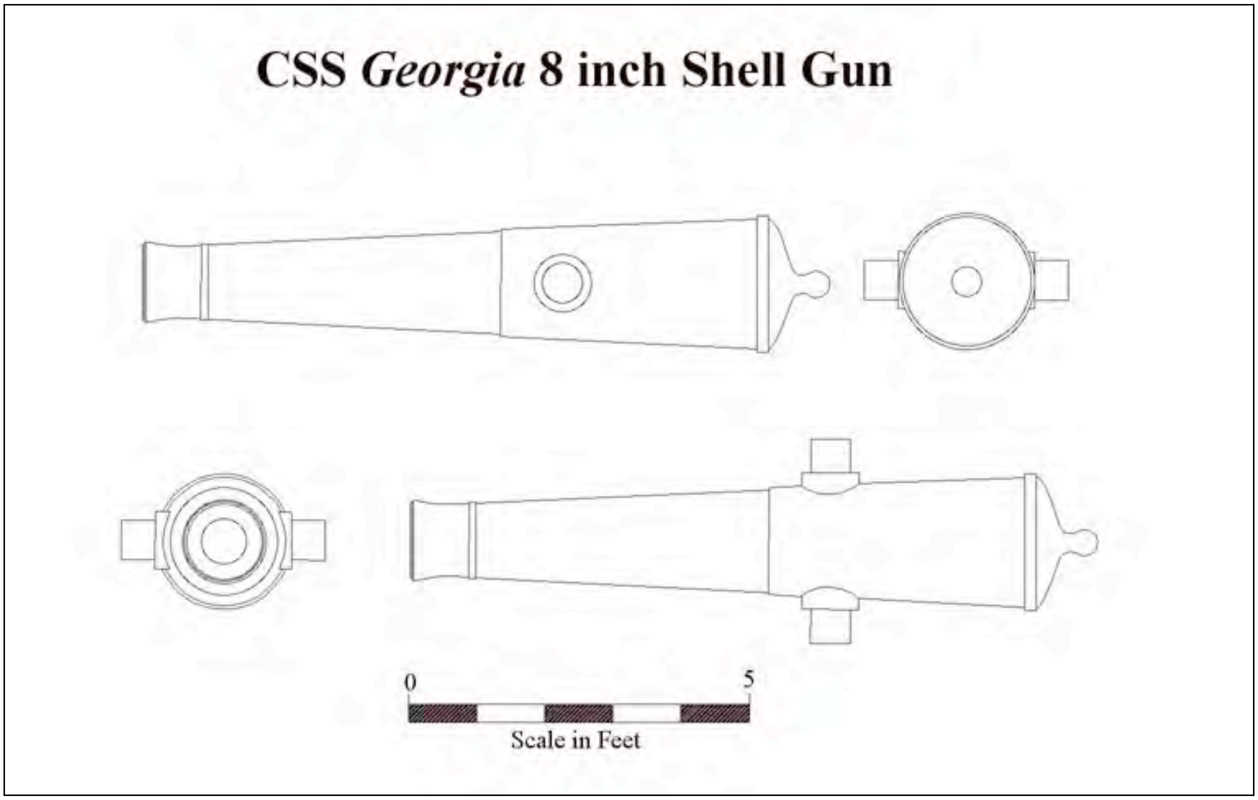


Figure 41. AutoCAD line drawing of Cannon No. 2. The design and bore diameter suggests that the piece is an 8.5-inch shell gun similar to a Sea Coast type.

With its muzzle pointing toward the West Casemate, Cannon No. 3 is situated just over 22 feet downstream from Cannon No. 2. With a total length of 10 feet 8 inches and a maximum diameter of 2 feet 2 inches, its flaring muzzle has a 5.5-inch bore diameter (concreted). The gun has a single reinforcing band 25.5 inches in length around its breech, and its cascabel has a 3-inch diameter hole through its center (Figure 42). What appear to be parts of a gun carriage are located near this gun. A 6-foot long iron rod with 2 circular objects, possibly wheels, lie 4 feet from the muzzle.

Although preliminary, the size, design, and caliber of this gun suggest that the piece is a 32-pounder Model 1846 that has been turned and banded. As stated, *Georgia* had six guns aboard at the time of her scuttling, and Swanson and Holcombe list two cannon that could be candidates for Cannon No. 3 (2003:84-85). Of the guns that were not removed during the 1860s or recovered during the District's 1986 diving operation, the remaining guns include only two that had the characteristic single reinforcing band. Both 6-inch rifled 32-pounders; one is identified as the bow gun and the other as the No. 3 Port gun (Swanson and Holcombe 2003:84-85). Illustrated in Figures 43 and 44, a similar 6-inch rifled 32-pounder, the No. 2 Port gun, was recovered in 1986 and now rests at Fort Jackson along with the 24-pounder from the Spar Deck (Figure 45).

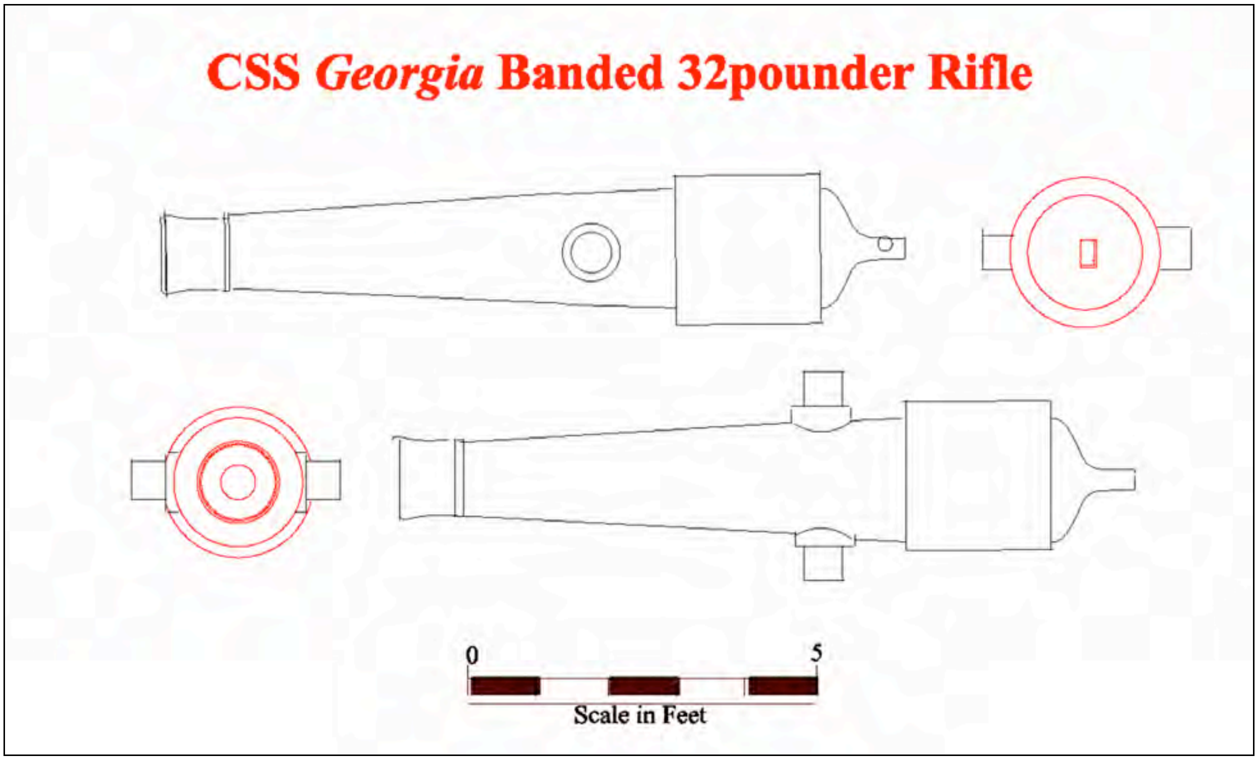


Figure 42. AutoCAD line drawing of Cannon No. 3. Although preliminary, the size, design and caliber suggest that the piece is a 32-pounder Model 1846 that has been turned and banded.

Designed to carry 10 heavy guns within the vessel's casemate, surviving historical evidence indicates that *Georgia* had four heavy and two light guns on her at the time of her sinking (Swanson and Holcombe 2003:61). During Savannah District diving operations at the wreck site in 1986, a 32-pounder reworked into a rifled gun, and a 24-pounder howitzer, were removed from the wreck site. This leaves three remaining heavy guns and the 6-pounder on the site. Of these remaining guns, Cannons 2 and 3 represent two of the three remaining heavy guns, and Cannon 1 represents the 6-pounder. The third remaining heavy gun has still to be relocated if present.

In addition to the two recovered cannon, numerous munitions were observed and recovered during the District's 1986 diving operations. As stated by Gary Sego, Corps Depot manager, the munitions were concentrated on the channel slope opposite the West Casemate (Personal Communication 2003). However, with the exception of two associated items, a sabot and a single round shot, munitions were not readily observed during this investigation.

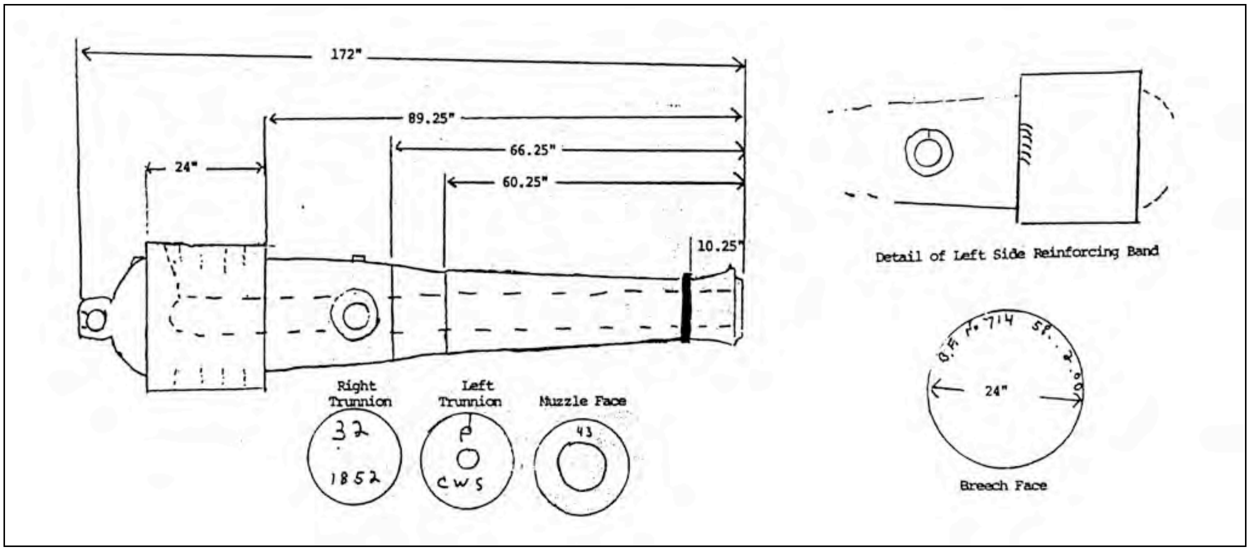


Figure 43. Line drawing of the 6-inch rifled, single-banded 32-pounder, the No. 2 Port gun, recovered in 1986 and now resting at Fort Jackson (As presented in Babits 1993:31). Compare cannon marks with those listed for the gun in Swanson and Holcombe (see Swanson and Holcombe 2003:85).

Figure 44. Photograph of the 32-pounder recovered during the 1986 diving operations and that now rests on display at Ft. Jackson.

SABOT

Similar to that illustrated in Figure 46, a single brass sabot was recovered between Cannon No. 2 and No. 3. In excellent condition and just over 6 inches in diameter, it had a 1-inch diameter bolt hole in its center and had five ratchet grooves on its exterior base. Identified as a 6.4-inch Brooke Copper Ratchet Disk Sabot, perhaps the most popular sabot type in the Confederate Navy (Bell 2003:510), similar sabots were present on Brooke projectiles recovered during the 1980 investigation (see Garrison et al. 1980:43-44, Figures 24 and 25). Most likely associated with munitions for the vessel's 32-pounders, the sabot was recorded on the surface and re-deposited on site adjacent to the muzzle of Cannon No. 3.

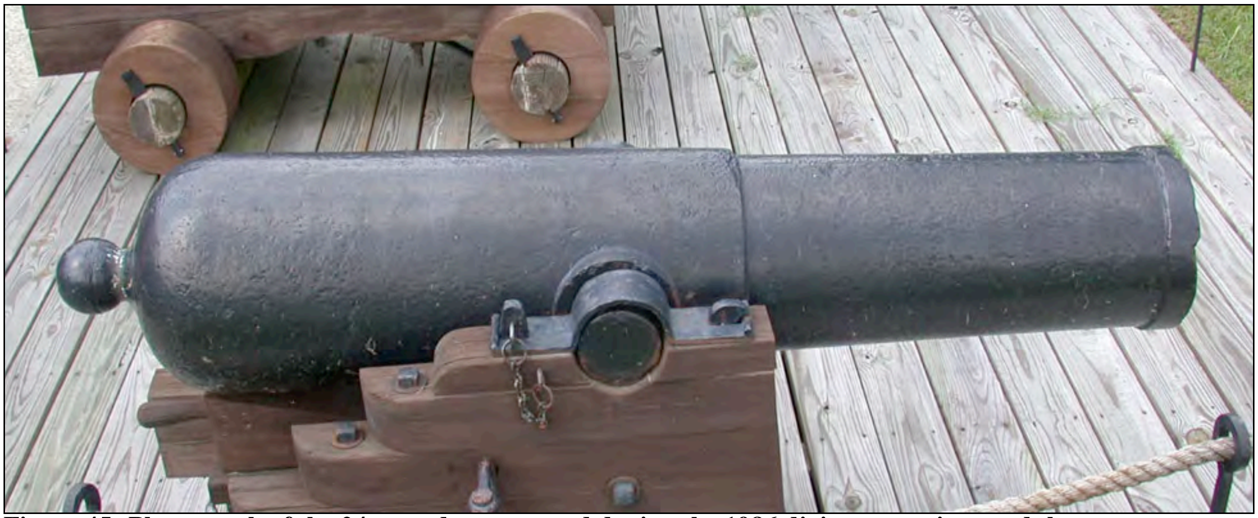


Figure 45. Photograph of the 24-pounder recovered during the 1986 diving operations and that now rests on display at Ft. Jackson.

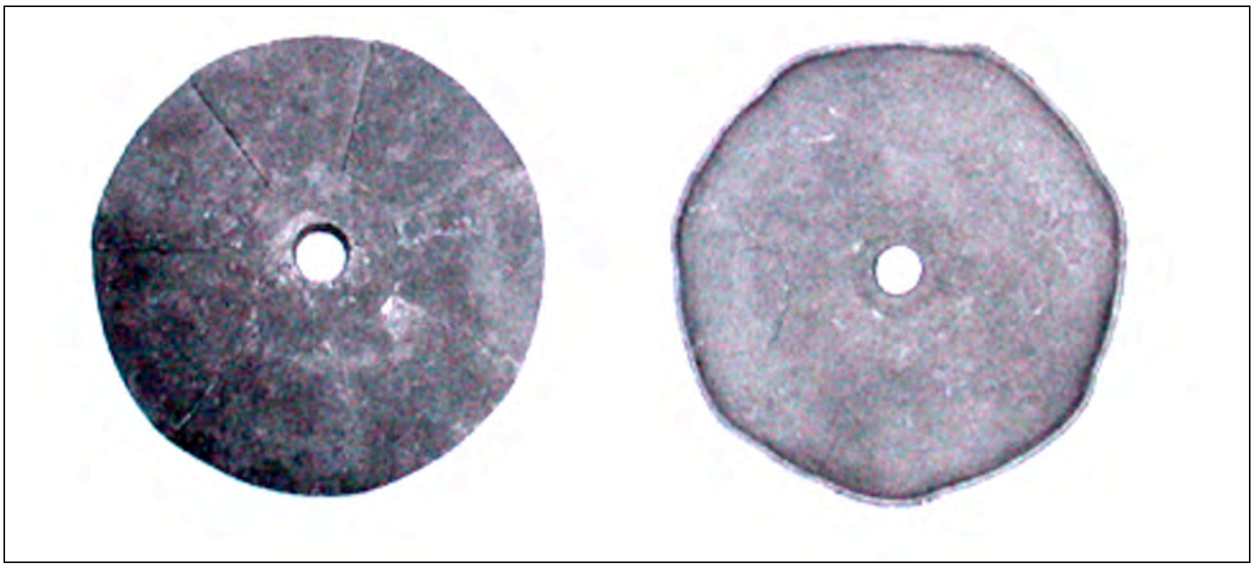


Figure 46. Photograph of 6.4-inch Brooke Copper Ratchet Disk Sabot similar to the one recorded between Cannon No. 2 and No. 3 (as presented in Bell 2003:73).

ROUND SHOT

A single iron round shot was located but not recovered just north of the East Casemate. Approximately 3-inches in diameter, it is possibly associated with Cannon No. 1, whose bore diameter is 3.5 inches. However, it may also be associated with canister or grape shot, both of which are listed in *Georgia's* on-board munitions (see Swanson and Holcombe 2003:83).

MISCELLANEOUS ARTIFACTS

Several miscellaneous artifacts were observed during diving operations, brought to the surface, briefly recorded, and then re-deposited. These included a fragment of a scale balance and a fragment of a chain link. Presented in Figure 47, the balance or beam of a scale from which hung both the weights and the item being weighed, has "V" indentations along its upper edge marking calibrated locations for a corresponding weight (pounds?). The far-left indentation has the number 80 impressed on the original surface, while the number "90" is visible beneath the far right V.

Figure 47. Photograph of balance fragment with an intact end at the right. Note the "V" indentations along the upper edge marking calibrated locations for a corresponding weight.

Also recovered was a small chain link fragment, ovoid in shape and 9.5 centimeters (3.75 in.) wide (Figure 48). Recovered adjacent to the small deteriorated section of casemate and hawse pipe south of the East Casemate, the chain link fragment was associated with other sections of deteriorated fragments of chain.

Figure 48. Photograph of chain link fragment recovered adjacent to the small, deteriorated section of casemate south of the East Casemate.

Because very little information on the design and construction of CSS *Georgia* survives in either the historical or the archaeological record, it is impossible to accurately reconstruct the vessel. However, significant clues are preserved in both historical material and in the surviving remains of the ironclad. By using those data it is possible to develop a reasonable reconstruction of the armored casemate, steam machinery and identify several potential designs for the hull. While archaeological evidence from the wreck site significantly enhances our understanding of CSS *Georgia*'s casemate and machinery, designs for the hull remain hypothetical. Based on historical information and archaeological data associated with other Confederate ironclads and floating battery designs several possible configurations have been generated. All of the hypothetical designs have been developed to support the 120-foot long by 44-foot wide casemate reconstruction and twin propeller steam machinery identified at the wreck site.

CASEMATE RECONSTRUCTION

Based on the archaeological evidence the armored casemate of CSS *Georgia* was approximately 120 feet in length on deck. That dimension reflects the combined length of the two sections of casemate that comprise most of the surviving wreck remains. The largest casemate section measures approximately 73 feet and the smaller section measures approximately 43 feet in length. The width of both sections measures 24 feet. Best measurements of the base of the sections indicated an angle of repose of 45 degrees. One end of each surviving section of the casemate structure was also designed to accommodate the forward and aft casemate sections. Both sections confirmed the ends of the casemate were inclined inward at an angle of 45 degrees. The third, and smallest, section of wreckage could be a fragment of either the forward or aft section (Figure 27 above). That fragment measures 12 feet across the top and approximately 18 feet across the base. It would appear that it could represent the section above the gun port or ports.

Each section of the casemate appears to have been constructed of 4 inches of railroad iron, over 4 inches of horizontal oak, attached to 12 inches of vertical pine backed by an additional 8 inches of horizontal pine timbers (Figure 49). Reconstruction of the casemate was based on those dimensions. The 12-inch pine timbers of the casemate frame would likely have been fastened using horizontal drift pins in a staggered arrangement similar to that employed in the hull of the CSS *Neuse* and CSS *Jackson* (Figure 50). The horizontal courses of 4-inch oak on the exterior and the 8-inch pine on the interior appear to have been attached by drift bolts and possibly spikes. Additional drift bolts fastened the two courses of railroad iron.

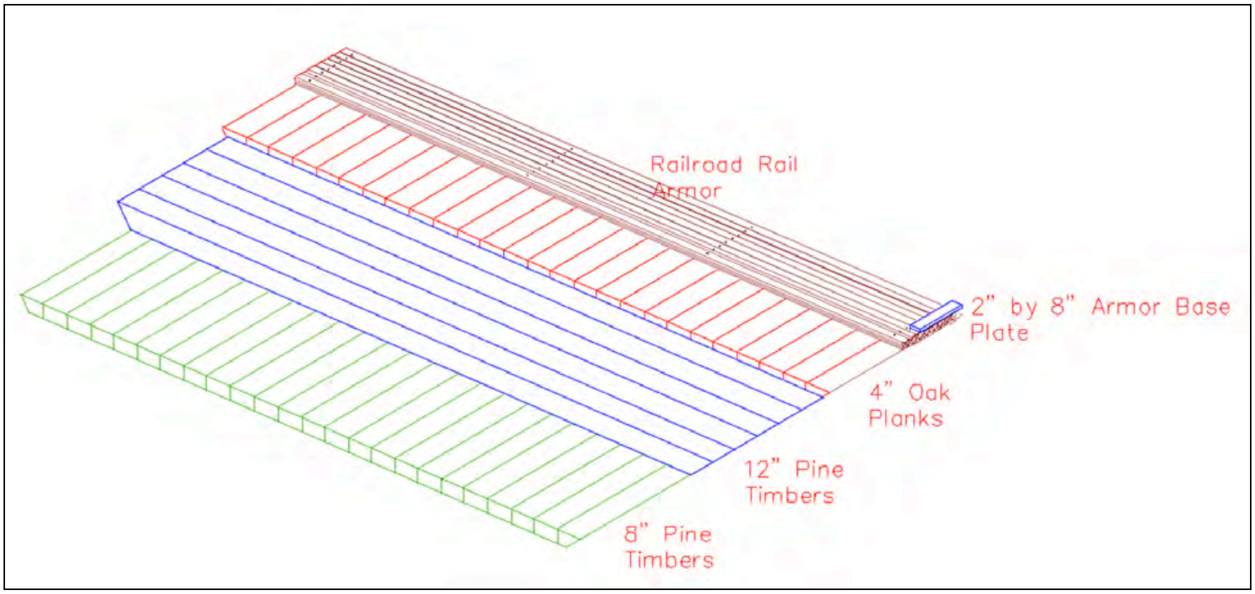


Figure 49. Casemate wall and armor construction configuration.

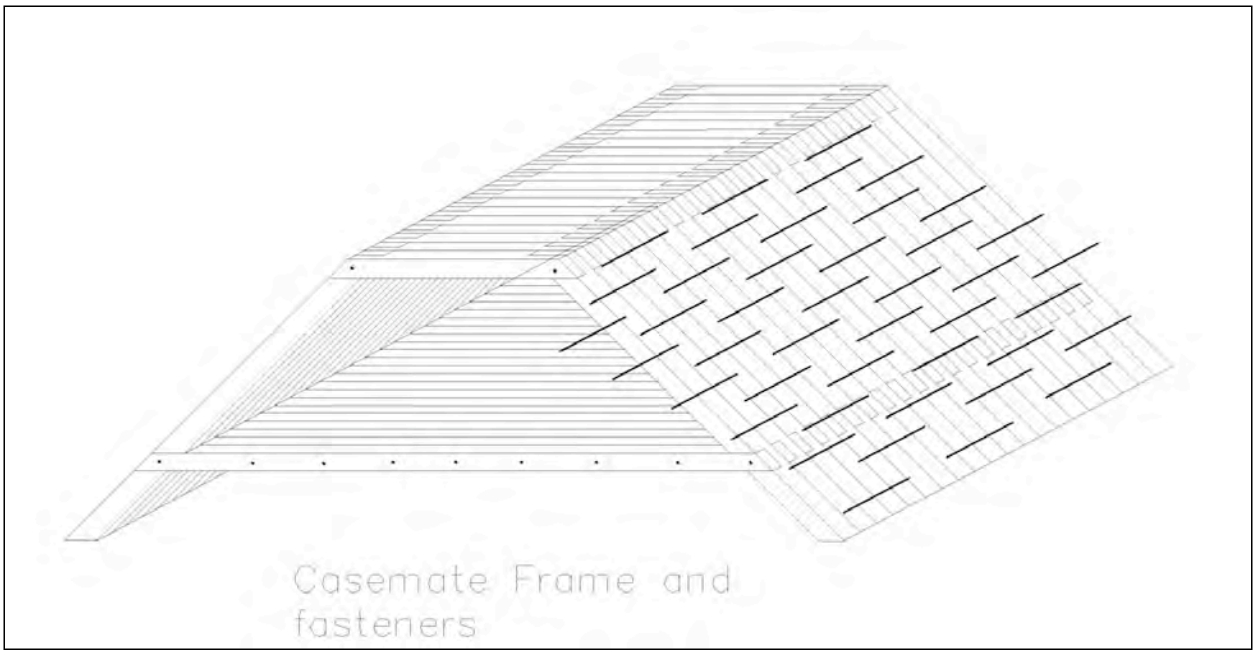


Figure 50. Casemate construction with framing and fastener arrangements.

Additional information for reconstruction of the casemate came from both the archaeological and historical record. A third section of the casemate lying east of the two major elements of that structure also suggests that the angle of repose for the sides of the casement was 45 degrees (see Figure 27 above). That 45-degree angle of repose is confirmed by at least one contemporary observer (Barnwell 1981:207). Reconstruction of the casemate also took into account information from the historical record. One of the most important pieces of evidence is a photograph of a casemated vessel thought to be CSS *Georgia* (Swanson and Holcombe, 2003:60). That image has been partially damaged but documents a vessel with a casemate length approximately seven times the height and an angle of repose of approximately 45 degrees

(Figure 51). Those dimensions alone suggest that the image is likely that of CSS *Georgia*. With the exception of CSS *Virginia*, that configuration would have been unique among Confederate armored vessels. The smoke pipe location aft at approximately 1/4 the length of the top of the casemate is also unique and compares favorably with three historical images of CSS *Georgia* (Figure 52) recorded by artists and published during the war (Swanson and Holcombe, 2003:58-59).

Figure 51. Photograph believed to be CSS *Georgia* showing a vessel with a casemate length approximately seven times the height and an angle of repose of approximately 45 degrees (courtesy of Bob Holcombe).

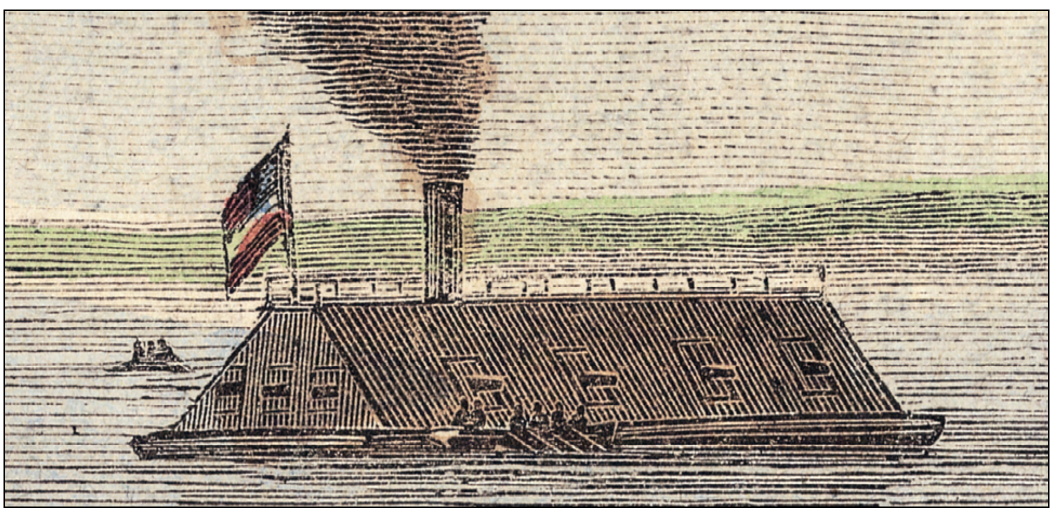


Figure 52. One of three historical images of CSS *Georgia*, this 1863 lithograph compares favorably with the photograph above (as presented in *Frank Leslie's Illustrated Newspaper* February 21, 1863).

The size of that casemate section suggests that the starboard and port sides of the structure were separated by approximately 10 feet at the top (Figure 53). At 45 degrees, that would make the base dimension 44 feet. Ten feet on the top of the casemate would provide sufficient space for the smoke pipe and heat shield, ventilation gratings and manning and serving the two small field pieces that were aboard CSS *Georgia*. The 44-foot width at the base would have provided sufficient space on the gun deck to man and serve the larger ordnance of CSS *Georgia* if the starboard and port gun ports were staggered.

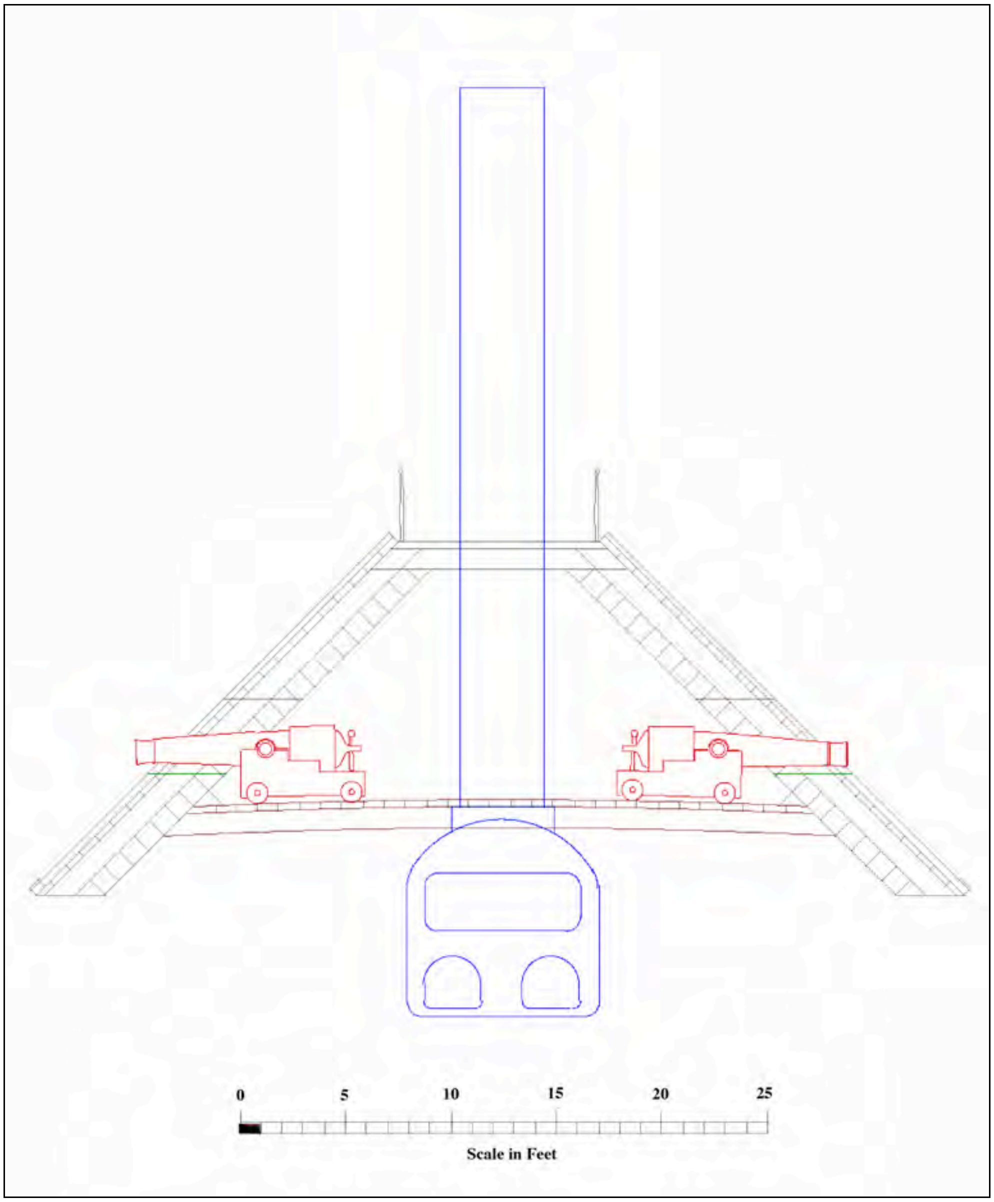


Figure 53. Casemate cross section.

Historical artistic representations of *Georgia* preserve conflicting information about the location of gun ports on both the starboard and port sides of the vessel. Gun ports in the casemate fore and aft are equally inconclusive with images illustrating from one to three ports. The CSS *Georgia* image also sheds light on the location of gun ports on the vessel's starboard side. Three gun ports are apparent in the image. The gun deck reconstruction illustrates one gun port in the stern and two in the bow (Figure 54). Space within the casemate would have supported either configuration. It would appear likely that more than one port would have been included at least at the bow to provide for additional firepower. Port and starboard gun ports in the casemate reconstruction have been staggered to provide more clear deck space for recoil and serving the weapons. With a 29-foot width on the gun deck that configuration appears to be likely. Staggered gun ports were not unknown on Confederate ironclads and were apparently employed on CSS *Virginia* and CSS *Richmond* (Stern 1992:80-81; Still 1971:13; Still 1987:22).

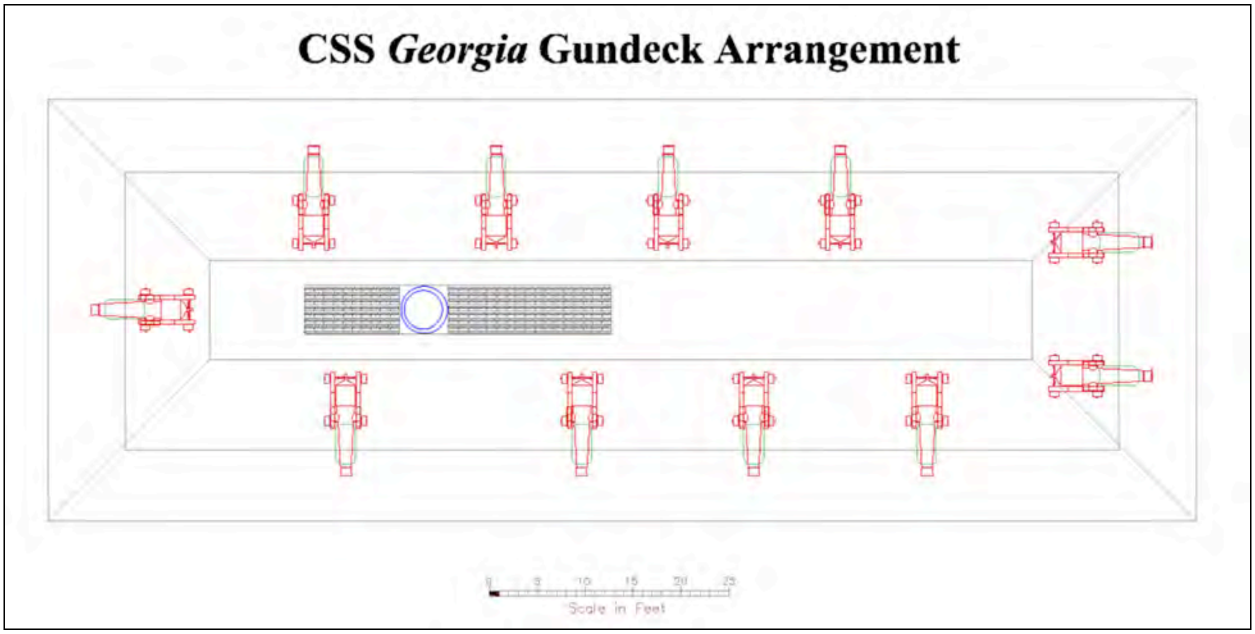


Figure 54. CSS *Georgia* gun deck arrangement.

The location of the gun ports, 8 feet above the base of the casemate, suggests that the gun deck was at least 6 feet above the level of any fore and aft decks (Figure 53). That deck could have been built into the casemate by mortising the ends of the deck beams into the casemate frame and/or interior sheathing (Figure 50). It is also possible that the deck was attached and supported by a shelf or deck clamps. The reconstruction includes camber in the deck that would channel water to the watercourses and assist in absorbing the energy of gun recoil. Over the boiler and machinery, the gun deck has been fitted with a ventilation grate to relieve heat and provide air for the boiler. A similar grate has been designed into the top of the casemate for that purpose and to facilitate clearing smoke from the gun deck (Figure 55). The fore and aft extremities of the top of the reconstructed casemate have been covered with wood and railroad iron for protection from the elements and plunging shot.

Reconstruction of the casemate affords some insight into both the design and displacement of the hull that was constructed for CSS *Georgia*. The 120-foot long by 44-foot wide casemate dictates basic dimensions for the hull. The hull form and length of the bow and stern could vary considerably. However the type of steam machinery found at the wreck site indicates that the hull was designed with sufficient hydrodynamic efficiency to support expectations for "gunboat" performance. That would eliminate the most simplistic forms that have been suggested. One of the critical factors in determining hull form is the displacement required to support the weight of the vessel and armor, machinery, fuel, ordnance, supplies and personnel.

The weight of the casemate and its armor can be calculated using the 120-foot length and 24-foot width of the sides and 44-foot length and 34-foot width of the ends (Figure 55). Those figures produce a total of 2,304 square feet per side of the casemate. Using the 44-foot width and 24-foot height of the ends produces a total of 672 square feet. Doubling both those values produces a total square footage of 5,952; less approximately 100 square feet for gun ports leaves a total of 5,852.

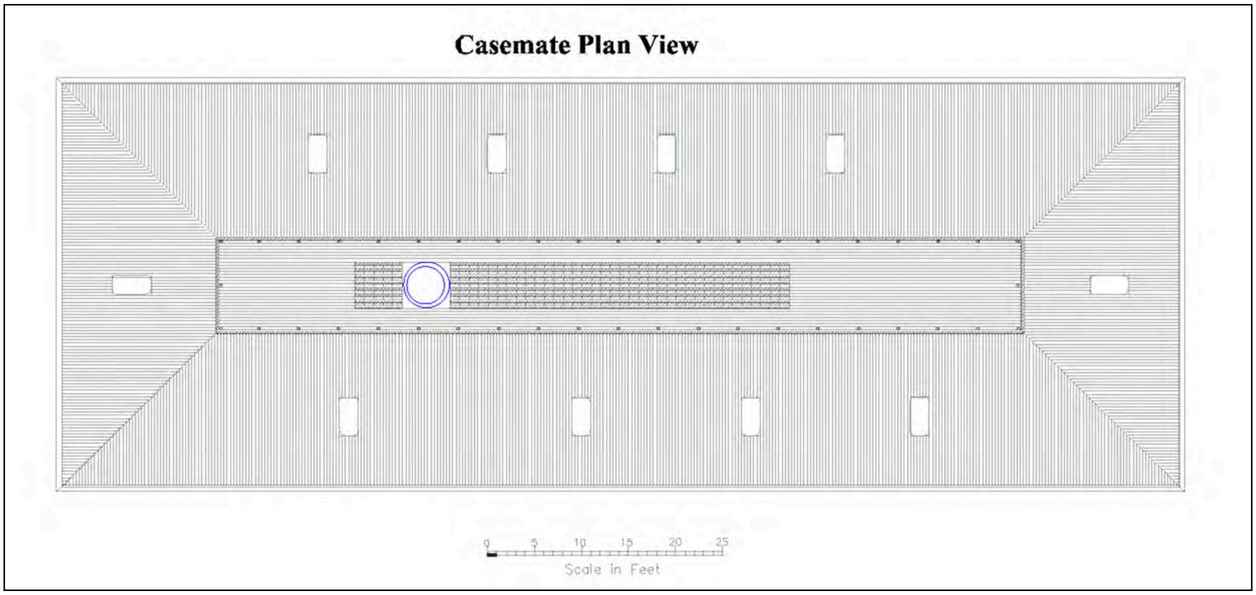


Figure 55. CSS *Georgia* casemate plan view.

The weight of railroad iron rails varied considerably during the 19th century. Using a conservative weight of 18 pounds per foot of railroad iron and the figure of 6 linear feet per square foot a figure of 108 pounds per square foot is produced (Holcombe, pers. com. 11 Nov 2004). Using 108 pounds per square foot and 5,904 square feet the total weight of rail iron appears to be at least 355.58 tons. Armor on the casemate roof and grating has been calculated at 36.78 tons. Fasteners could add another 12 tons to the weight of armor. The total weight of the armor and fasteners in the casemate reconstruction has been calculated to be approximately 404.36 tons.

The weight of wood in the casemate, including a gun deck, can also be calculated. White oak and water oak weigh approximately 47 pounds per square foot cured. Long leaf yellow pine weighs 41 pounds per square foot cured. While green wood weighs more than those figures, cured wood would have been preferred for construction. Whether it was available is not known. Based on evidence from the wreck site, each square foot of casemate would be composed of a 4-inch layer of oak, a 12-inch layer of pine and a final 8-inch layer of pine. The 4-inch layer of oak would weigh approximately 16 pounds, the 12-inch layer of pine would weigh 41 pounds, and the 8-inch layer of pine would weigh about 28 pounds per square foot. Each square foot of casemate would weigh 85 pounds. With 5,904 square feet of structure, less 710 to compensate for the 45-degree bevel on each edge, the total weight would be 250.92 tons. The weight of a gun deck constructed of 12-inch square beams on 24-inch centers and 4-inch pine planks would be an additional 77.66 tons. The top of the casemate could add an additional 20.3 tons of wood. Fasteners could make up another 22 tons to the weight of the casemate structure. The total weight of wood and fasteners in the casemate reconstruction has been calculated to be approximately 370.88 tons.

Construction details associated with surviving remains of the casemate confirm that the structure was built of both pine and oak. The inner liner of the casemate consisted of pine timbers 8 inches thick attached horizontally. The outer liner was a layer of 4-inch thick oak planks also attached horizontally. The casemate frame was fashioned from 12-inch by 12-inch pine timbers positioned vertically. Casemate armor consisted of two vertical layers of railroad iron. The first layer attached upright over the 4-inch oak exterior. The second layer of rail was inverted. Each inverted rail was placed in between two of the initial rails and was attached through the casemate structure by up to five 3/4-inch iron bolts (Figure 56). Although the method of attaching the casemate to a deck or hull remains to be ascertained, it appears to have rested on a deck or deckclamp level with the top of the hull. The method of attachment to the top of the casemate also remains to be determined but it is possible that the vertical 12-inch pine timbers of casemate were notched into top timbers of similar dimensions.

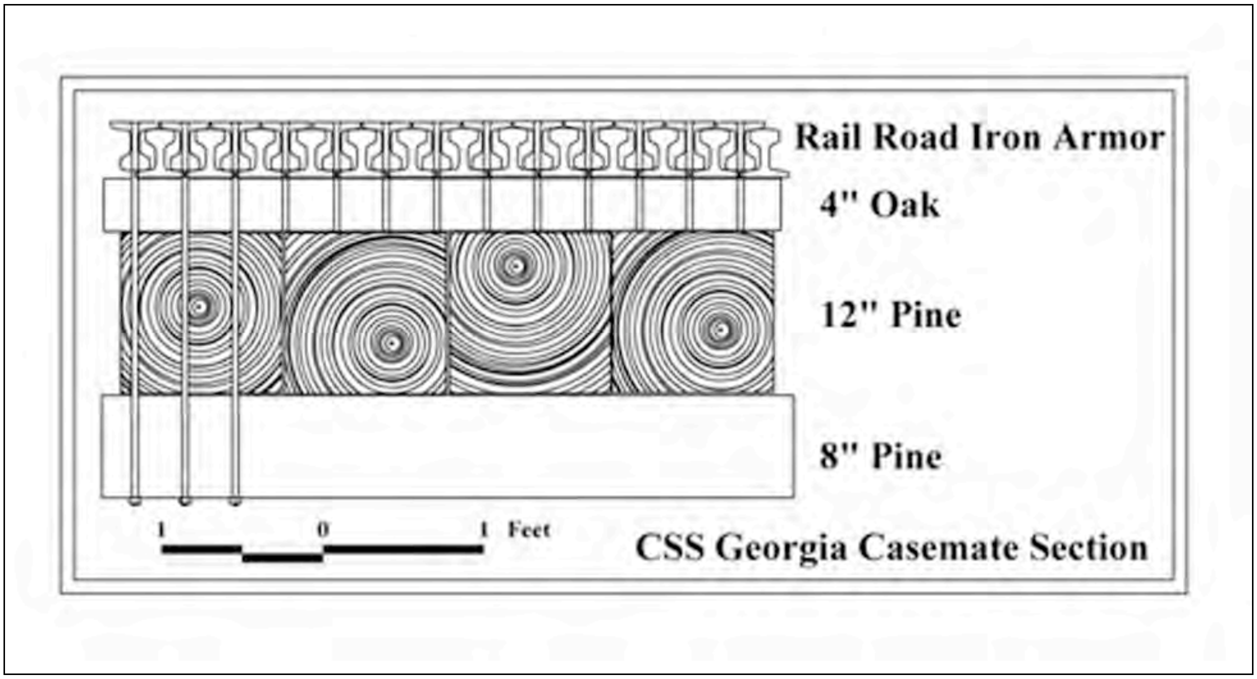


Figure 56. Casemate armor configuration.

STEAM MACHINERY

Historical sources provide only a few clues to the nature of the CSS *Georgia's* steam machinery. As illustrated above, three published images of CSS *Georgia* indicate that the smoke pipe was located in the aft end of the casemate. The historic photograph that appears to be CSS *Georgia* confirms that location. That location for the smoke pipe confirms that the vessel's boiler was located in the stern. No historical evidence survives concerning the type of boiler or boilers that were used in the ironclad. However, fragments of what appear to be a boiler do survive at the wreck site. Those remains suggest that the boiler was rectangular and approximately 18 feet long and 7' 6" in width (see Figure 27 above). A type of boiler common at the time and perhaps available in the Savannah area was a marine version of the locomotive configuration. That style boiler was designed around a vertical rectangular firebox and a horizontal cylindrical return flue water chamber (Figure 57). This was perhaps the most common American design until the last quarter of the 19th century. An excellent example was found in the remains of a 19th century tug excavated on Hutchinson Island across the river from Savannah (Figure 58). As it was perhaps the most readily available steam plant at the time of CSS *Georgia's* construction, that boiler configuration has been used in reconstruction (Figure 59).

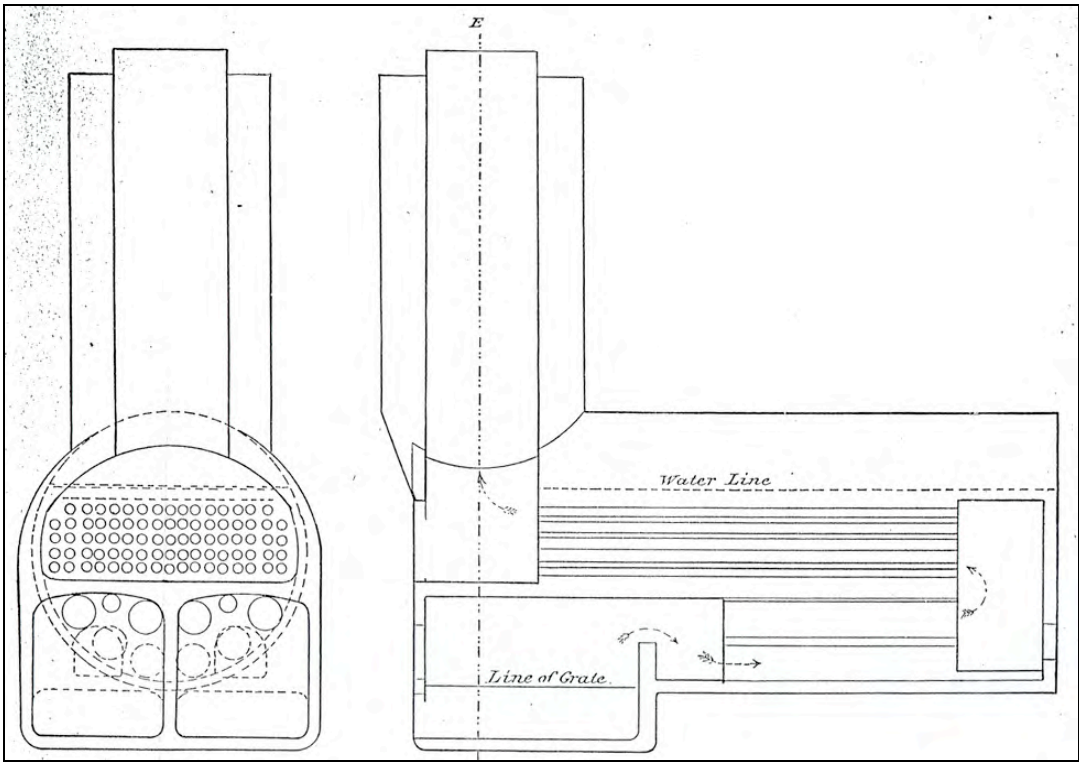


Figure 57. Historical boiler drawing (as presented in United States Department of the Interior 1888:57).

Figure 58. Photograph of Savannah/Fig Island tug boiler (as presented in Tidewater Atlantic Research 1992).

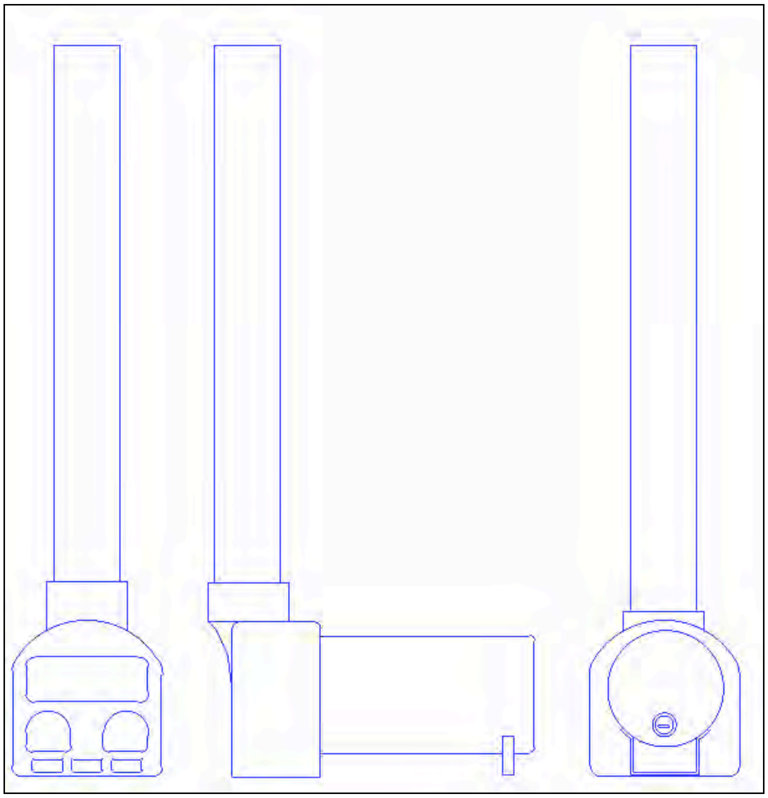


Figure 59. CSS *Georgia* boiler reconstruction.

Historical sources indicate that CSS *Georgia* was powered by "a double engine and twin propellers" (Barnwell 1981:203, 206-208; Melton 2002:19). That description has been confirmed at the wreck site. The 2003 investigation of CSS *Georgia*'s remains identified a propeller and shaft, two steam cylinders, a condenser, and several pipe fittings (see Figure 27 above). The three-blade propeller measured 8 feet in diameter. It was mounted on a 6-inch diameter shaft approximately 12 feet 6 inches in length (Figure 60). The configuration of the Strut, cutlass bearing, and stuffing gland indicate that the propeller was mounded relatively close to the side of the hull and not in the sternpost.

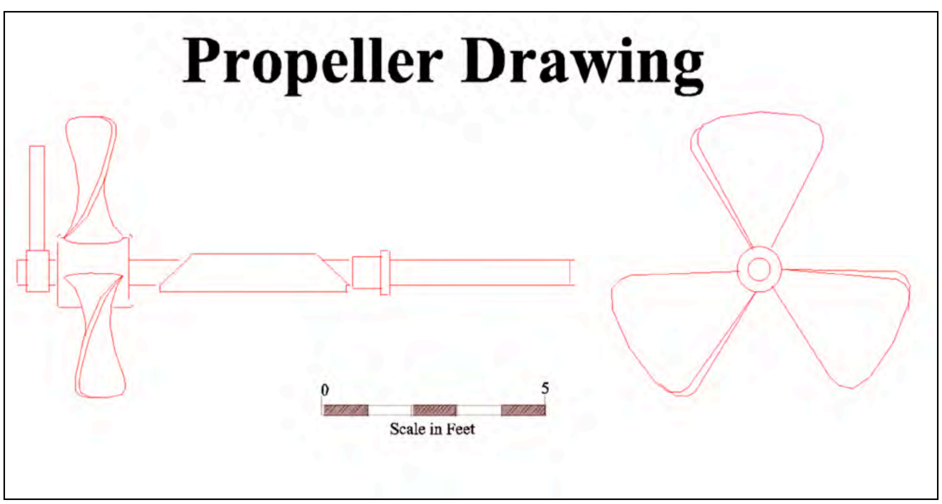


Figure 60. AutoCAD line drawing of propeller and shaft.

The propellers of CSS *Georgia* were turned by short stroke steam cylinders. Two steam cylinders were identified during investigation of the wreck in 2003 (see Figure 27 above). There is insufficient evidence from the wreck site to determine if one or two cylinders were attached to each propeller and whether there was any mechanical advantage. However, historical sources and archaeological evidence from other Civil War vessels suggest answers to those questions. The cylinder dimensions, approximately 18 inch bore and 26-inch stroke, compare with those of the gunboat CSS *Chattahoochee* (Figure 61). *Chattahoochee*'s cylinder dimensions are approximately 28-inch bore and 20-inch stroke and each is direct acting (Watts et al. 1990:42). As at least one historical source refers to a "double engine" and each cylinder was commonly referred to as an engine it would appear that *Georgia* was fitted with a direct acting single cylinder engine for each screw (Barnwell 1981:203, 206-208; Melton 2002:19). That arrangement was common in spite of the potential for bottom dead center problems. Two cylinder per screw designs were also in use at the time but they were rare and most, such as those in the blockade runner *Hebe*, (Figure 62) were produced in Great Britain (Watts 1997:297). Although no evidence was found at the *Georgia* wreck site, each propeller shaft was likely supported by one or more pillow block bearings and a thrust bearing.

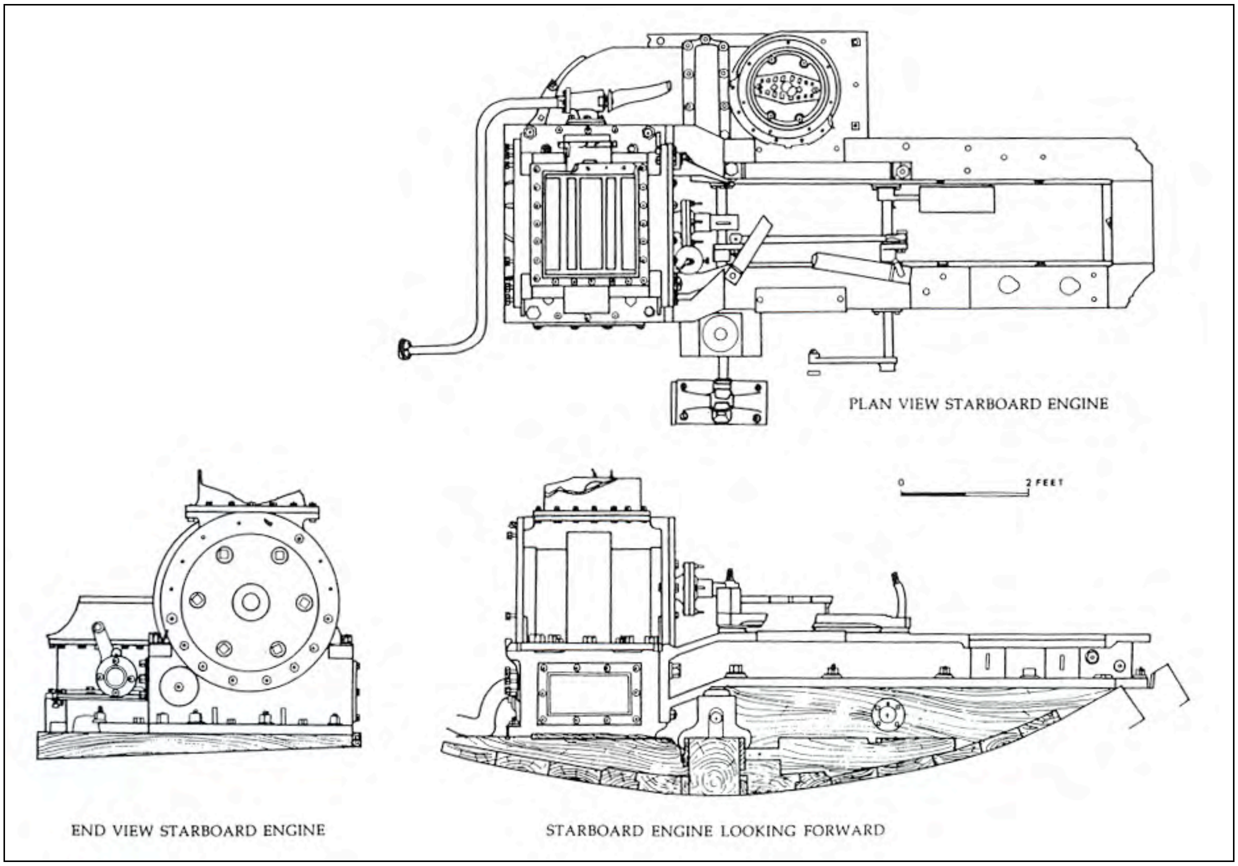


Figure 61. Drawing of the CSS *Chattahoochee* engines (as presented in Watts et al. 1990:44).

While a double cylinder arrangement is possible, the reconstruction has been based on a single cylinder per propeller configuration. Like the *Chattahoochee* engines those of *Georgia* were probably mounted on iron frames that were fitted with pillow blocks for the propeller shaft and bell crank (Figure 63). That frame would also have been employed to mount the crosshead. Both cylinders were upside down on the river bottom making the valve chest inaccessible during the 2003 investigation. However, like the *Chattahoochee*, both cylinders were likely fitted with slide valves operated by eccentrics that functioned off the propeller shaft. The cylinders have been place in the hull in a staggered orientation similar to *Chattahoochee*. As no evidence of the design of the valve chest, eccentrics and reversing gear is available those details have been omitted. The bell cranks and crossheads are based on the cylinder diameter and stroke.

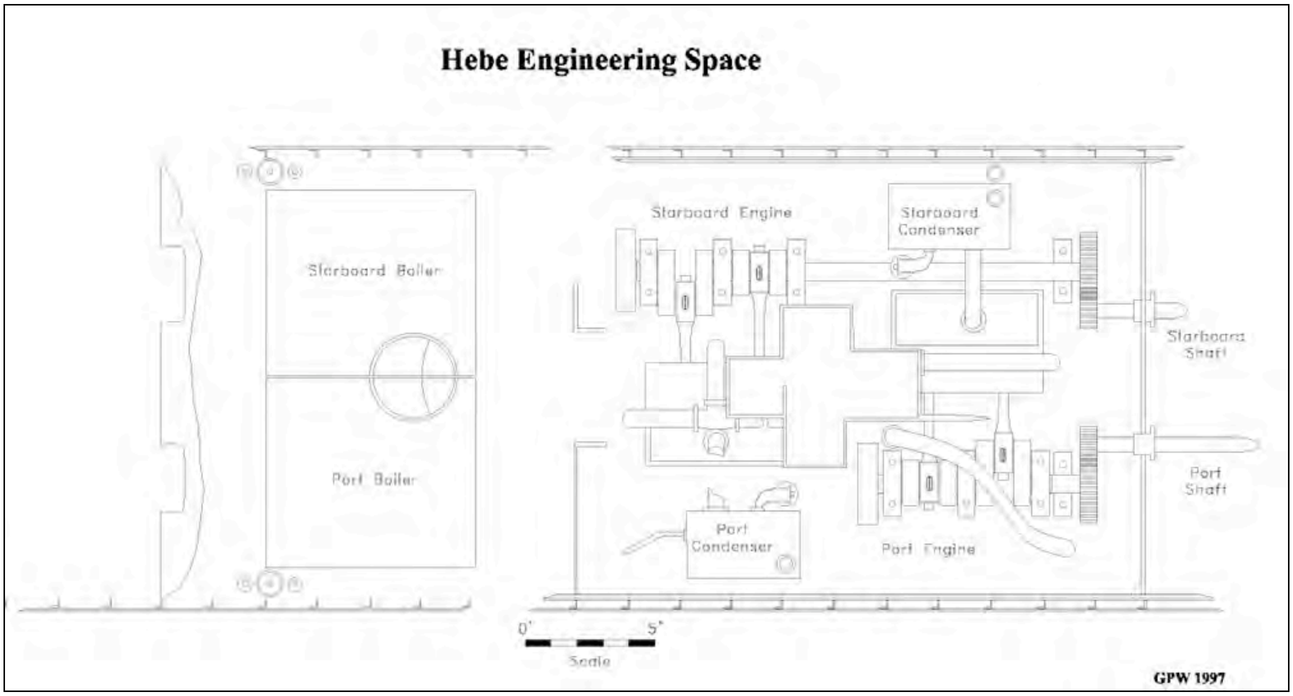


Figure 62. Drawing of the *Hebe* engine room (courtesy of Watts 1994).

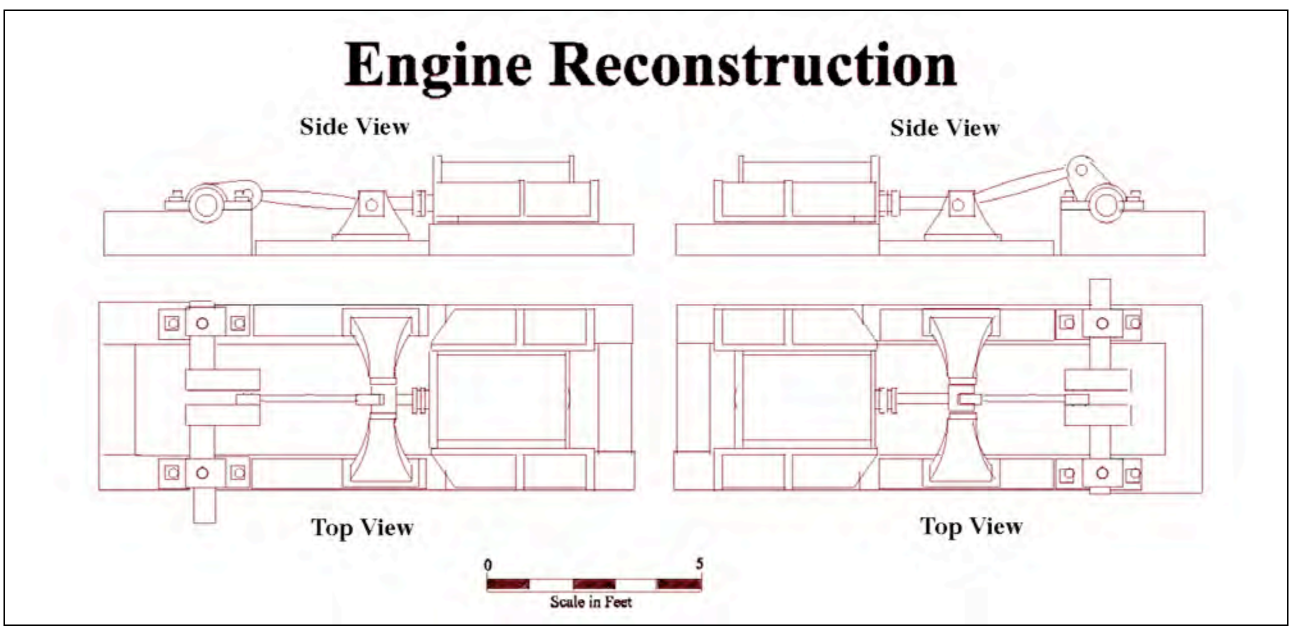


Figure 63. Reconstruction of CSS *Georgia* engines.

Because of the salt and sediment content of the Savannah River *Georgia* was fitted with one or more steam condensers (see Site Plan, Figure 27). What appears to be one of the condensers was found in the immediate vicinity of the 32-pounder smoothbore south of the largest section of casemate. The cylindrical condenser measured 9 feet 4 inches in length and is 20 inches in diameter (Figure 64). Cylindrical condensers were not uncommon during the period and most vessels operating in salt, brackish or high sediment environments would likely be fitted with a condenser. The length and diameter of the cylinder suggests that there was one condenser for each of *Georgia*'s steam cylinders.

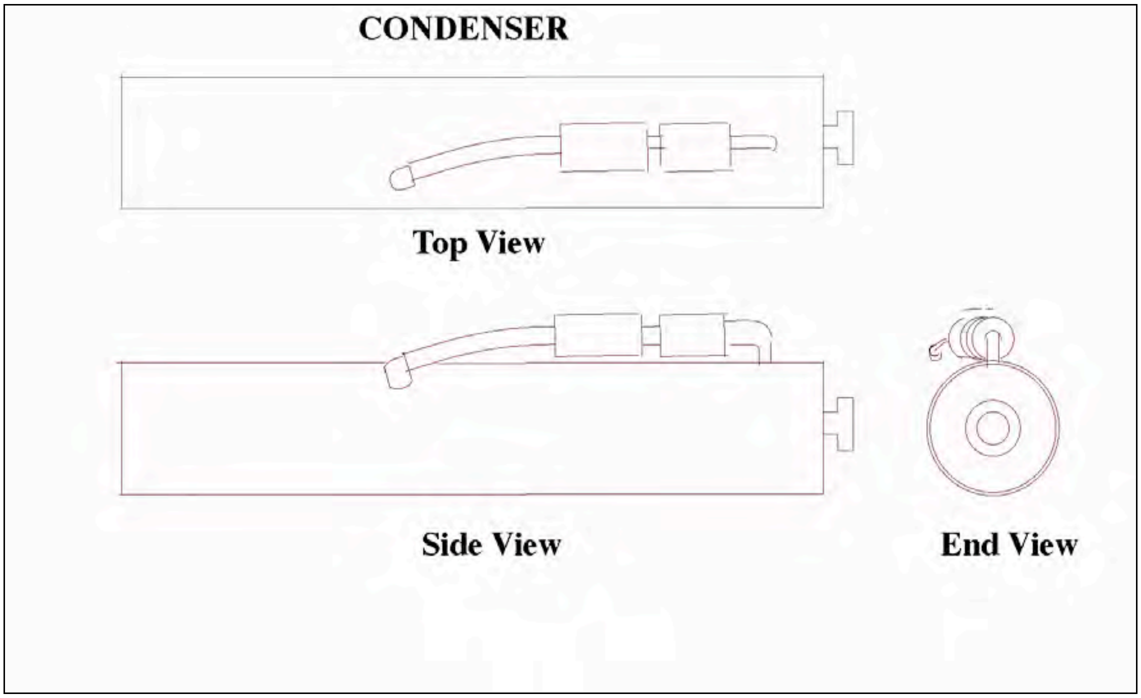


Figure 64. AutoCAD line drawing of condenser located on the site.

The source of CSS *Georgia*'s steam machinery remains to be identified. However, it would not have been beyond the capability of Savannah ironworks to cast machinery for the vessel. The foundry of Alvin N. Miller cast steam cylinders for a locomotive for the Savannah, Skidaway, and Seaboard Railroad a decade before construction of CSS *Georgia*. Miller also proposed to cast six 32-pounders for the state of Georgia in December 1860 and in June 1861 he produced a 10-inch mortar that weighed 8,000 pounds (Swanson and Holcombe 2003:49). Clearly his foundry had the capacity to produce *Georgia*'s machinery. Another possibility might be the machinery of the steamer *Emma*. According to Lamar, *Emma* was fitted with "two disconnected engines" and in rough water the boiler did not "make enough steam" (Swanson and Holcombe 2003:69). The "disconnected " engines could well refer to independently operating steam cylinders like those identified at the wreck site. While *Emma's* owner did not apparently sell the vessel to Lamar, the steamer was run aground and burned (Swanson and Holcombe 2003:70). That might have destroyed the vessel but it likely did not destroy the machinery or steam plant. Salvage of those items would have been well within the capacity of Savannah or Confederate engineers. Unfortunately, no information on *Augusta Emma* can be identified in the Lytle-Holdcamper list of Merchant steam Vessels of the United States (Lytle-Holdcamper 1975:64).

Hull Designs

Although no evidence of the hull of CSS *Georgia* was identified during the 2003 investigation, the casemate size and configuration, steam machinery and the combined weight of the ordnance, fuel, supplies, crew and equipment can be used to support several hypothetical designs. Five have been identified based on the on-site archaeological record, historical source material, and evidence from the remains of other Civil War vessels.

The most simplistic of the hypothetical hull configurations is a barge. While no doubt one of the least likely to have been employed, that design could certainly have carried the vessel's weight and would have insured the ironclad's almost complete lack of performance under power. The second hull design is based on a seagoing hull configuration such as was employed for the CSS *Richmond* class vessels and CSS *Milledgeville*. That form might have been as unlikely as the barge configuration but would have certainly contributed to obtaining the performance expected of a gunboat.

Two hull permutations are based on the armored battery concepts of Brooke and Porter. Like CSS *Virginia* (Figure 68) both designs include bow and stern that extended well beyond the longitudinal extremities of the casemate. Like *Virginia*, decks covering the hull extensions are at or even below the waterline (Stern 1992:80, Still 1971:13; Still 1987:60). This could explain the contemporary images and expectations for gunboat performance. One of the Porter/Brooke hull design concepts developed for CSS *Georgia* is based on a hard chine hull with a rounded bow and stern. The second Porter/Brooke design concept developed for CSS *Georgia* also has a round bow and stern but the hard chine hull has the more hydrodynamic lines of a bluff bow and stern vessel like a canal barge.

A fourth design is based on the hull configuration of CSS *Mississippi* and CSS *Louisiana*. Although both *Mississippi* and *Louisiana* were dramatically larger than *Georgia*, their hull designs would have been relatively easy to construct and required no compass timber. As the design of CSS *Mississippi* was conceived by Georgian Nelson Tift, his hull-form ideas may well have been shared with the designers and builders of CSS *Georgia*. The final design is based on the hull form of CSS *Jackson* and CSS *Neuse*, with a deck shape resembling those of CSS *Atlanta*, CSS *Mississippi,* and CSS *Louisiana*. Aspects of that configuration were employed in Georgia-built vessels and the design would have required a limited amount of compass timber at best.

Each of the possible hull designs is based on supporting the 775.24-ton casemate reconstructed on the basis of historical, photographic, and archaeological evidence. Based on the steam machinery identified at the site and data from both the historical and archaeological record, a total weight for the CSS *Georgia's* propulsion equipment has been calculated at 42 tons. That figure includes boiler water weight. CSS *Georgia* could have easily carried 100 tons of coal and that weight has been used for fuel in the designs. The total weight of ordnance, including cannon, carriages, shot, and powder has been calculated at 50.5 tons. That figure is based on a 10 gun main battery and two small deck guns. Potable water and supplies could easily have added another 8 tons and the crew and their possessions could have weighed 6 tons. Those figures total

981.74 tons that each hull design would have to carry in addition to the weight of the hull structure.

The photograph, like virtually all of the artist's images of CSS *Georgia*, suggests that there is no visible evidence of the hull beyond the extremities of the casemate. Only one of the artist's representations, published in *Frank Leslie's Illustrated Newspaper* on 21 February 1863, provides an indication that the hull extended fore and aft beyond the casemate. However, it is worthwhile to note that contemporary artist's illustrations of CSS *Louisiana* and CSS *Chicora* do not show decks fore and aft of the casemate. The *Louisiana* illustration (Figure 65) clearly does not convey the extensive fore and aft deck that plans of the vessel confirm. Similarly, the artist illustration of CSS *Chicora* (Figure 66) does not document the deck structures readily apparent in a contemporary photograph of the ironclad (Figure 67). Those illustrations confirm the possibility and all likelihood that artistic representations of CSS *Georgia* cannot be relied upon to confirm a lack of fore and aft hull and deck structure.

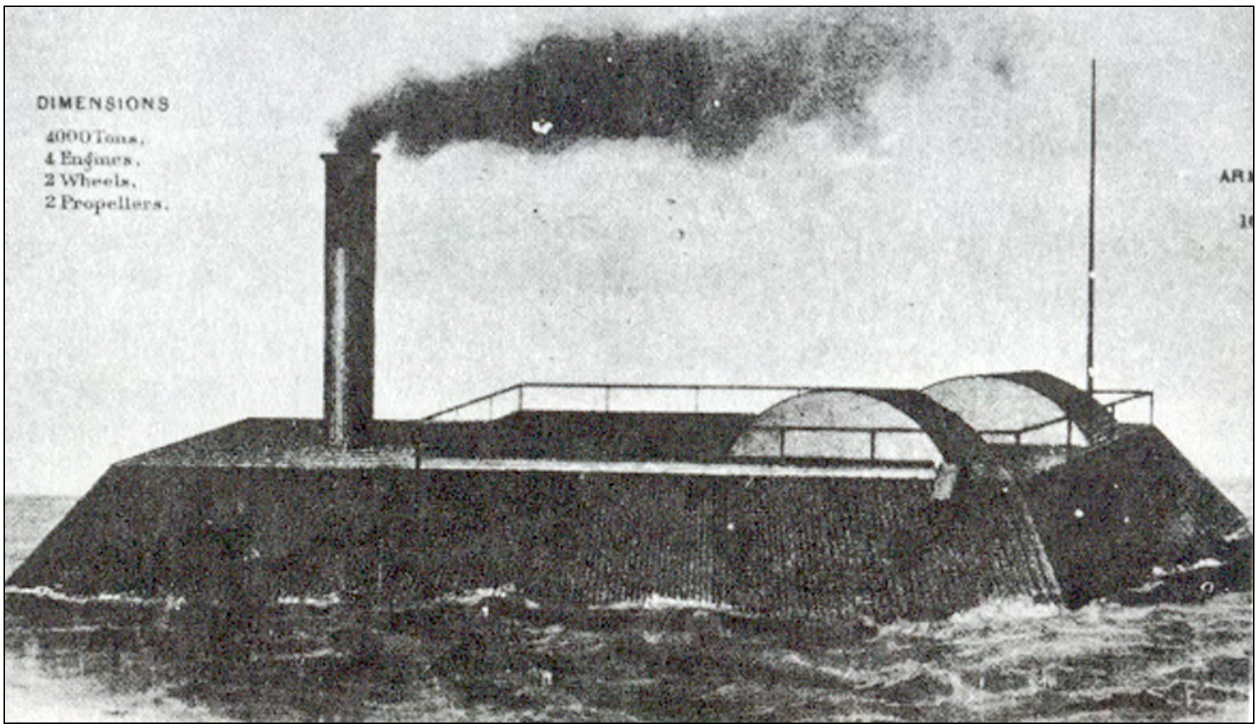


Figure 65. Contemporary illustration of CSS *Louisiana* (As presented in Stern 1992:101).

It is still possible that the hull did not extend beyond the casemate. However, that would create both displacement and hydrodynamic problems. It is also possible that the hull fore and aft of the casemate was at or below the waterline as was the case with CSS *Virginia* (Figure 68). Extending the hull fore and aft of the casemate would have increased displacement and reserve buoyancy and permitted a more hydrodynamic design to be adopted for the hull. In a letter written on 19 May 1862, the day CSS *Georgia* was launched, Gazaway Bugg Lamar noted that the armor had not been completed "on the roofing and the bow and stern." While that could mean the fore and aft sections of the casemate itself, it could also suggest that the hull extended beyond the casemate and plans called for cladding those decks (Swanson and Holcombe 2003:33).

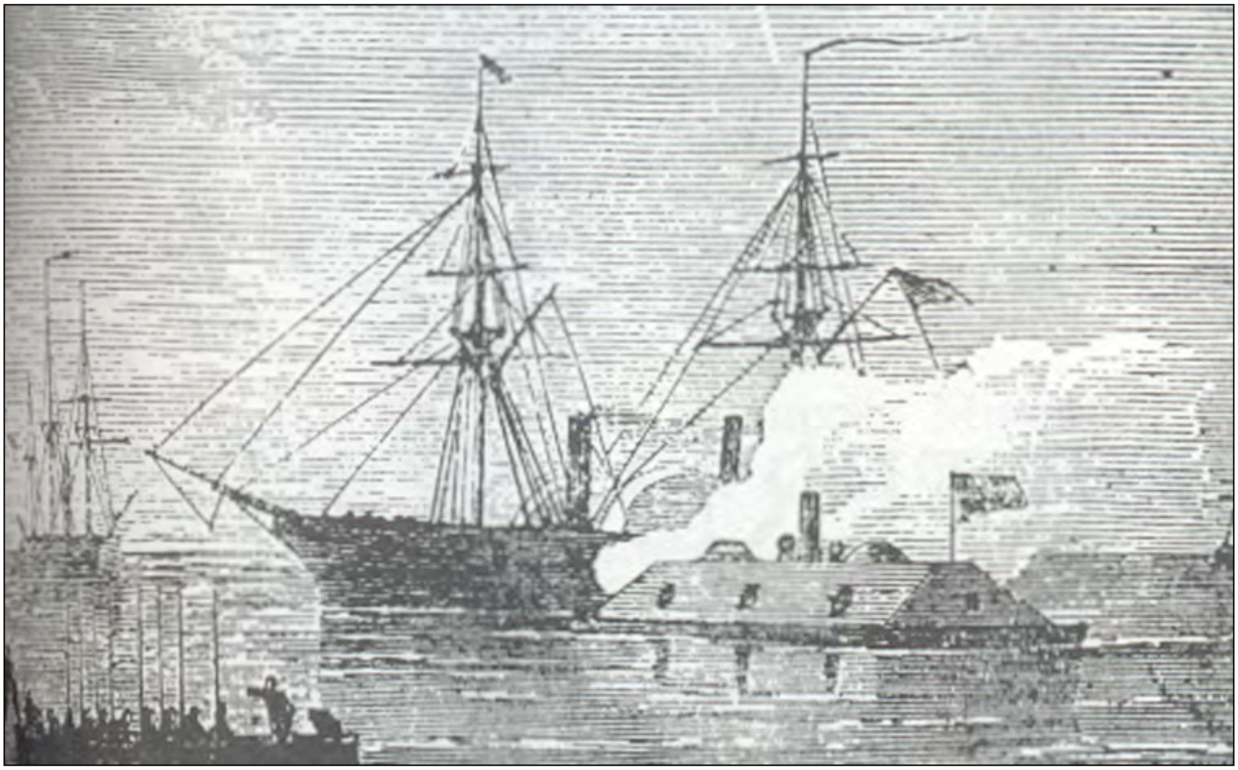


Figure 66. Contemporary illustration of CSS *Chicora* (as presented in Stern 1992:130).

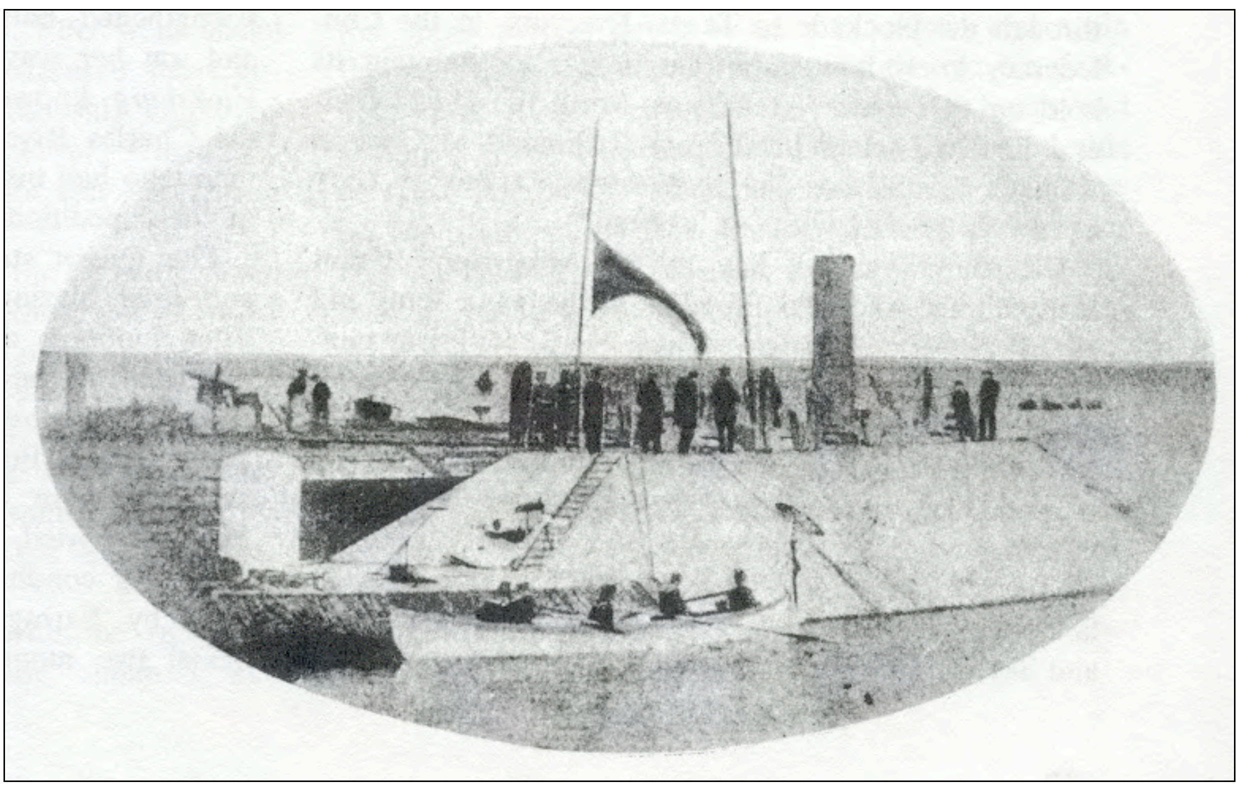


Figure 67. Contemporary photograph of CSS *Chicora* (as presented in Stern 1992:130).

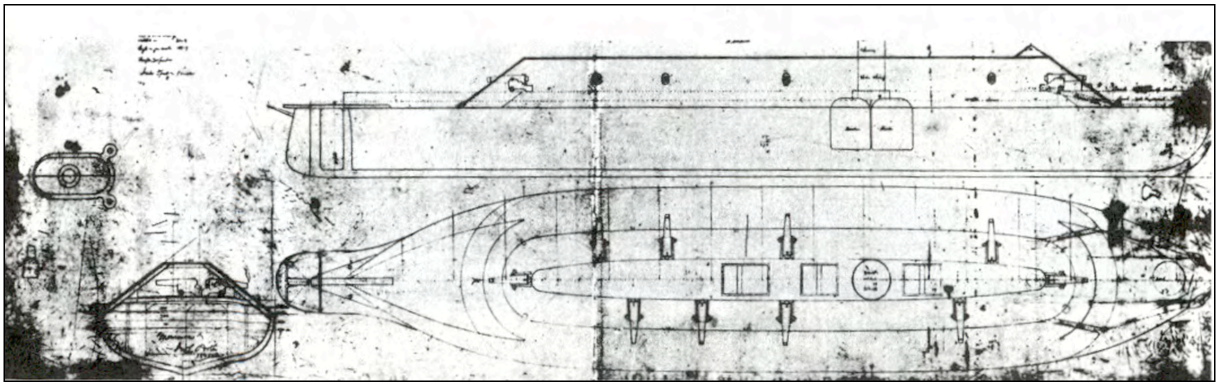


Figure 68. Porter plans of CSS *Virginia* (as presented in Stern 1992:80).

BARGE HULL CONFIGURATION

Based on the concept that the hull did not extend beyond the casemate, or extended only marginally beyond the casemate, a barge-like hull would have provided the most appropriate form and displacement. That design would have also ensured the hydrodynamic problems that could have been in part responsible for the lack of speed and maneuverability of CSS *Georgia*. However, it would seem that this form would be the most unthinkable configuration that anyone familiar with even the rudiments of ship design and construction would adopt. As the design for the CSS *Georgia* may never have been approved by the Confederate Chief Naval Constructor, it may well have lacked engineering merit. However, the participation of men such as A. N. Miller, Gazaway B. Lamar, and likely Josiah Tattnall should have ensured that the design was the most functional and seaworthy given the resources available. It would seem that either the gunboat or the steam battery concept would include provisions for a more hydrodynamic hull form.

The most elementary design for the hull of CSS *Georgia* could have been a barge with ramped ends. That form could have been quickly built and would have required only saw cut timber for construction. A barge hull design would have required little of the shipwrights' skills necessary for a more complex and hydrodynamic form. The 21 February 1863 Frank Leslie's illustration suggests that there were short decks or bulwarks on submerged deck structures fore and aft of the casemate (see Figure 52 above).

A barge-built hull of sufficient strength to support the 120-foot long, 44-foot wide casemate of CSS *Georgia* would likely have been slightly longer but equal in width. The additional length would have provided buoyancy at the bow and stern to compensate for loss due to the ramps and additional weight of the casemate ends. In the stern additional displacement would be necessary to compensate for machinery weight and provide a configuration adaptable for twin screws. In the reconstruction, the bow has been extended 12 feet forward of the end of the casemate and the bow ramp is 45 degrees (Figure 69). As with traditional heavy barge construction, the bottom might have been cross-planked with 1-foot square floor timbers. The method of attachment might have been staggered drift pins similar to that employed in constructing the bottom of the *Jackson*. The sides of the hull would likely have been constructed of stacked and similarly pinned timbers 1-foot square. It is also possible that the sides of the barge were constructed of vertical, 1-foot square timbers notched into the floor timbers and fastened with staggered pins. In

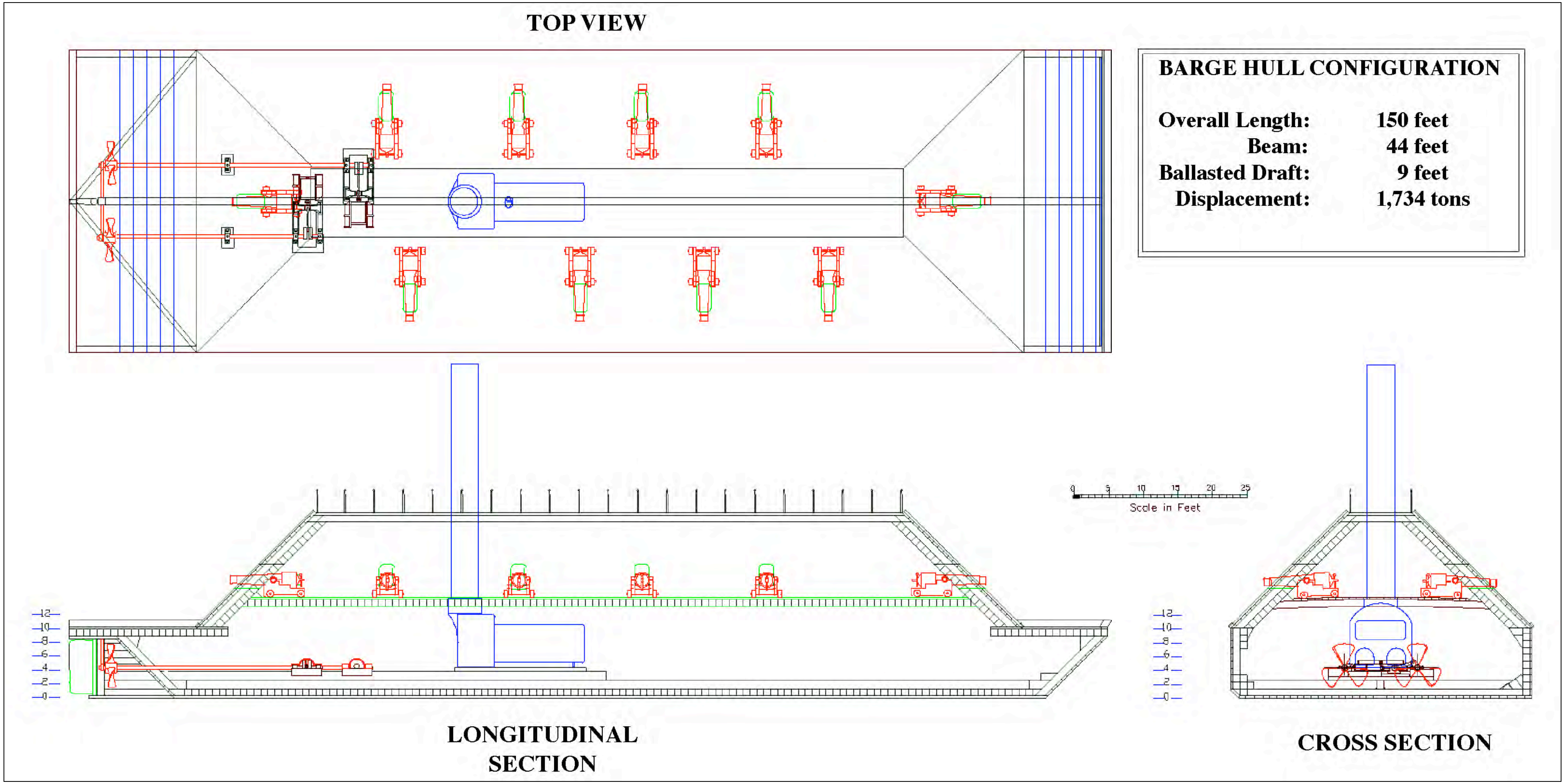


Figure 69. Barge hull configuration.

either case, the chine and gunnel would have been reinforced by heavy longitudinal timbers. Two chine concepts have been illustrated in the barge section drawings. On the right the floors and sides of the hull form a 90 degree angle. While simpler to build, that configuration would have been more susceptible to damage than the beveled chine illustrated on the left side of the hull. At the gunnel those timbers would have formed a clamp or shelf to accommodate the casemate (Figure 69).

The ramps could have been constructed of either longitudinal or athwartships timbers. The top and bottom of the ramps would likely have been reinforced by heavy timbers and the top would have included a shelf or clamp for the deck. The stern, aft of the ramp would have no doubt been formed by a platform extending aft to protect the propellers and rudder. A skeg and deadwood would have extended aft to accommodate the rudder and cutlass bearing mounts. The entire structure would likely have been planked with 2 1/2 to 3 inch oak. The interior of the barge would have been strengthened with heavy stringers that would also have provided a platform for machinery and support for deck structures. Both the fore and aft decks might have been fitted with a timber structure extending from the casemate corners to the bow and stern to provide some marginal protection from water on the bow and stern. That arrangement is suggested in one of the contemporary artistic illustrations of the vessel (see Figure 52). Both the bow and stern decks have been fitted with bulwarks to channel water away from the casemate and provide deck space necessary for vessel handling (Figure 69).

Because of the size of the propellers, 8 feet in diameter, a draft in excess of that would have been desirable. Submerged to a depth of 9 feet the short barge hull would have provided approximately 1,556 tons of displacement. The weight of the vessel, machinery, ordnance, fuel, supplies, and crew with minimal equipage has been calculated at 1,284.5 tons. That would provide approximately 271.5 tons of reserve buoyancy. A portion of that could have been used to ballast the bow of the Georgia thus compensating for the machinery and fuel weight aft of amidships and still maintain a relatively comfortable reserve (Figure 69).

Steam machinery in the barge configuration would have been located in the stern. The boiler would have been mounted between the stringers on a heavy timber bed designed to support a layer of firebrick or cement insulation. Bunkers for coal would likely have been located outboard of the boiler on both sides of the hull. Aft of the boiler the steam cylinders would have been mounted on athwartships beds of sufficient length to provide for pillow blocks for the forward end of the propeller shaft and bell crank or crank wheel. Additional pillow blocks would have supported each shaft between the engine and a stuffing gland. A cutlass bearing supported the end of each shaft and was attached to the ramp and deadwood by 2-×-6 inch struts (Figure 69).

While adoption of the barge hull form could have simplified construction, that configuration would have created serious propulsion and navigation problems. While those problems might have been acceptable in a floating battery they would have seriously compromised the vessel's capacity to operate as a gunboat. The ramp stern would have seriously restricted the flow of water to the propellers causing cavitation and loss of efficiency. That would have made any potential for speed highly unlikely. That design would also have resulted in a serious loss of rudder efficiency. To a degree, it might have been compensated by judicious use of the two propellers at the low speeds required to navigate the battery from one location to another.

For a combat gunboat, that would appear to have been unacceptable. The ramp design of the bow would have only increased the problems associated with navigation. As there were clearly expectations for speed and handling prior to trials of the vessel, it would appear that the adoption of a barge hull would have been highly unlikely. With at least some input into design by Confederate naval constructors and Savannah shipwrights, the barge hull design does not appear to be a very likely candidate regardless of the simplicity of construction. However in the final analysis, numerous factors could have dictated design and construction compromises that would otherwise have made either barge hull form unacceptable.

SAVANNAH/NORTH CAROLINA HULL CONFIGURATION

The vessel lines hull form is based on the designs adopted for the CSS *Richmond* class ironclads, CSS *Savannah*, CSS *Raleigh* and CSS *North Carolina* and the later CSS *Milledgeville*. Both CSS *Savannah* and CSS *Milledgeville* were constructed in Savannah. Their construction demonstrates the capacity of that city's shipbuilders to produce complex ship hull forms when construction materials and labor were even more difficult to obtain than when CSS *Georgia* was built. At the same time it would appear that had CSS *Georgia* been constructed with a hull form similar to the that of *Savannah* or *Milledgeville*, there would not likely have been the number of references to the vessel as a floating battery. While it is perhaps unlikely that CSS *Georgia* was fitted with a hull form of an ironclad gunboat, that configuration cannot be entirely eliminated based on either historical or archaeological information. For that reason the ship lines hull form has been included along with the other possibilities. By comparison the time required to build and launch *Milledgeville*, approximately 18 months, *Georgia* was launched in less than 3 months.

Historical and archaeological information on the *Richmond* class and *Milledgeville* vessels confirms that they were built with deadrise in the floors, a round chine, and vertical sides amidships (Figure 70). While the casemates of the *Richmond* class vessels were contoured to conform to the lines of the hull, *Milledgeville* was designed with a short rectangular casemate similar in design to that of *Georgia* (Figure 71). Unlike the *Richmond* class vessels and *Milledgeville*, *Georgia* apparently did not have an armored knuckle at or below the waterline.

Under the casemate this hull form consists of a rectangle 120 feet in length and 44 feet in width. The overall length of the hull might have been 200 feet (Figure 73). The floors have 3 degrees of deadrise and the bilge is round. Beyond the round chine the hull rises vertically to the bottom of the casemate. Compass timber, likely oak, would have been used in framing the bilge if not throughout the hull. Floors and frames would probably have been 12 inches sided and molded. Room would likely have been double the space as a staggered pattern of framing was the general fashion at the time. That was the case in the lower hull of CSS *North Carolina* (Figure 72). Below the turn of the bilge, stringers might have reinforced the lap between floors and first futtocks and above the turn deck clamps could have reinforced the futtock and top timber laps.

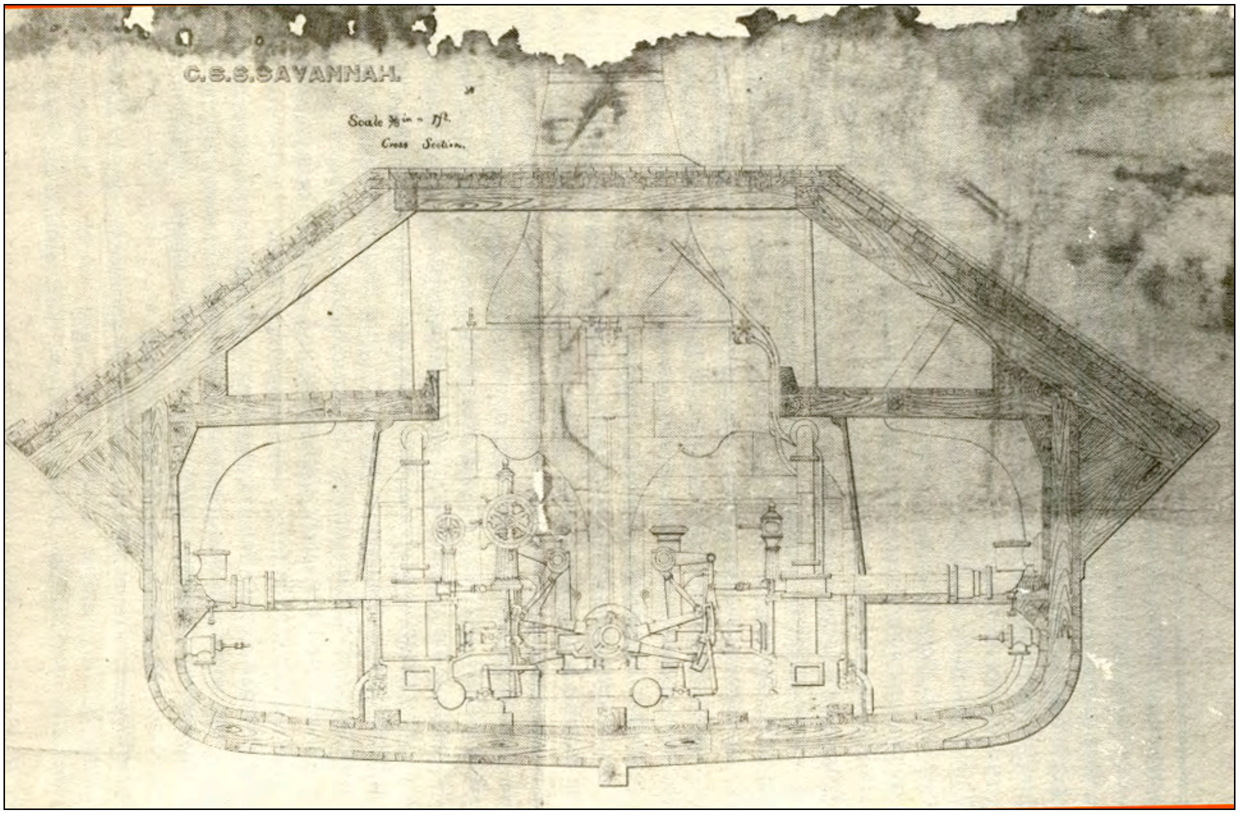


Figure 70. CSS *Savannah* section plan (as presented in Still 1971:14).

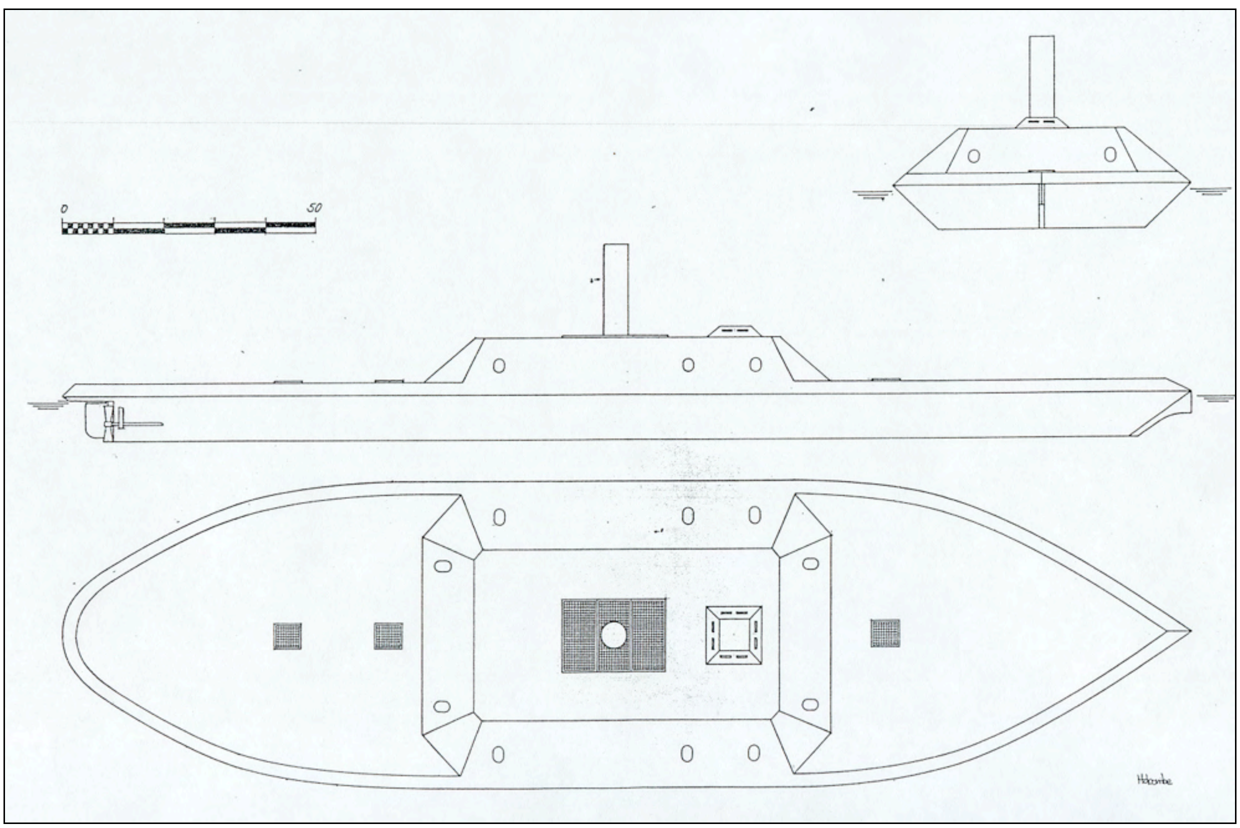


Figure 71. CSS *Milledgeville* drawing (as presented in Holcombe 1993:124).

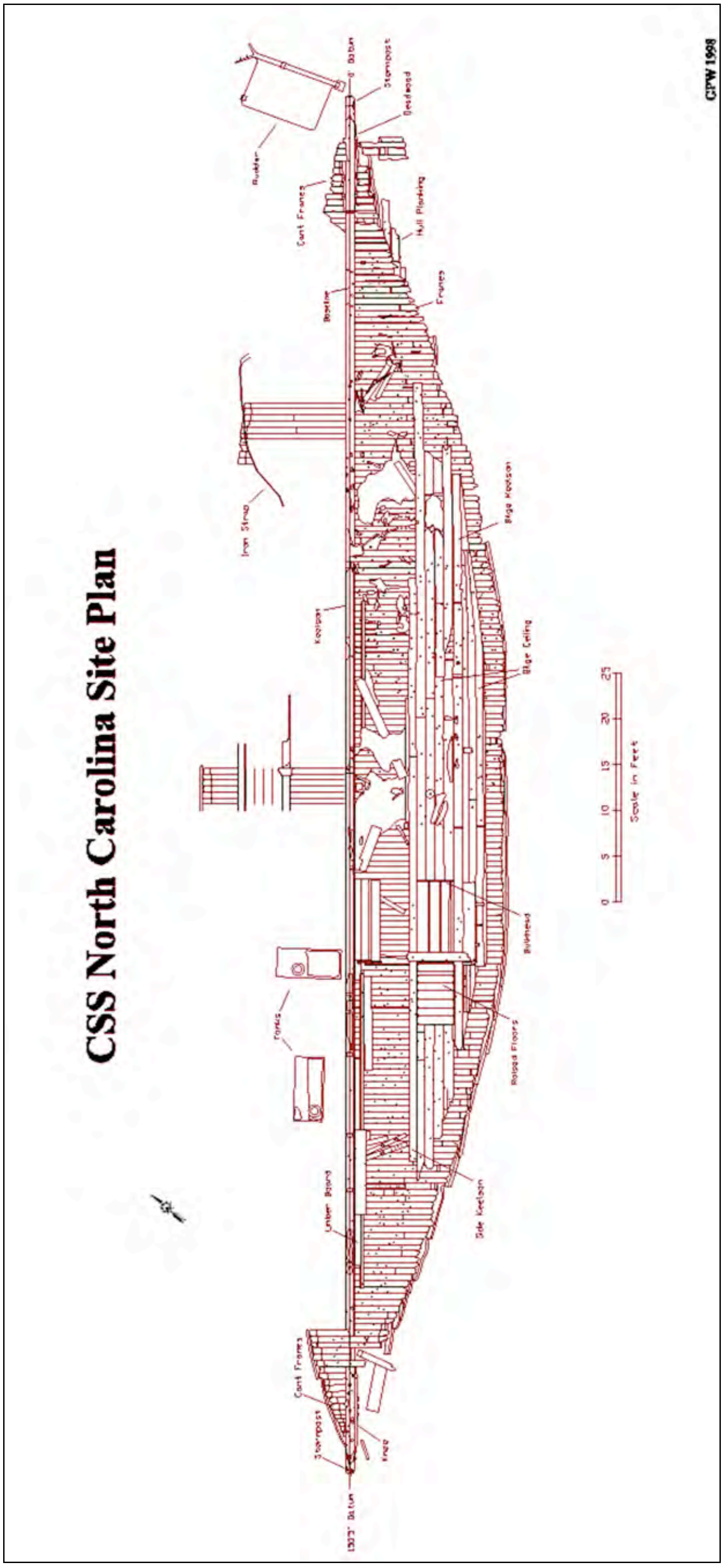


Figure 72. Site Plan of CSS *North Carolina* (As presented in Tidewater Atlantic Research 1999:7).

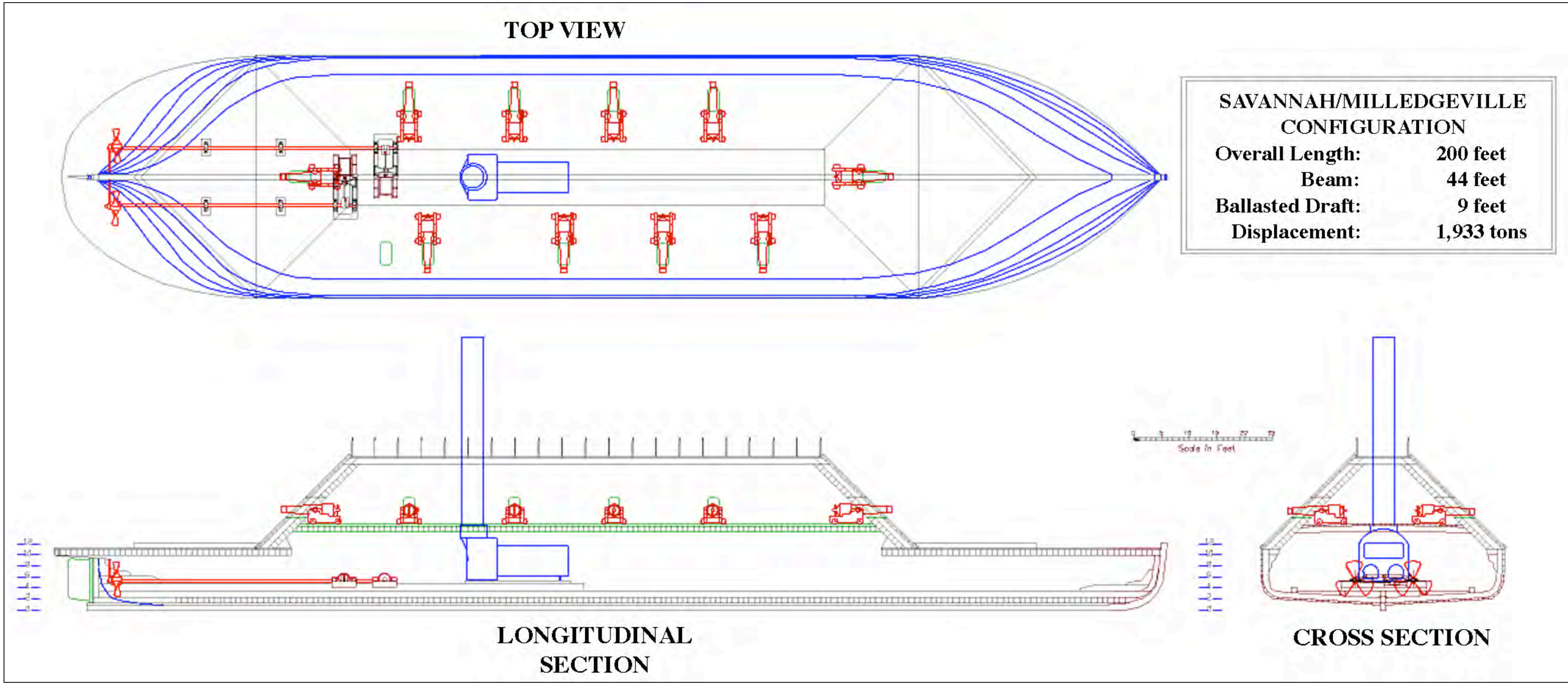


Figure 73. *Savannah/Milledgeville* configuration.

Fore and aft of the casemate, the bow and stern of the ship line's reconstruction has the lines of a vessel designed for performance (Figure 72). The bow extends 45 feet beyond the casemate and includes a sharp entry and hollow forefoot. The stern extends 35 feet aft of the casemate. Underneath an elliptical transom designed to protect the screws and propeller, the waterlines convey a bluff hull faired to the sternpost to give adequate flow to the propellers. Both the bow and stern of this reconstruction would have required compass timber for production of the necessary cant frames. Like *Savannah*, *Milledgeville,* and *North Carolina*, this version of *Georgia* could have planked with 4-inch oak, as considerable bending of the hull planks would have been required in the bow and stern. Both the fore and aft decks are fitted with low bulkheads to deflect water away from the casemate. While *Milledgeville* was apparently not fitted with a keel, a keel has been included on this version of *Georgia's* hull one had been proposed, "to insure her steering" (Savannah Republican 1862).

The ship lines hull configuration is certainly appropriate for a gunboat or ram where speed and maneuverability were a consideration. However, the design would have been relatively complex to build in the short time required for launching *Georgia*. This hull form would also have required a considerable amount of compass timbers which were not as readily available, and were certainly more expensive than straight timbers that could be cut using water and steam powered mill. Hydrodynamically efficient, the design would certainly have reinforced expectations of both maneuverability and speed.

A ship lines hull configuration would have given *Georgia* a total weight of approximately 1,295 tons. That weight includes the vessel hull and casemate, machinery, ordnance, fuel, supplies and crew with minimal equipage. With a 9-foot draft the hull would have produced a displacement of approximately 1,933 tons. That would provide approximately 638 tons of reserve buoyancy. That would have provided capacity for ballasting the bow to compensate for machinery and fuel weight aft of amidships and loading additional ballast for general stability while still maintaining a very comfortable reserve buoyancy. However, to sink the vessel to a point where the decks were at or near the waterline considerable additional ballast would have been required.

The ship lines hull configuration would not have been simple to construct but would have had a hydrodynamic form that reinforced expectations for speed and handling prior to trials of the vessel. It could also have been built with a slightly reduced depth of hold that would have reduced both draft and requirements for additional ballast.

PORTER/BROOKE HULL CONFIGURATIONS

It is almost inevitable that some consideration was given to the Harbor Defense Ironclad concept developed by naval constructor John L. Porter and the plans for an armored vessel developed by Lt. John M. Brooke. Porter's 1861 design was for a 160-foot long casemated ironclad with a beam of 40 feet (Figure 74). A single screw propelled the battery and steam machinery was located in the stern. Below the rounded ends of the casemate there was a hard chine hull with a bluff bow and stern configuration (Still 1971:12-13; Holcombe 1993:10-12). Brooke's design was for a ship's hull approximately 192 feet in length with a beam of approximately 55 feet (Figure 75). An armored casemate approximately 115 feet in length was located on deck and both the bow and stern extended beyond the casemate at the water level. Both bow and stern are fitted with what Brooke called a false bow and stern to deflect water from the casemate (Holcombe 1993:8-9). The form of those bulkheads is similar to those of CSS *Louisiana* (Holcombe 1993:48). Brooke's virtually submerged bow and stern design was subsequently used in Confederate alteration of the salvaged USS *Merrimack* (Still 1971:114-15). Design information generated by both Brooke and Porter would have been available to consideration in designing CSS *Georgia*.

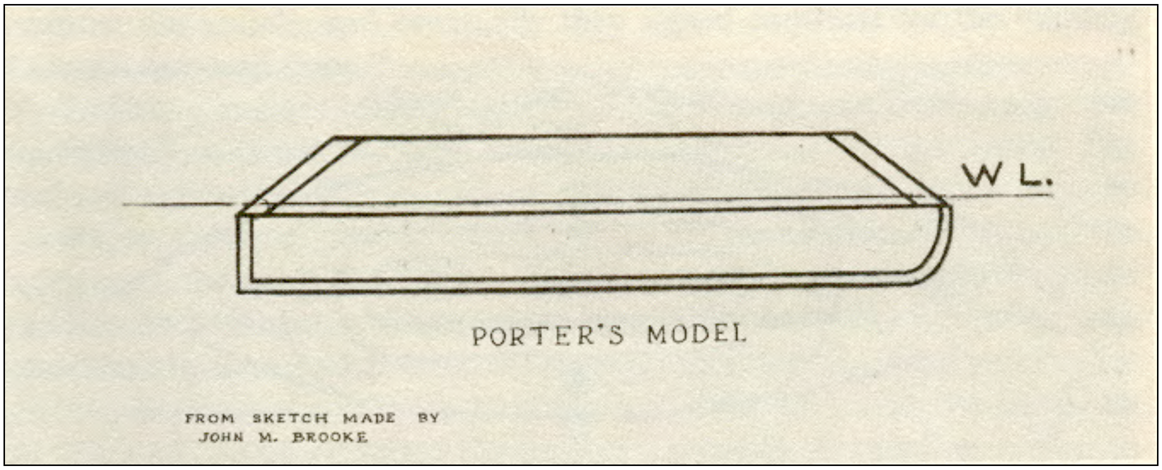


Figure 74. Porter harbor defense ironclad design concept (as presented in Still 1971:14).

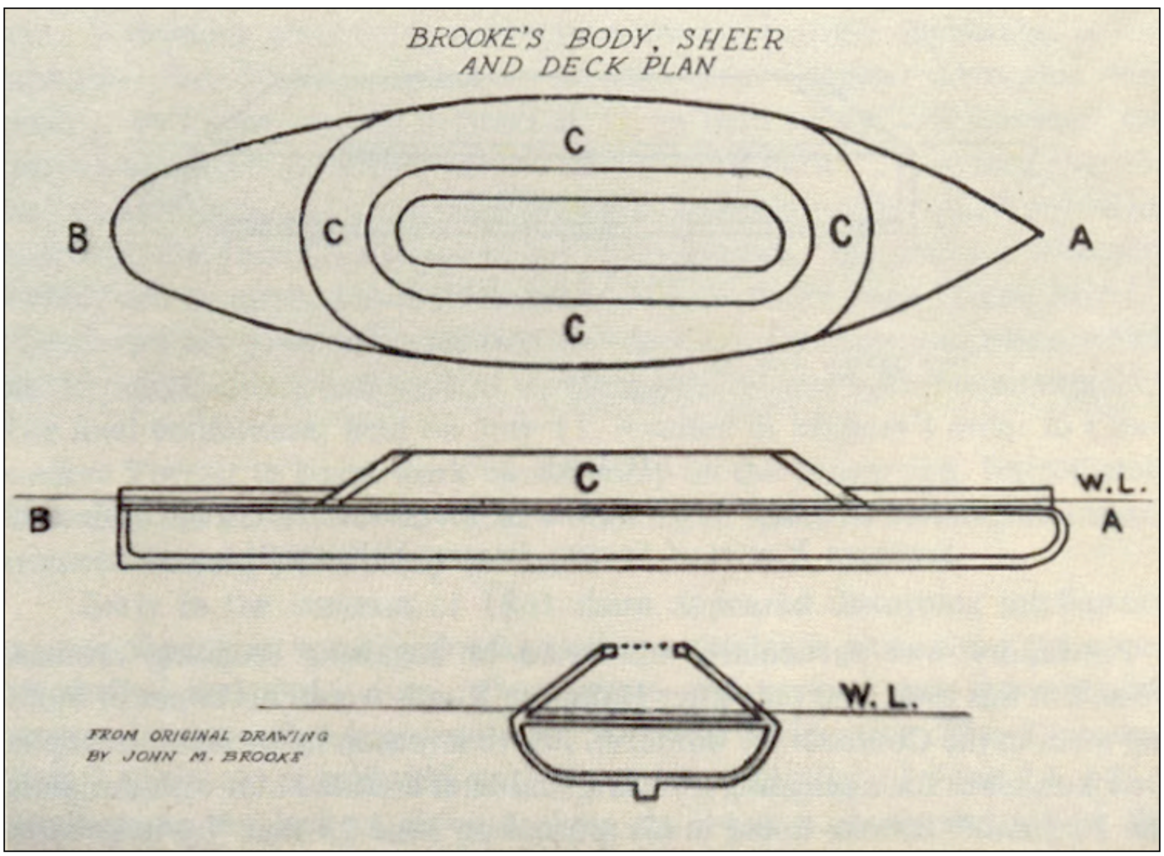


Figure 75. Brooke ironclad design concept (as presented in Still 1971:13).

Two sets of waterlines have been developed based on the Brooke/Porter concept. One is based on the lines and construction techniques a shipwright might employ. The other is based on waterlines and a simplified construction methodology more appropriate for a floating battery where navigation was a considerably less important consideration. As there was some expectation of maneuverability and speed prior to the first trial voyage, it would appear that a hydrodynamic hull form would have been a priority. The casemate would have dictated a 44-foot beam and an extended round bow and stern would have increased the overall length of the vessel to 164 feet.

The ships lines version of the Porter/Brooke concept is based on the hull configuration employed on vessels like CSS *Jackson* and CSS *Neuse* (Figure 76). It is based on flat floors and sides that angle outward at 110 degrees from a hard chine. Both the floors and side timbers would likely have been 12-inch by 12-inch pine. The outboard ends of each floor and the foot of each of the vertical side timbers could have been notched together in the same fashion as those of the *Jackson* and *Neuse*. Iron drift pins approximately five feet in length could have been employed in a staggered pattern to fasten both the floors and frames. That technique was used in both *Neuse* and *Jackson*. While neither *Jackson* nor *Neuse* was fitted with a keel, both vessels had keelsons and stringers. It would be likely that the CSS *Georgia* was similarly equipped. The chine would likely have been reinforced by chine logs, perhaps like those of *Neuse* and *Jackson*.

Fore and aft of the casemate the hull would have been framed with compass timbers, possibly of oak, and designed to produce a bluff but hydrodynamic form. Those lines could have provided at least the potential for “gunboat” performance and maneuverability. Like both *Jackson* and *Neuse*, *Georgia* could have been planked with 4-inch oak.

This hull configuration would have given *Georgia* a total weight of approximately 1,241 tons. That weight includes the vessel hull and casemate, machinery, ordnance, fuel, supplies and crew with minimal equipage. With a 9-foot draft the hull would have produced a displacement of approximately 1,516.7 tons. That would provide approximately 275.7 tons of reserve buoyancy. That would have provided capacity for ballasting the bow to compensate for machinery and fuel weight aft of amidships and loading additional ballast for general stability while still maintain a relatively comfortable reserve buoyancy.

This hull configuration would have been relatively simple to construct yet have a sufficiently hydrodynamic form to reinforce expectations for speed and handling prior to trials of the vessel. With at least some input into design by Confederate naval constructors and Savannah shipwrights, this improved hull form would appear to be a more likely candidate for CSS *Georgia* than a barge.

The second hull Porter/Brooke hull configuration is perhaps more appropriate for a floating battery where speed and maneuverability were secondary considerations (Figure 77). However, the round bow and stern were sufficiently hydrodynamic to support some expectation of maneuverability and speed prior to the first trial voyage. The casemate would have dictated a 44-foot beam and an extended bow and stern would have increased the overall length of the vessel to 164 feet.

The round lines version of the Porter/Brooke concept is marginally influenced on the hull configuration employed on vessels like CSS *Jackson* and CSS *Neuse*. It is based on flat floors and sides that angle outward at 110 degrees from a hard chine. Both the floors and side timbers would likely have been 12-inch by 12-inch pine. The outboard ends of each floor and the foot of each of the vertical side timbers could have been notched together in the same fashion as those of *Jackson* and *Neuse*. Iron drift pins approximately five feet in length could have been employed in a staggered pattern to fasten both the floors and frames. That technique was used in both *Neuse* and *Jackson*. While neither *Jackson* nor *Neuse* was fitted with a keel, both vessels had keelsons and stringers. It would be likely that this hull configuration for CSS *Georgia* would have been similarly equipped. The chine would likely have been reinforced by chine logs, perhaps like those of *Neuse* and *Jackson*.

Fore and aft of the casemate the hull would have been framed without compass timbers but still designed to produce a simple bluff yet hydrodynamic form. A radial pattern for the bow and stern frames could have been employed without extensive trimming to produce a fair surface for planking. These lines could have provided at least the potential for "gunboat" performance and maneuverability. Like both *Jackson* and *Neuse*, this version of the *Georgia* could have planked with 4-inch oak.

This hull configuration would have given *Georgia* a total weight of approximately 1,225.9 tons. That weight includes the vessel hull and casemate, machinery, ordnance, fuel, supplies and crew with minimal equipage. With a 9-foot draft the hull would have produced a displacement of approximately 1,551.2 tons. That would provide approximately 325.3 tons of reserve buoyancy. That would have provided capacity for ballasting the bow to compensate for machinery and fuel weight aft of amidships and loading additional ballast for general stability while still maintaining a relatively comfortable reserve buoyancy.

This hull configuration would have been relatively simple to construct yet have a sufficiently hydrodynamic form to reinforce expectations for speed and handling prior to trials of the vessel. With at least marginal input into design by Confederate naval constructors and Savannah shipwrights, this hull form would appear to be a candidate for simplified construction with some performance potential. However, no other naval vessel built by the Confederacy was designed around this type of hull.

CSS MISSISSIPPI/ *CSS* LOUISIANA *HULL CONFIGURATION*

The *Mississippi/Louisiana* hull form is based on the design adopted for CSS *Mississippi* and CSS *Louisiana*. While CSS *Mississippi* (Figure 78) was never completed, CSS *Louisiana* (Figure 79) was launched but her center paddlewheel machinery proved entirely unsuccessful (Still 1971:43-46; Holcombe 1993:44-49). Historical information on both vessels confirms that they were built with flat floors, a 90-degree chine, and vertical sides. Under their casemates both hulls were rectangular. Fore and aft of the casemates their bow and stern were formed by elongated triangles (Holcombe 1993:45-48). Fore and aft decks on both *Mississippi* and *Louisiana* were fitted with low bulkheads to deflect water away from the casemate (Holcombe 1993:48, 51). Like *Georgia*, CSS *Louisiana* was armored with railroad iron (Still 1971:52).

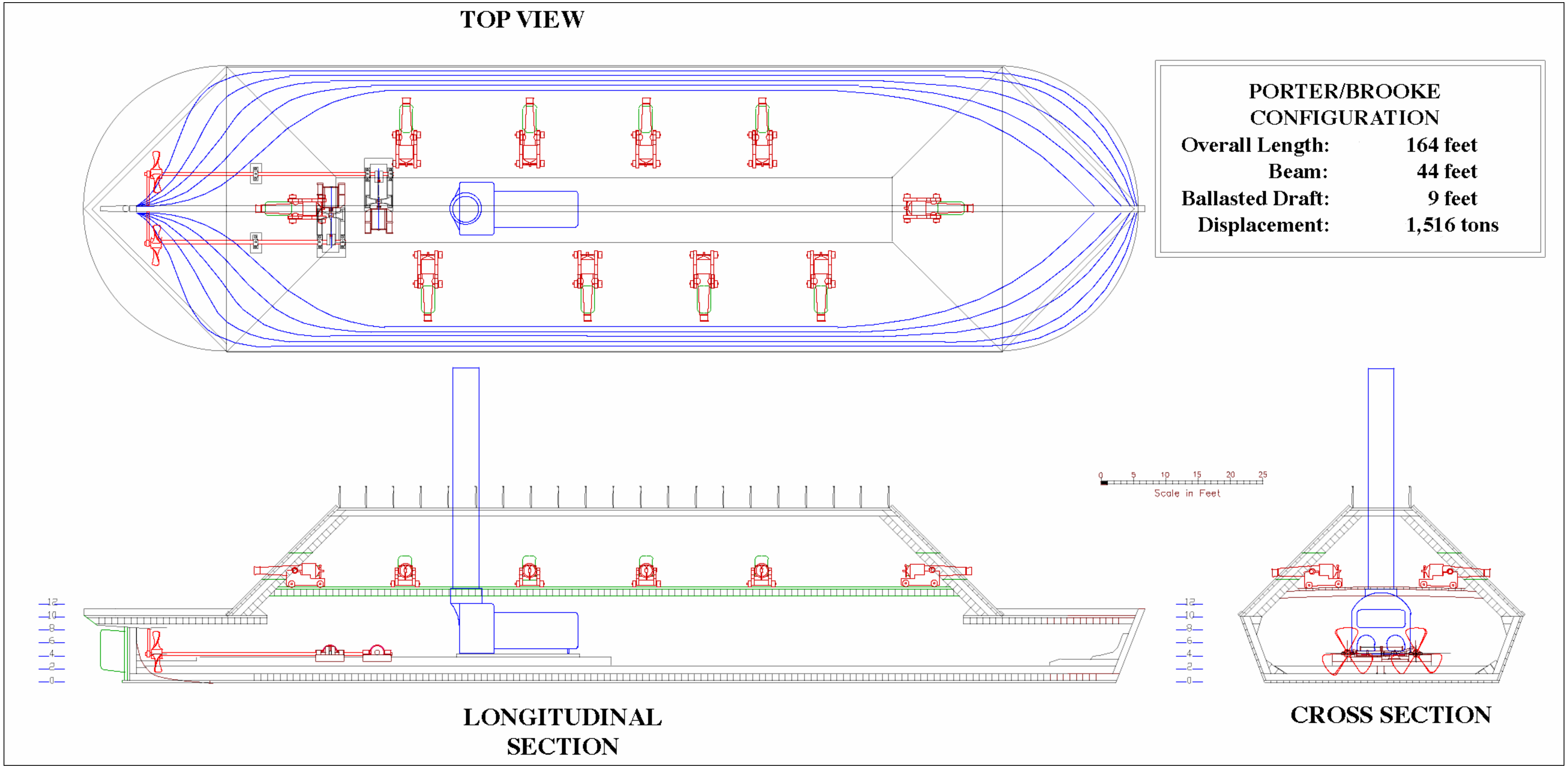


Figure 76. Porter/Brooke gunboat configuration.

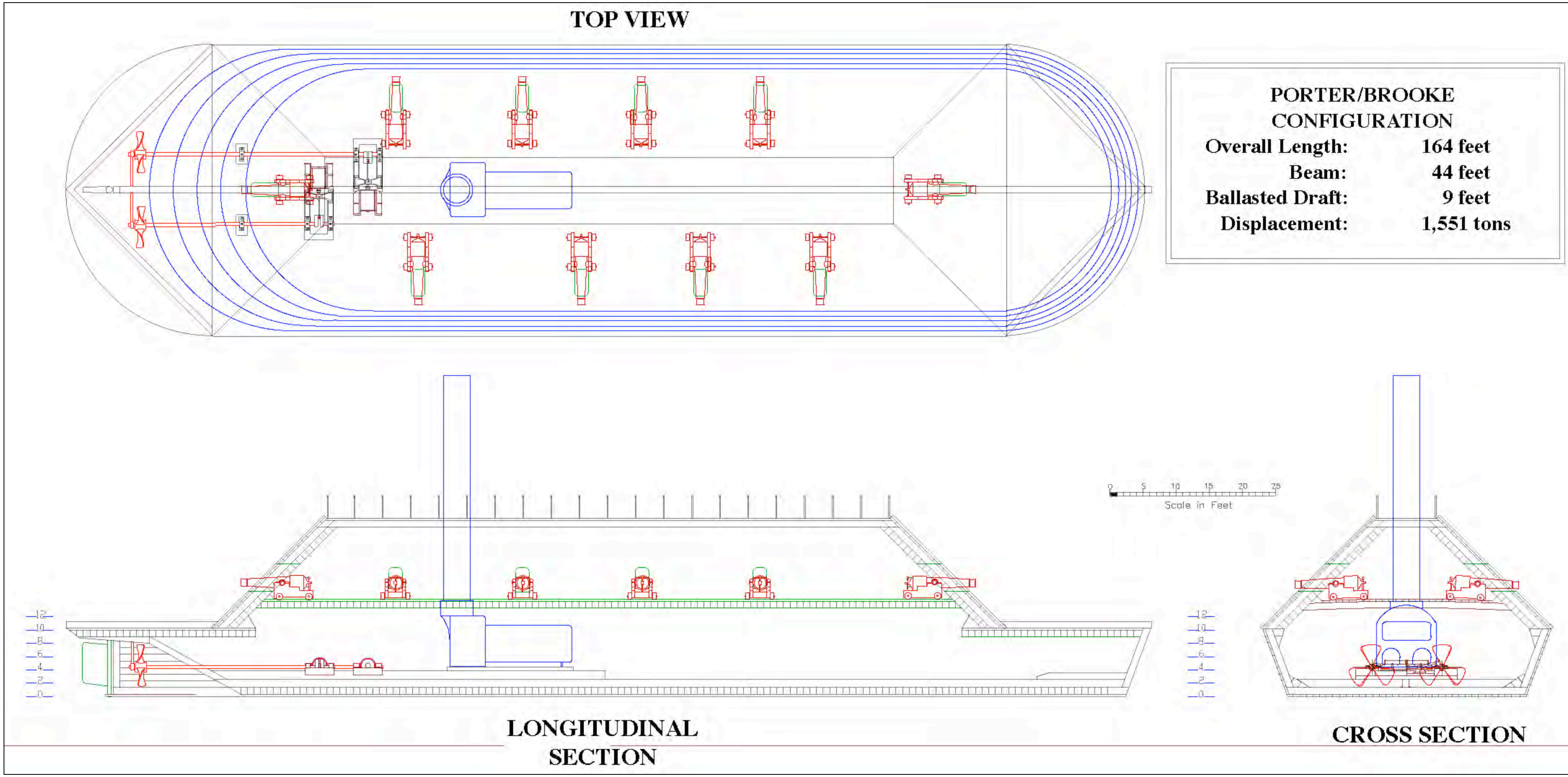


Figure 77. Porter/Brooke canal barge configuration.

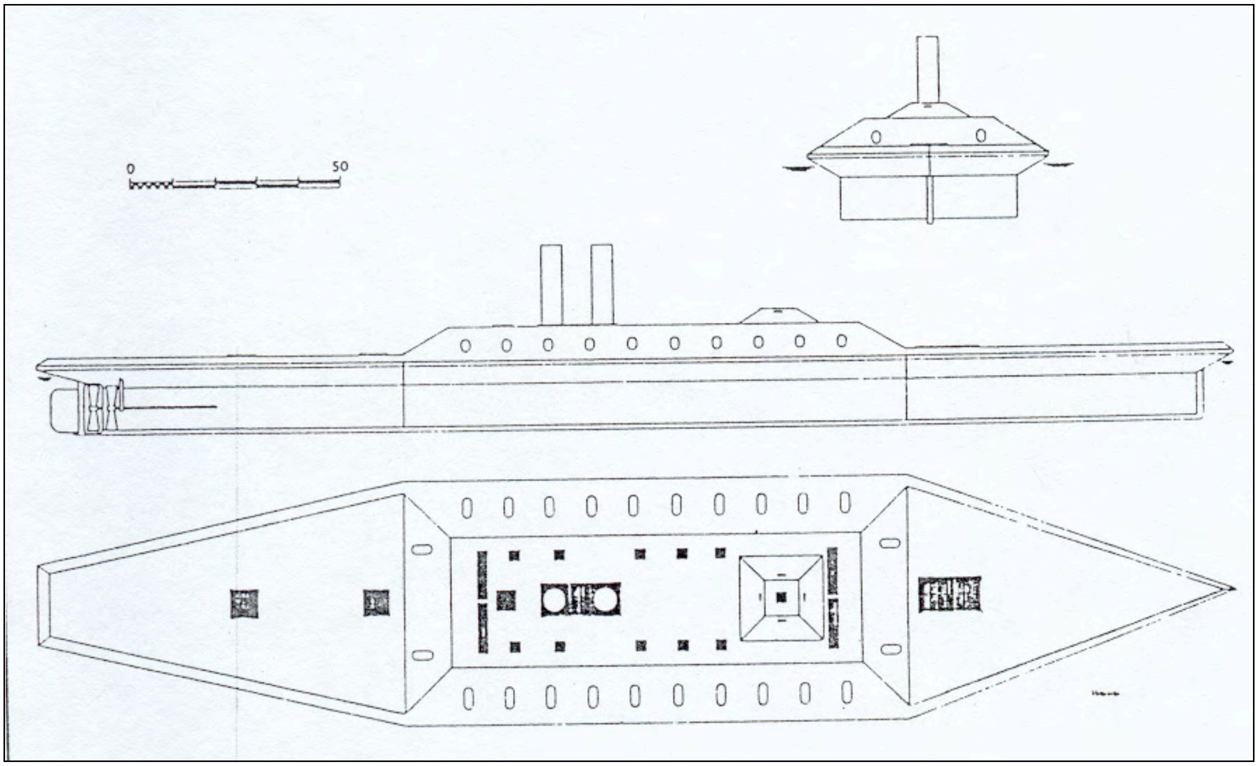


Figure 78. Illustration of CSS *Mississippi* (as presented in Holcombe 1993:45).

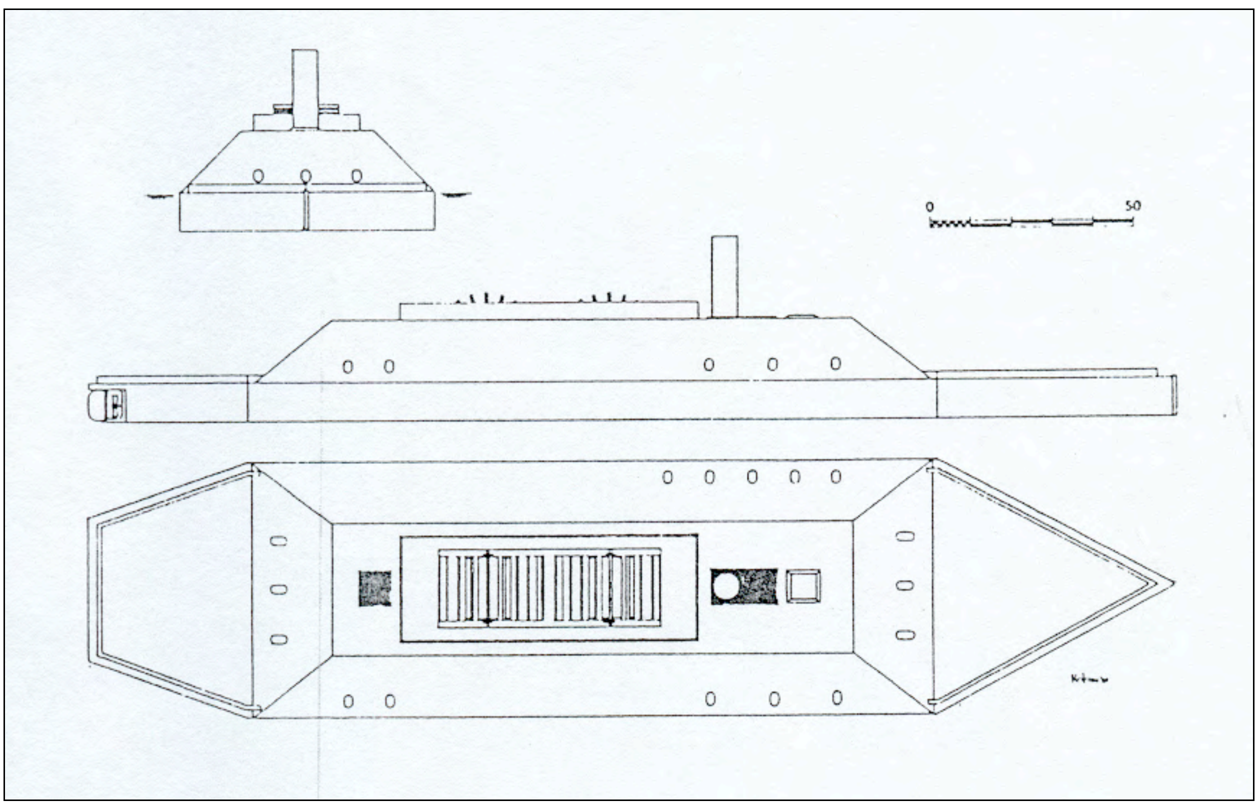


Figure 79. Illustration of CSS *Louisiana* (as presented in Holcombe 1993:48).

Plans for both *Mississippi* and *Louisiana* were approved by the Confederate Navy Department. Those of *Mississippi* were developed by a South Georgia planter, entrepreneur, and politician Nelson Tift (Holcombe 1993:44). Those connections suggest that the hull form concept employed on *Mississippi* and *Louisiana* would have been accessible to the designers and builders of CSS *Georgia*. In fact, Tift visited Savannah in the fall of 1861 and apparently conferred with H. F. Willink (Swanson and Holcombe 2003:47).

The *Mississippi/Louisiana* hull configuration is certainly appropriate for a gunboat or floating battery where speed and maneuverability were a consideration. The design would have been relatively simple to build and no compass timber would have been required. Although hydrodynamically crude the *Mississippi/Louisiana* design is sufficiently hydrodynamic to support some expectation of maneuverability and speed. Water flow to the screws and rudder would have been greater and more efficient than on the barge design.

The reconstructed casemate would have dictated a 44-foot beam for the *Mississippi/Louisiana* hull form. The extended bow could have been formed by an equilateral triangle extending 30 feet beyond the casemate. The stern extension of the hull could have been as short as 24 feet and still cleared the propellers. The stern has been designed with an angular fantail to reduce cavitation and provide protection for the screws and rudder. Thus designed the overall length of the vessel could have been 180 feet (Figure 80).

The *Mississippi/Louisiana* concept is based on flat floors and sides that extend vertically from a hard chine. Both the floors and side timbers would likely have been 12-inch by 12-inch pine. The outboard ends of each floor and the foot of each of the vertical side timbers could have been notched together in the same fashion as those of CSS *Jackson* and CSS *Neuse*. However the sides of the hull could also have been constructed in the same stacked-timber fashion as the barge design. The sectional profile illustrates vertical frame sides and an improved chine on the port side of the hull and a 90-degree stacked timber chine on the starboard side. Iron drift pins approximately five feet in length could have been employed in a staggered pattern to fasten both the floors and frames or side timbers. That technique was used in both *Neuse* and *Jackson*. Like the other flat floor designs, the *Mississippi/Louisiana* concept hull would likely have had no keel but been fitted with a keelson and stringers like both *Jackson* and *Neuse*. Similarly, the chine would likely have been reinforced by chine logs, perhaps like those of *Neuse* and *Jackson*.

Fore and aft of the casemate the hull would have been framed with saw cut timbers and designed to produce a simple angular yet somewhat hydrodynamic form. Like the amidships section of the hull both the bow and stern could have been constructed with vertical frames lap jointed into the floors or with horizontally laid timbers resting of the ends of the floors. Those angular lines could have provided at least the potential for “gunboat” performance and maneuverability. Like both *Jackson* and *Neuse*, this version of *Georgi*a could have planked with 4-inch oak.

A *Mississippi/Louisiana* hull configuration would have given *Georgia* a total weight of approximately 1,275.2 tons. That weight includes the vessel hull as well as casemate, machinery, ordnance, fuel, supplies, and crew with minimal equipage. With a 9-foot draft, the hull would have produced a displacement of approximately 1,861 tons, which would provide approximately

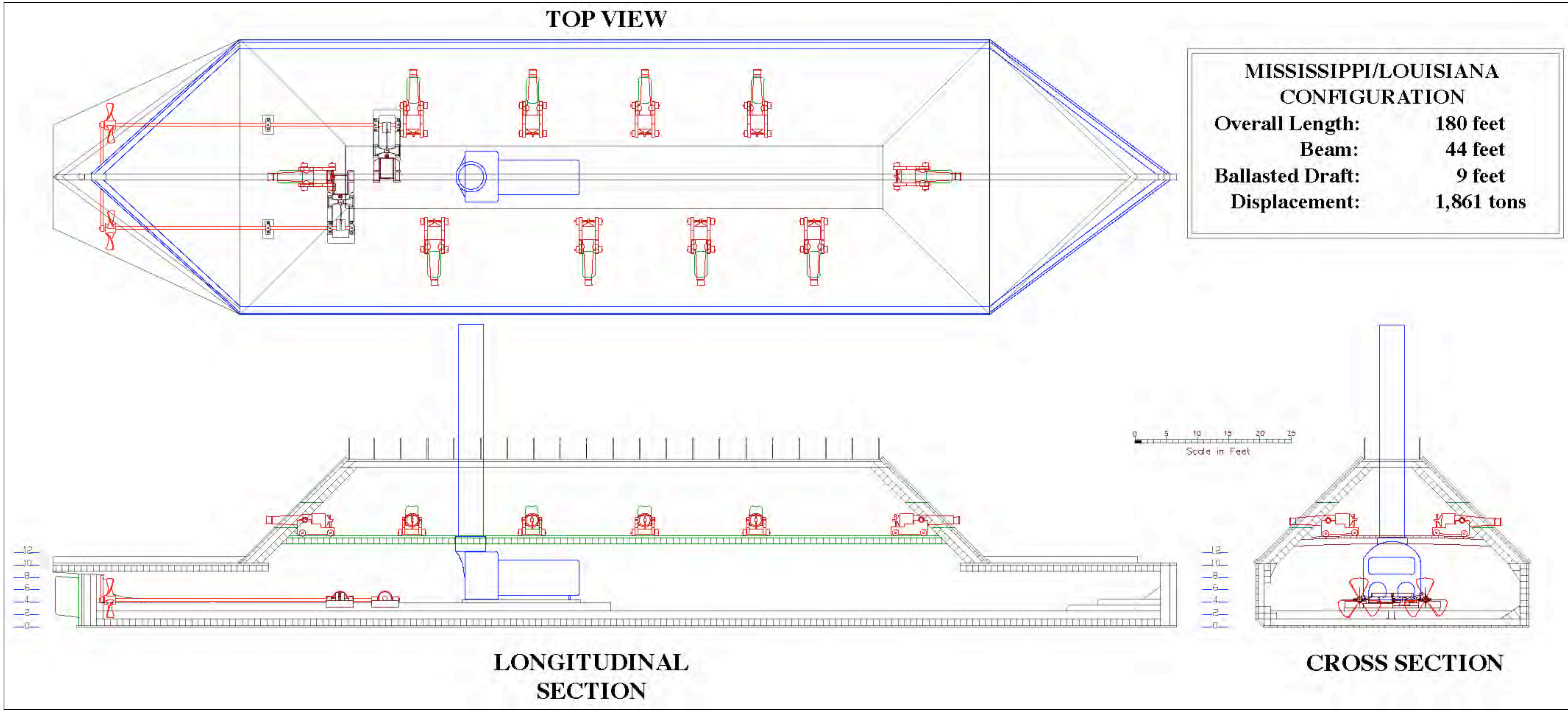


Figure 80. Mississippi/Louisiana configuration.

585.8 tons of reserve buoyancy. That would have provided capacity for ballasting the bow to compensate for machinery and fuel weight aft of amidships and loading additional ballast for general stability while still maintain a relatively comfortable reserve buoyancy. However, to sink the vessel to a point where the decks were at or near the waterline considerable additional ballast would have been required.

The *Mississippi*/*Louisiana* hull configuration would have been relatively simple to construct yet have a sufficiently hydrodynamic form to reinforce expectations for speed and handling prior to trials of the vessel. This hull form would appear to be an excellent candidate for simplified construction with some performance potential. It could also have been built with a slightly reduced depth of hold that would have reduced draft and requirements for additional ballast. It is possible that the small section of wreck structure lying downstream from the two sections of casemate could be a fragment of the bow or stern floors or deck from this hull configuration.

CSS JACKSON, NEUSE *HULL CONFIGURATION*

The final hull concept reflects a combination of hull designs used in CSS *Jackson* and CSS *Neuse* and angular deck configurations similar to those of CSS *Atlanta*, CSS *Mississippi,* and CSS *Louisiana*. The hull concept is based on flat floors and sides that angle outward at 110 degrees from a hard chine (Figure 83). Both the floors and side timbers would likely have been 12-inch by 12-inch pine. The outboard ends of each floor and the foot of each of the side timbers could have been notched together in the same fashion as those of *Jackson* or *Neuse* (Figure 81). Iron drift pins approximately five feet in length could have been employed in a staggered pattern to fasten both the floors and frames. That technique was used in both *Neuse* and *Jackson*. A staggered fastener pattern is illustrated for the casemate reconstruction (Figure 50 above). While neither *Jackson* nor *Neuse* was fitted with a keel, both vessels had keelsons and stringers. It would be likely that CSS *Georgia* was similarly equipped. The chine would likely have been reinforced by chine logs, perhaps like those of *Neuse* and *Jackson*.

Fore and aft of the casemate the hull would have been framed with a combination of mill cut and compass timbers. The configuration of the bow would have permitted the use of mill-sawn pine. The stern could have been built of frames constructed from pine futtocks or possibly compass oak. The design would have produced an acceptably hydrodynamic form for both entry and run to the propellers and rudder. Those lines could have provided at least the potential for "gunboat" performance and maneuverability. Like both *Jackson* and *Neuse*, this concept of CSS *Georgia* could have planked with 4-inch oak.

The fore and aft deck could have been angular as was the case with CSS *Mississippi* and CSS *Louisiana* and CSS *Atlanta, which* was built in Savannah (Figure 82). The fore deck resembles that of the *Atlanta* and provides covering for the more elongated hull form. The angular aft deck extends to a transom piece designed to reduce cavitation and provide protection for the screws and rudder. Fore and aft decks on both *Mississippi* and *Louisiana* were fitted with low bulkheads to deflect water away from the casemate (Holcombe 1993:48, 51). A similar arrangement is included on this concept of *Georgia*. The overall length of this hull concept is 190 feet.

Figure 81. Photograph of CSS *Jackson* Floor/Frame joint (courtesy of Gordon Watts 1993).

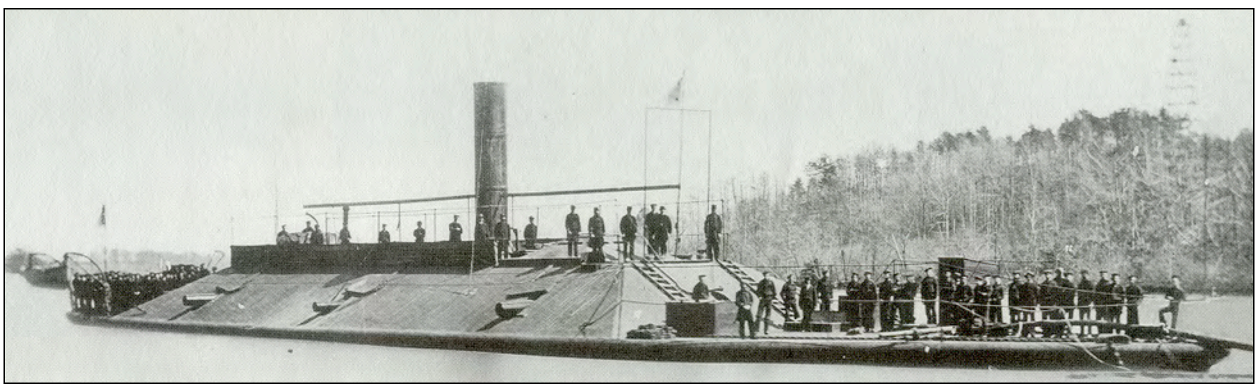


Figure 82. Photograph of CSS *Atlanta* after capture (as presented in Silverstone 1989:204).

A *Jackson*/*Neuse* hull configuration would have given *Georgia* a total weight of approximately 1,275.2 tons. That weight includes the vessel hull and casemate, machinery, ordnance, fuel, supplies and crew with minimal equipage. With a 9-foot draft the hull would have produced a displacement of approximately 1,861 tons. That would provide approximately 585.8 tons of reserve buoyancy. That would have provided capacity for ballasting the bow to compensate for machinery and fuel weight aft of amidships and loading additional ballast for general stability while still maintain a relatively comfortable reserve buoyancy. However, to sink the vessel to a point where the decks were at or near the waterline considerable additional ballast would have been required.

The *Jackson*/*Neuse* hull configuration would have been relatively simple to construct yet have a sufficiently hydrodynamic form to reinforce expectations for speed and handling prior to trials of the vessel. This hull form would appear to be an excellent candidate for simplified construction with some performance potential. It could also have been built with a slightly reduced depth of hold that would have reduced draft and requirements for additional ballast.

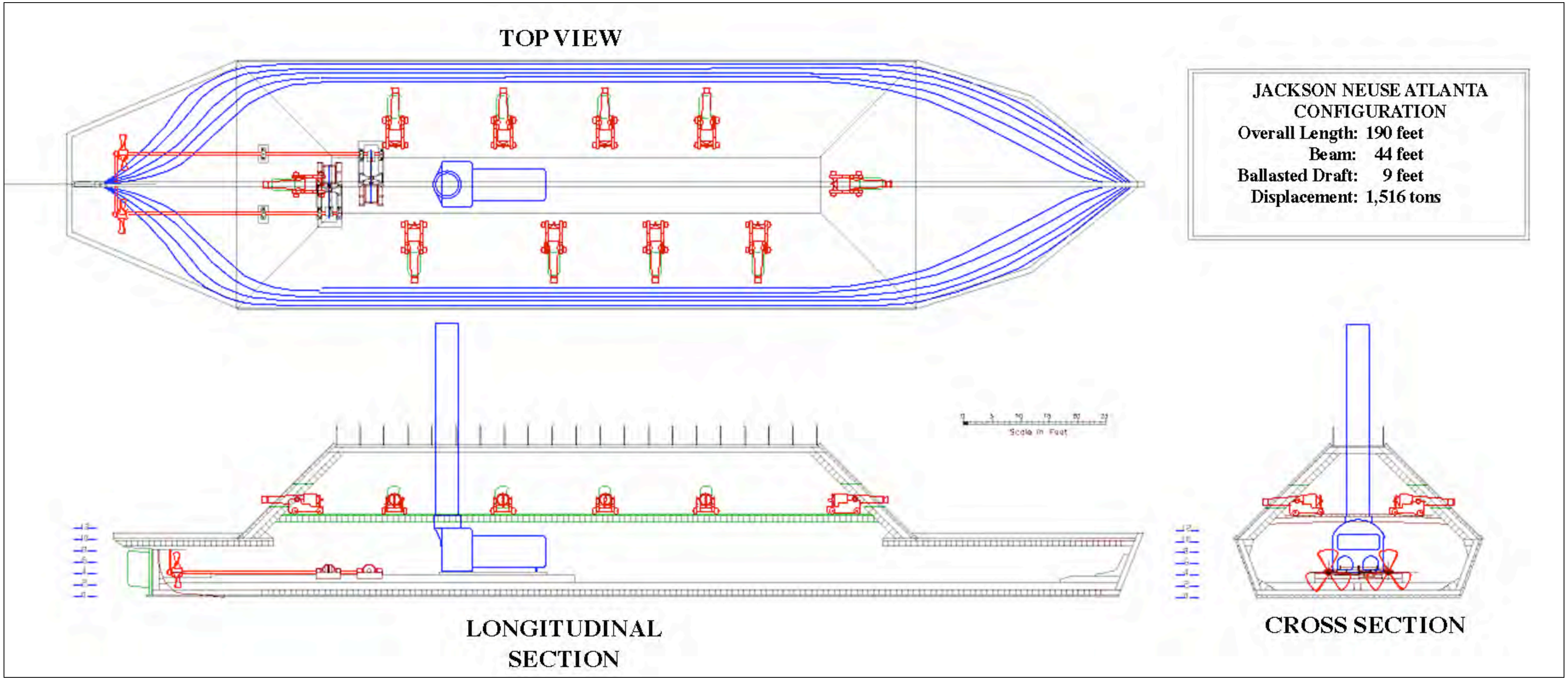
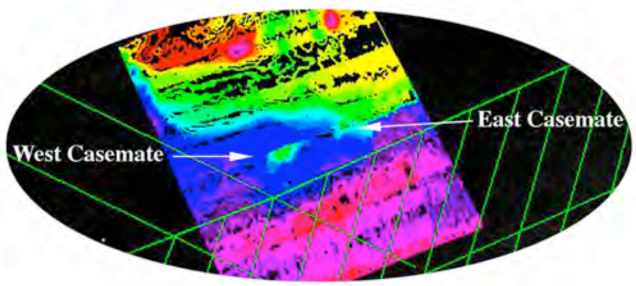


Figure 83. Jackson/Neuse/Atlanta configuration.



As stated previously, in 1969 Navy divers examined the site and reported that the "superstructure and upper works had deteriorated and collapsed; the gun deck had collapsed and the engines were determined to be in the same approximate position as when *Georgia* was scuttled. It was also reported that the vessel was covered with 12 to 16 feet of silt and the hull was believed to be intact" (Garrison et al. 1980:35). Ten years later, during Texas A&M's 1979 archaeological investigation and engineering assessment, results of coring indicated that no more than 1.5 feet of sand over dark gray clays surrounded the wreck site (Garrison et al. 1980:101). While the 1969 amount of silt coverage is most likely incorrect, the difference in silt or overburden depths in just ten years could also suggest major on-going environmental site formation processes, most likely culturally induced (i.e. dredging, wing-dam construction, etc.). A review of hydrographic data correlated with maintenance and construction activities illustrates the changes in the river channel adjacent to the wreck and the wreck site area itself.

The 1872 report of the Chief of Engineers states the *Georgia* wreck "lies on the north side of the channel abreast of Ft. Jackson and has occasioned accident. It has now 11 feet over it at low water, with a sand-bar forming around it on the north side and west end" (Garrison et al. 1980:35). Figure 84 illustrates a section of an 1867 survey map produced immediately after the war. Shown opposite Fort Jackson, the "Ram Georgia" is located in 21 to 26 feet of water with little if any shoaling noted. However, Figure 85, the survey map that mirrors the 1872 report, shows dramatic shoaling immediately adjacent and north of the wreck, as well as an increase in the main channel depth to the south. Shoal depths to the north are 10 feet versus the 21 feet five years earlier.

Dated one year after the Gillmore and Ludlow map, the 1872 U.S. Coast Survey map shown in Figure 86 mirrors the earlier map depicting shoaling around the wreck. However, the shoaling does not appear as pronounced, differing some five feet deeper on the north side of the wreck while the main channel depths correspond. After this date, the wreck site disappears from historic maps, possibly as a result of its "clearance" by Wells, or because the focus turned to the control of the main channel, the wreck lying outside the channel to the north as it does today. Whatever the case, perhaps the greatest known effects on the wreck site can be attributed to the results of these continued efforts at channel improvements, improvements that continue to this day. The current archaeological work on the *Georgia* wreck site, a component of a channel enlargement feasibility study, illustrates this fact.

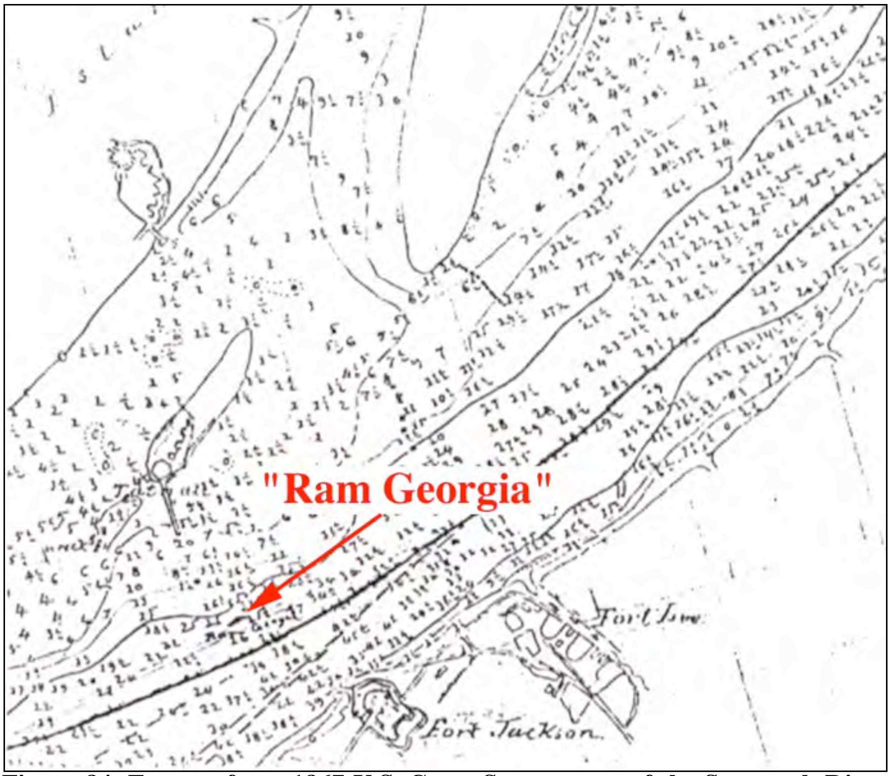


Figure 84. Excerpt from 1867 U.S. Coast Survey map of the Savannah River showing wreck of the "Ram Georgia" opposite Fort Jackson (as presented in Duff and Simmons 1995:2-35).

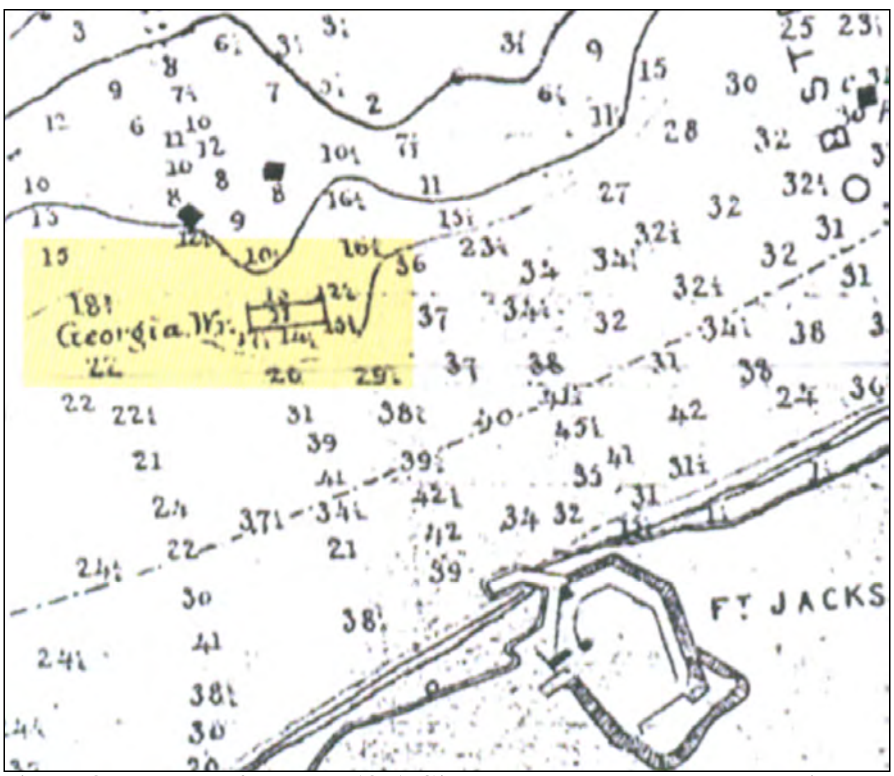


Figure 85. Excerpt from the 1871 Gillmore and Ludlow Map showing the shoaling on the north side of the wreck site (as presented in Swanson and Holcombe 2003:96).

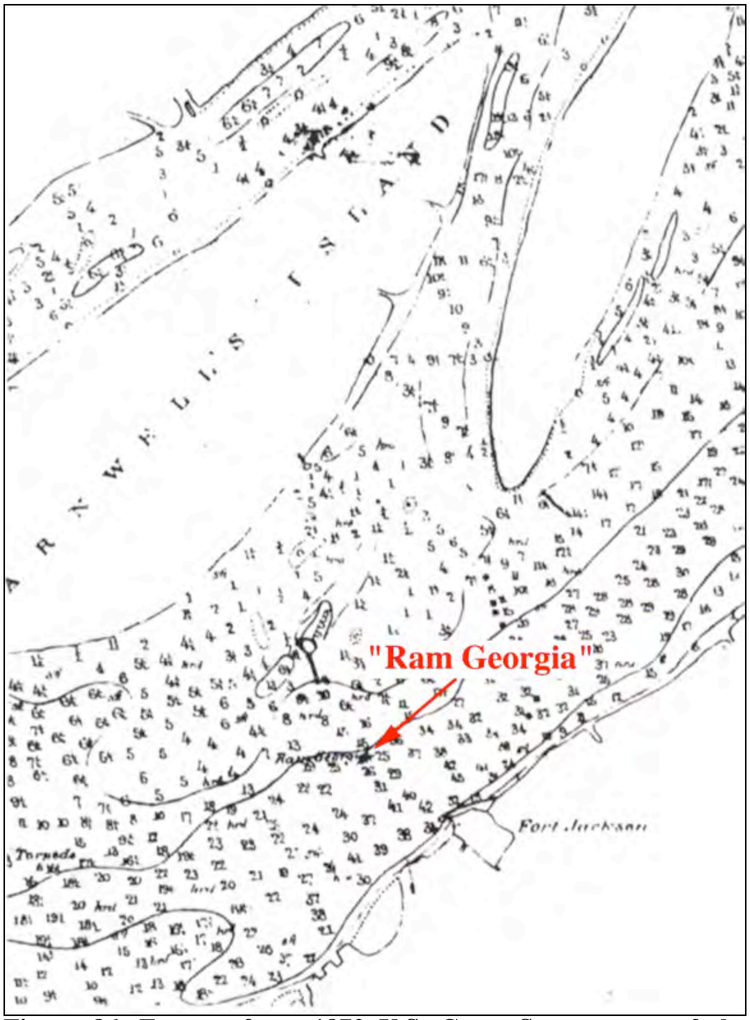


Figure 86. Excerpt from 1872 U.S. Coast Survey map of the Savannah River (as presented in Duff and Simmons 1995:2-36).

Channel improvements and harbor maintenance efforts began in the colonial period when it was determined that the Fig Island Channel, flowing between Fig Island and Hutchinson Island, caused a shoaling problem in the main channel of the river, creating the problematic Garden Bank directly across from Savannah. Shoaling was also a problem at the downriver end of Fig Island where both the Back and Front Rivers came together to form the main channel, the present location of the *Georgia* wreck site. Basically, all improvement efforts attempted to focus the tidal current into one channel by closing all others, with the increased water speeds theoretically keeping the single main channel free of shoals. Illustrating this thought, in 1891 an Engineers' report was published to show the advantages of improving Savannah's harbor. It was entitled "A Plea in Behalf of the South and West for Deep Water at Savannah, Georgia". On July 22, 1890, the Secretary of War approved the project for a 26-foot depth of water and on September 19, 1890, Congress appropriated $350,000 to begin the work (U.S. Army Corps of Engineers 1891:4). Lieutenant O.M. Carter of the Corps of Engineers submitted a project for the improvements to Savannah Harbor and River to obtain a channel depth of 26 feet. The culmination of many years of effort on the part of the citizens and businesses of Savannah, Lt. Carter's project called for a combination of dredging and construction of retaining walls and jetties. Carter based his project on surveys that had begun in 1889. The surveys provided data to explain the volumes of water that flowed down Front and Back Rivers. Carter goes on to explain that the survey data showed "the effect of Cross Tides dam is strikingly illustrated...Previous to its construction two-thirds of the entire volume of Savannah River passed through Cross Tides into Back River, and only one-third passed down Front River. Now the situation is precisely reversed...The results of the survey appear to indicate that a mean ebb velocity of about 2 feet per second is required to secure permanence of the channel. The general aim of the revised project will be to mold the river bed from Cross Tides to the sea in such a way as to allow the free ascent of the flood tide, and to secure throughout, as far as practicable, the above uniform mean velocity of ebb flow" (U.S. Army Corps of Engineers, Savannah District 1891:7-10).

Capt. O.M. Carter produced a map in 1891 to accompany the Annual Report for the Corps of Engineers. While little specific wreck information is presented, including an absence of any indication of the *Georgia* wreck site, the map is the first to show both Hutchinson and Fig Island as one land mass. Furthermore, it illustrates the funneling of the tide through the main channel by the construction of numerous features including the Cross Tides Dam (1937) at the north of Hutchinson Island and the Fig Island Training Wall at the southern end of the Fig Island, just to the west of the wreck site (Figure 87).

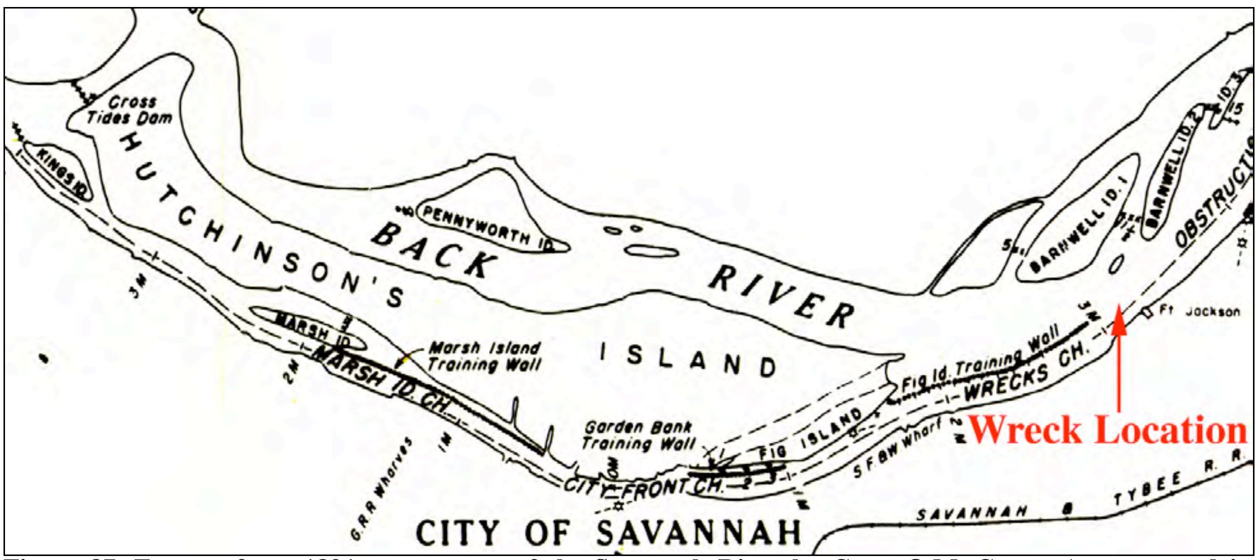


Figure 87. Excerpt from 1891 survey map of the Savannah River by Capt. O.M. Carter (as presented in Granger 1968).

After implementation of these improvements, it was found that the Wrecks Channel, south of Fig Island and adjacent to the *Georgia* site:

> had maintained its depth reasonably well. The silting that had taken place was believed to have accumulated on the ebb tide from Back River across the shoal of the old channel. It was planned to build a training wall downstream from the lower end of Fig Island parallel to the new channel, and it was believed that with this concentration of the ebb tide and the increased flow from the Cross Tide dam, 'The Wrecks' channel [Front River - navigation channel] could be maintained [Granger 1968:46].

Begun in 1882, the Fig Island Training Wall extended 5,000 feet from the extreme lower eastern end of the island, and the wall ran due east toward the *Georgia* wreck site. In 1883, it was extended another 1000 feet downstream to counteract shoaling at its end, and in 1887 another 750 feet was added (Granger 1968:46-50). It was rebuilt in 1940 (Barber and Gann 1989:104).

The Emergency Rivers and Harbors Act of 1900 called for the survey of Savannah Harbor by the Corps of Engineers to determine if the harbor should be deepened to 28 feet mean high water. This had been proposed in 1886 and reported on in the 1888 Annual Report of the Chief of Engineers, although it was never adopted. But after the District Engineer Cassius E. Gillette responded favorably to the idea, a special board of engineer officers was appointed to review the 1888 project to recommend any changes. Due to Savannah's potential for increased maritime commerce, the board recommended the 28-foot depth and a width varying from 350 feet to 500 feet. The work area was from the city waterworks to the sea and was to be accomplished primarily by dredging with government equipment or by contract (Barber and Gann 1989:90-91).

Owing in part to continuous shoaling, and to the expanding commerce and the increasingly more numerous and larger vessels, requests have been repeatedly made for further channel deepening and widening. The harbor was deepened to 34 feet in 1947 and 1949, and by 1985 the area up to the entrance of the Sediment Basin in the Back River was dredged to 38 feet. The Harbor or Navigation Channel presently stands at a depth of 42 feet Mean Low Water (mlw) and a width of 500 feet (Barber and Gann1989:355). However, the Savannah District in partnership with the Georgia Ports Authority, is currently examining the feasibility of deepening the existing 42' Savannah Harbor navigation channel by up to six additional feet, and furthermore, the construction of a passing lane on the wreck site side of the channel. This increased depth would definitely affect the *Georgia* wreck, and the associated widening would mean full removal.

Little channel morphology change is noted on maps up to and through the turn of the century for the area surrounding the *Georgia* wreck site. However, as illustrated in Figure 88, by the first quarter of the 1900s, through the use of dikes and or dams, Barnwell Island No. 1 and Island No. 2, located just to the north of the wreck site, are starting to merge into one land mass. With the addition of dredge material in-filling, by the 1940s the islands have completed their transformation and comprise the solid northern or South Carolina bank of the river. Illustrated in Figure 89, a 1940 map represents the general topography of the area as it exists today.

Although impacted by the contract dredge *St. Louis* in 1968, maintenance dredging by the U.S. Pipeline Dredge *Bacon* continued along the north side of the channel adjacent to the wreck of CSS *Georgia* in September 1969, September 1970, and August 1974. Since 1974, it was anticipated that no additional maintenance dredging would be necessary at this location due to the installation and operation of the Tide Gate and the construction of the Sediment Basin (U.S. Army Corps of Engineers 1983:III-4). However, it was again dredged in 1982, as well as the 1983 advance maintenance dredging that dredged into the site. Specifically, the 1983 activities included box cutting of side slopes and excavation of four vertical feet of channel bottom for the advance maintenance dredging (Judy Woods, Personal Communication 2003). The District's 1992 Final Comprehensive Impact Statement states that the "vessel was impacted in 1969, 1970, 1974 and 1983 (U.S. Army Corps of Engineers, Savannah District 1992:46). Besides cutting or "chewing" into the wreck, dredging impacts destabilized and exposed the site by removing protective sediments resulting in continuous and ongoing degradation to the wreck through exposure (i.e. teredo damage, erosion, etc).

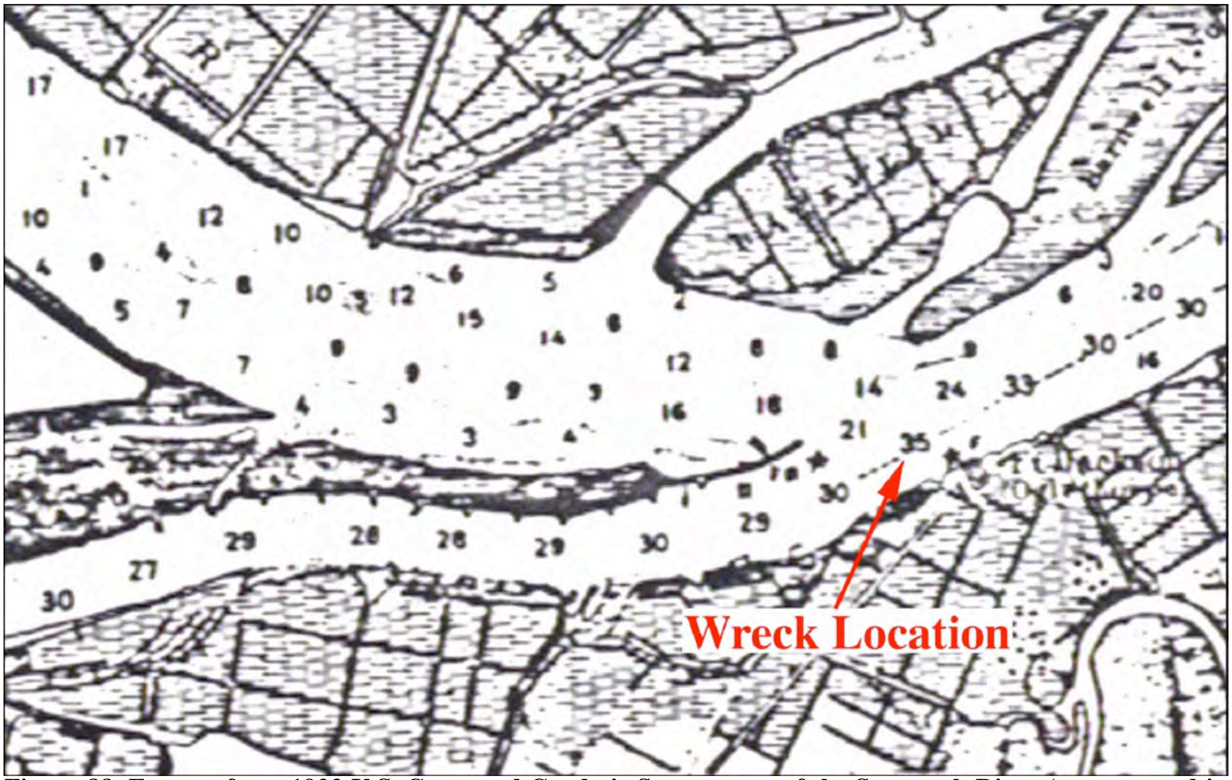


Figure 88. Excerpt from 1923 U.S. Coast and Geodetic Survey map of the Savannah River (as presented in Watts 1992:68).

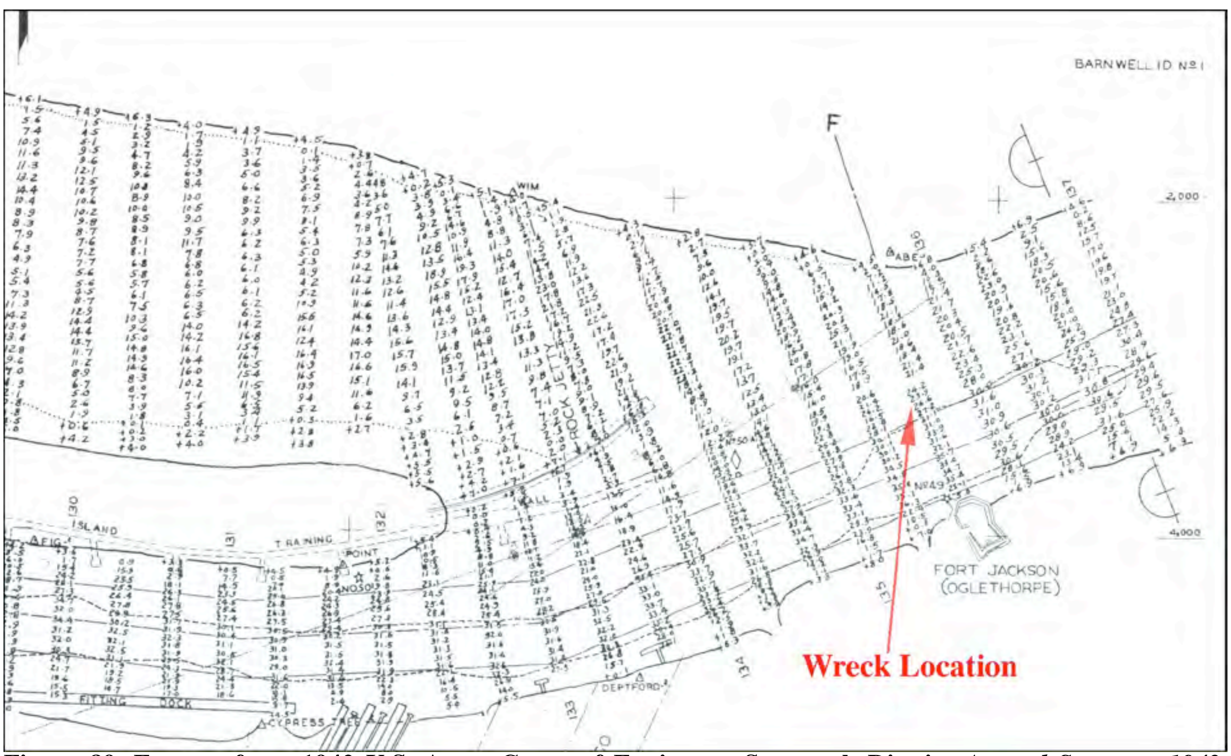


Figure 89. Excerpt from 1942 U.S. Army Corps of Engineers, Savannah District *Annual Survey – 1942, Savannah Harbor, Georgia* showing Barnwell Island now a complete landmass with South Carolina.

In addition to dredging impacts, between December 24, 1981 and January 3, 1982 a vessel fouled the wreck buoy marking the site, dragging it and its 10-ton anchor approximately 300 feet downstream through the wreck site. A hydrographic survey was conducted to determine effects to the site, but, no recognizable change in contours were noted. However, since the buoy was in area of scattered debris, it is likely that some wreck components were impacted to varying degree. The USCG wreck buoy and anchor were removed to prevent similar occurrences (U.S. Army Corps of Engineers 1983:III-5, 6, VI-10).

Another probable, but less documentable impact to the site is associated with the Tide Gate, which crosses the Back River approximately two miles from the *Georgia* site, and the Sediment Basin, which comprises the two-mile length of the Back River from the Tide Gate to Front River. Fully operational by 1977, as planned and constructed, the Tide Gate would allow incoming tides to pass through but would shut automatically on ebb tides, with the overall effect being to trap sediments in the Sediment Basin that normally would collect in the Front River. The sediments could then be economically dredged into nearby disposal areas (Barber and Gann 1989:356-359). Since its operation, the Tide Gate changed the shoaling pattern in the Savannah Harbor with a marked increase in the shoaling rate in the Basin, a corresponding decrease in shoaling in the navigation channels, and an increase in Front River velocities (U.S. Army Corps of Engineers 1983:VII-2). However, the Savannah District took the Tide Gate structure out of operation in 1991 due to concerns that the elevated salinity levels in the Back and Little Back Rivers were having adverse effects on freshwater marshes in the surrounding wildlife Refuge and striped bass habitat (U.S. Army Corps of Engineers, Savannah District 1991). Protruding slightly into the north side of the navigation channel, it is assumed that the resultant increased velocities would serve to clear sediments from the wreck, while at the same time having a greater negative effect due to these increased velocities (i.e. wood degradation).

An analysis of detailed hydrographic survey maps for the *Georgia* site area for the period prior to construction of the Tide Gate, its period of operation, and after its removal from operation was conducted in order to ascertain temporal presence or absence of sediments. While factors such as extended periods of low or high river levels associated with drought or flood were not accounted for, the period from 1990, just prior to the closure of the Tide Gate, to 1992, the year after its closure, saw in some locations increase in depths of five to nine feet. Suggesting loss of sediments due to increased currents, the question of the affects to the site can only be postulated.

Bathymetric maps and images were also analyzed in an effort to characterize the site and identify any changes over time such as sediment buildup or loss. Figure 90 is a 2002 Reson Bathymetric image of the site that graphically illustrates the site and its surrounding environment. The dark pinks indicate the deepest portion of the dredged channel, with actual linear dredge marks visible. The West Casemate appears as an isolated green pedestal surrounded by slightly deeper blue, indicating a surrounding uniform depth. The greens and yellows indicate shallower water as you go north toward the South Carolina bank.

Figure 91, a 2003 Reson Bathymetric oblique image of the site taken just before diving investigations, illustrates the West Casemate similarly pedestaled on a uniform surrounding bottom. Like the 2002 image, depths can be seen to increase as one moves down slope from the East Casemate towards the West Casemate and into the channel proper. This is graphically illustrated in Figure 92 below, a close up image of the East Casemate. Because of our field investigations we can state that there is little if any sediment surrounding the West Casemate, and little if any around the East Casemate, and both wreck sections rest on a hard bottom of miocene clay. Furthermore, when both the 2002 and 2003 images are contrasted with the 1979 sidescan image below, the wreck sections do not appear to be buried, suggesting little if any sediment was present at the site at this early, pre-Tide Gate Closure date (Figure 93).

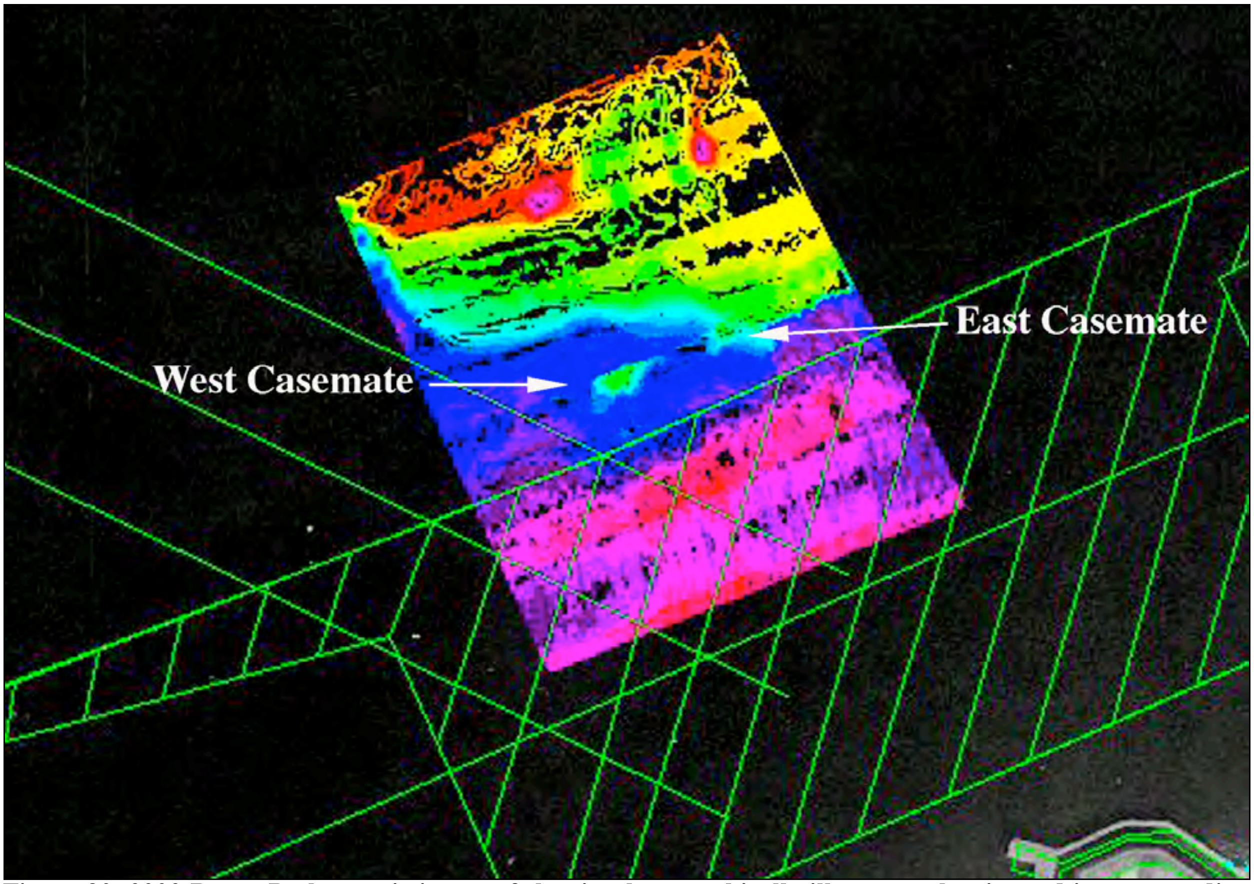


Figure 90. 2002 Reson Bathymetric image of the site that graphically illustrates the site and its surrounding environment (Courtesy of the U.S. Army Corps of Engineers, Savannah District).

While data indicate environmental factors, historic salvage, fouled buoy anchors, and the closure of the Tide Gate have all played a role to varying degrees in the degradation of the wreck, there is no question that past dredging has caused the most detrimental and adverse affects to the site. Employing the most recent remote sensing records, dredging impacts can be clearly seen in many of the sidescan sonar images and some are quite striking. Illustrated in Figures 94, 95 and 96, dredging scars can be seen on the southern or main channel side of the site, with no evidence of dredging to the north. Figure 94 is an acoustic image of the wreck site looking downriver or east. Clearly visible, the linear dredge scars that are cut into the Miocene clays run just up to the West and East Casemate sections. The easternmost section of wreck and an "unknown," possibly a boiler, lie in the deep scars within the channel. Again looking downriver to the east, Figure 95 shows the depth or height of the dredge cuts, and the face that the cuts leave in the clay bottom. An acoustic image of the wreck site looking down on the West Casemate, Figure 96, shows the linear dredge scars running in multiple directions. Known as the "Debris Field," the dredged area to the left of and below (south) the Casemate contains propulsion machinery (i.e. engines, propeller, shaft, etc.), and cannon. While it is unknown if the multiple scar directions indicate different episodes of dredging (by the *Bacon* or *St. Louis*?), it is known this area of the wreck, including the West Casemate, has been heavily and adversely impacted by dredging operations.

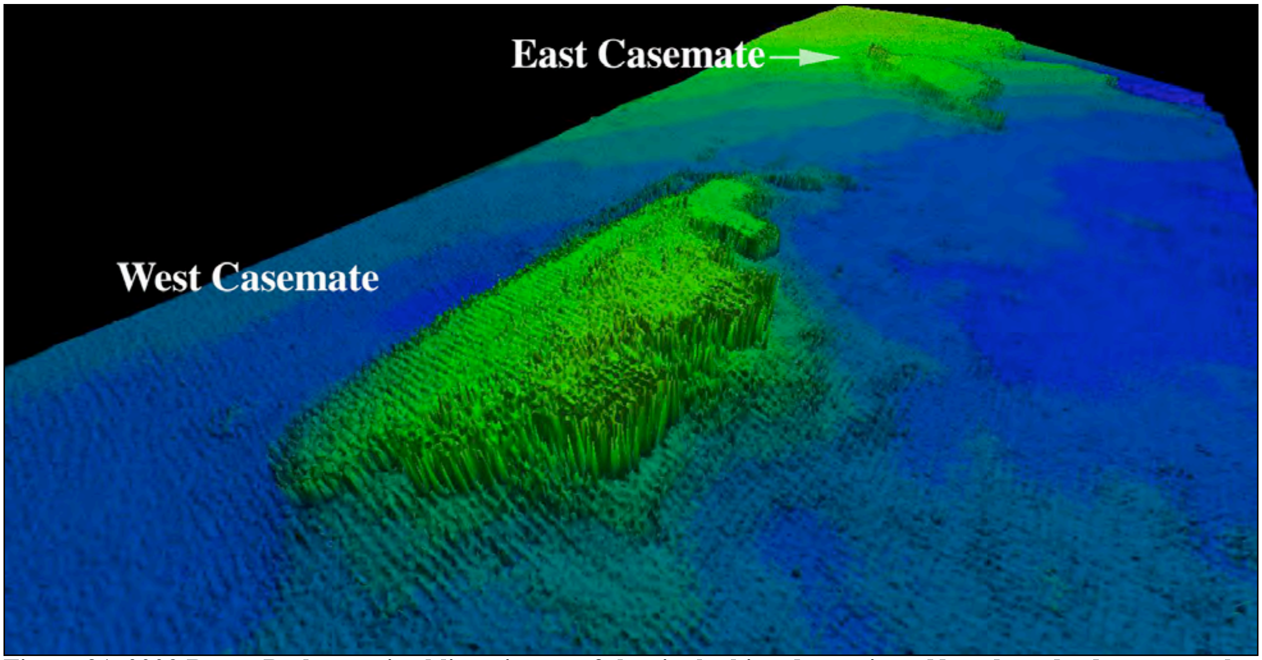


Figure 91. 2003 Reson Bathymetric oblique image of the site looking down river. Note deep dredge cuts to the left of the East Casemate (Courtesy of the U.S. Army Corps of Engineers, Savannah District).

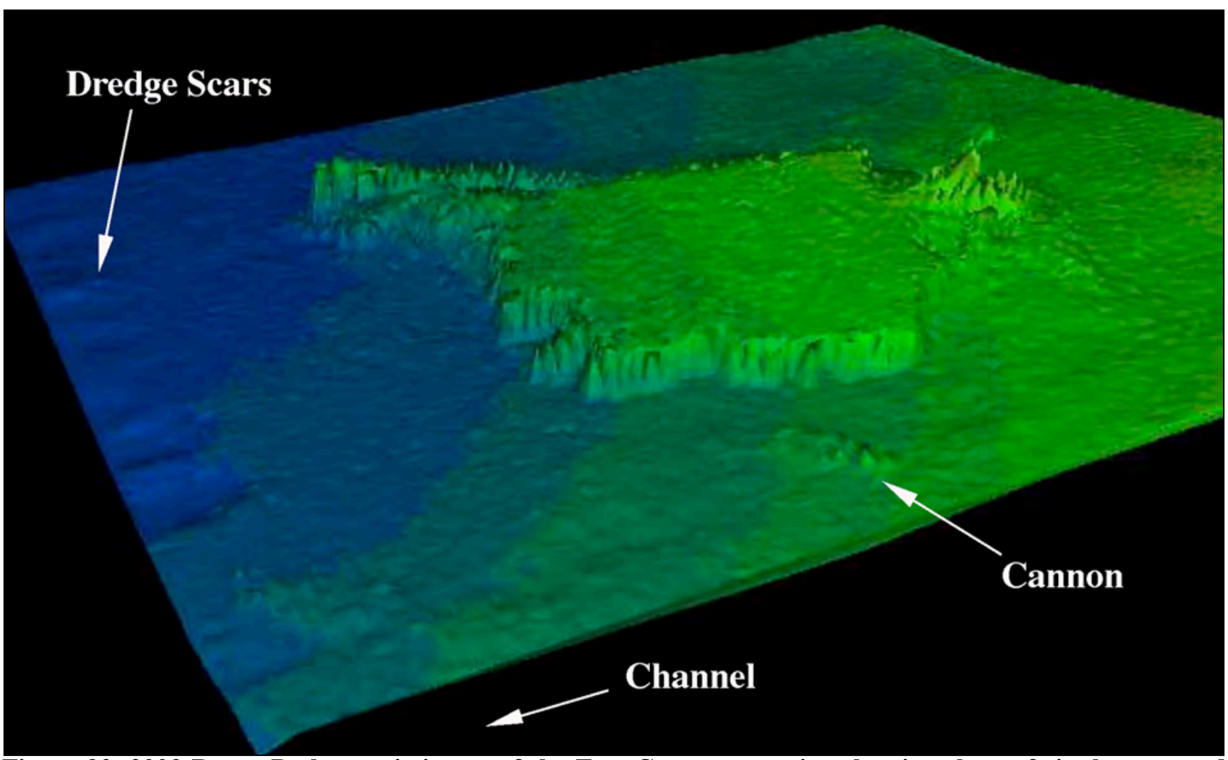


Figure 92. 2003 Reson Bathymetric image of the East Casemate section showing slope of site bottom and proximity of dredge cuts (Courtesy of the U.S. Army Corps of Engineers, Savannah District).

Figure 93. Excerpt from the 1979 acoustic image showing casemate sections with little if any surrounding sediment (as presented in Garrison et al. 1980:Figurre 39).

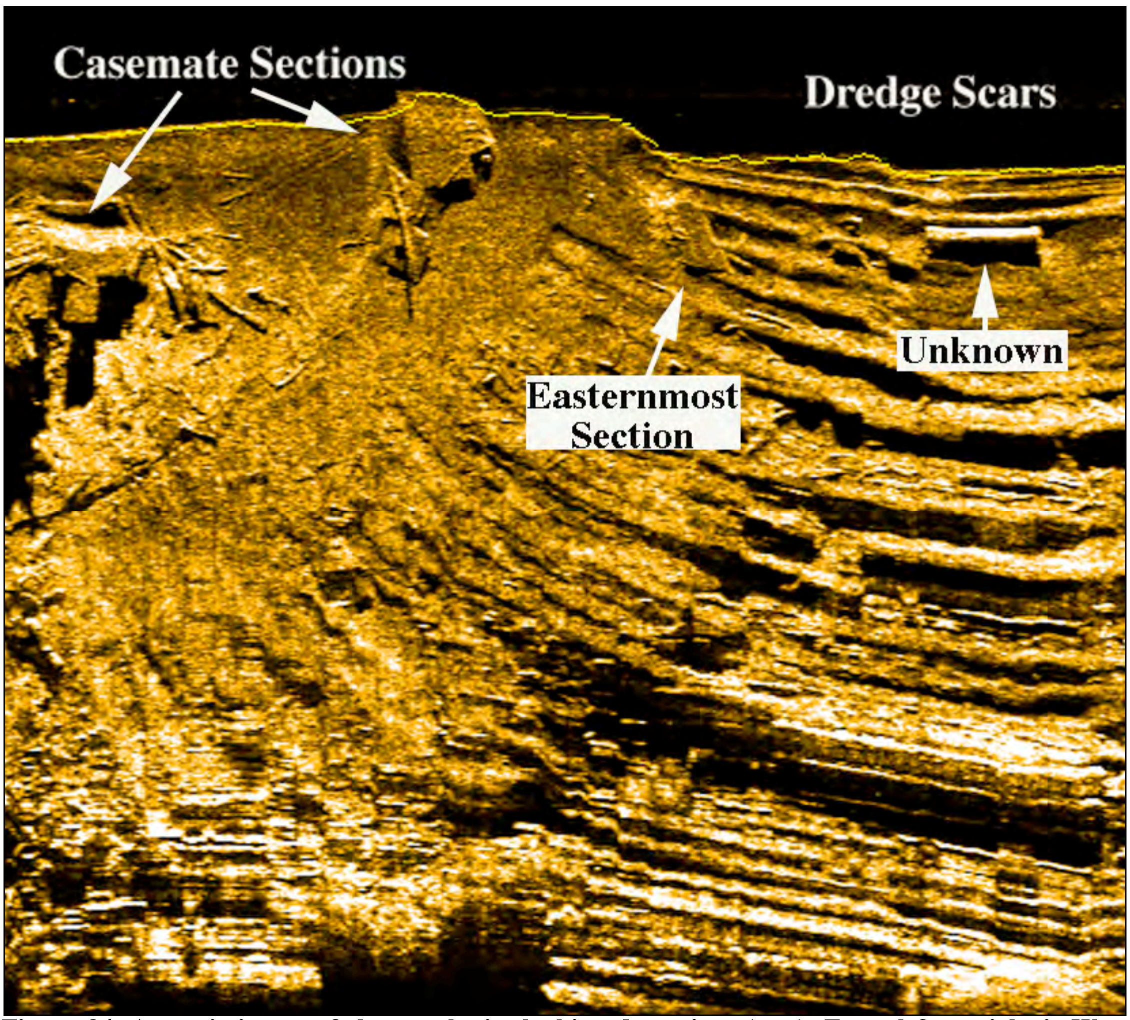


Figure 94. Acoustic image of the wreck site looking downriver (east). From left to right is West Casemate followed by the East Casemate, then the easternmost wreck section, and at far right an "unknown" (boiler?). Note linear dredge scars going just up to the Eastern Casemate; the easternmost section and "unknown" rest in the scars.

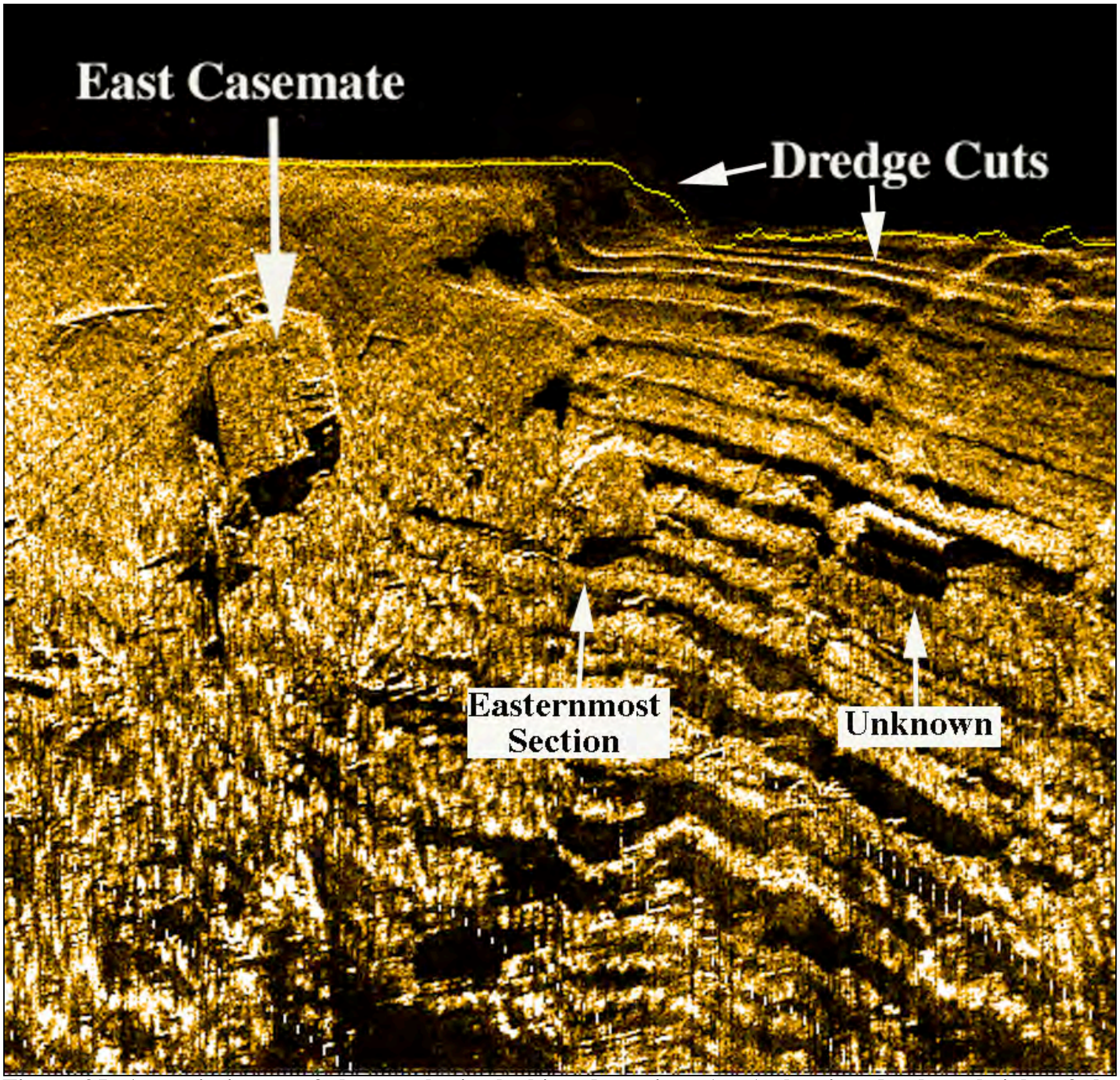


Figure 95. Acoustic image of the wreck site looking downriver (east) showing depth or height of the dredge cuts. From left to right is the East Casemate, then the easternmost wreck section and at far right an "unknown" (boiler?). Again, note linear dredge scars going just up to East Casemate; the easternmost section and "unknown" rest in the scars.

A comparative analysis of sidescan images from the 1986 study and the current 2003 study, a period of 17 years, shows virtually the same site composition and reveals, in some instances, severe degradation to the resource. Taking into account technological advances and directional movement in the survey vessel or tow fish, both the 1986 image (Figure 97) and the 2003 image (Figure 98) depict the West and East Casemate sections with only slight differences. Figures 99, 100, 101 and 102 are close-ups from both the 1986 and 2003 images showing comparative differences or changes to each casemate section highlighted in red. The changes in the 2003 images are all thought to be a direct result of the 1982 incident during which a vessel fouled the site's wreck buoy dragging it and its 10-ton anchor through the site. Evidenced by two parallel lines visible in the Miocene clay bottom, what are believed to represent the anchor's drag scars can clearly be seen in the 2003 image running between the casemate sections (Figure 98).

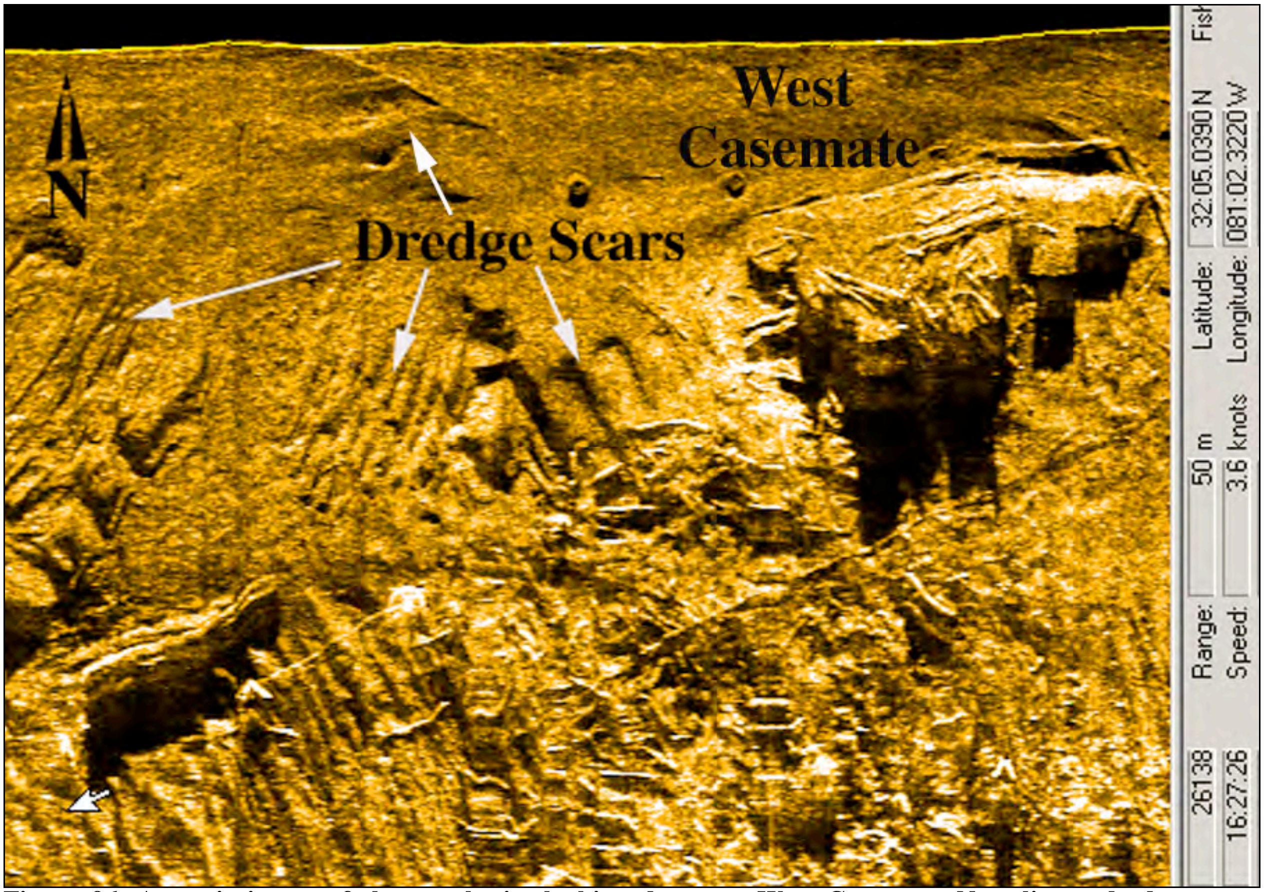


Figure 96. Acoustic image of the wreck site looking down on West Casemate. Note linear dredge scars running in multiple directions. Known as the "Debris Field," the area to the left of and below (south) the West Casemate contains propulsion machinery (i.e. engines, propeller, shaft, etc.), and cannon that have been heavily and adversely impacted by dredging operations.

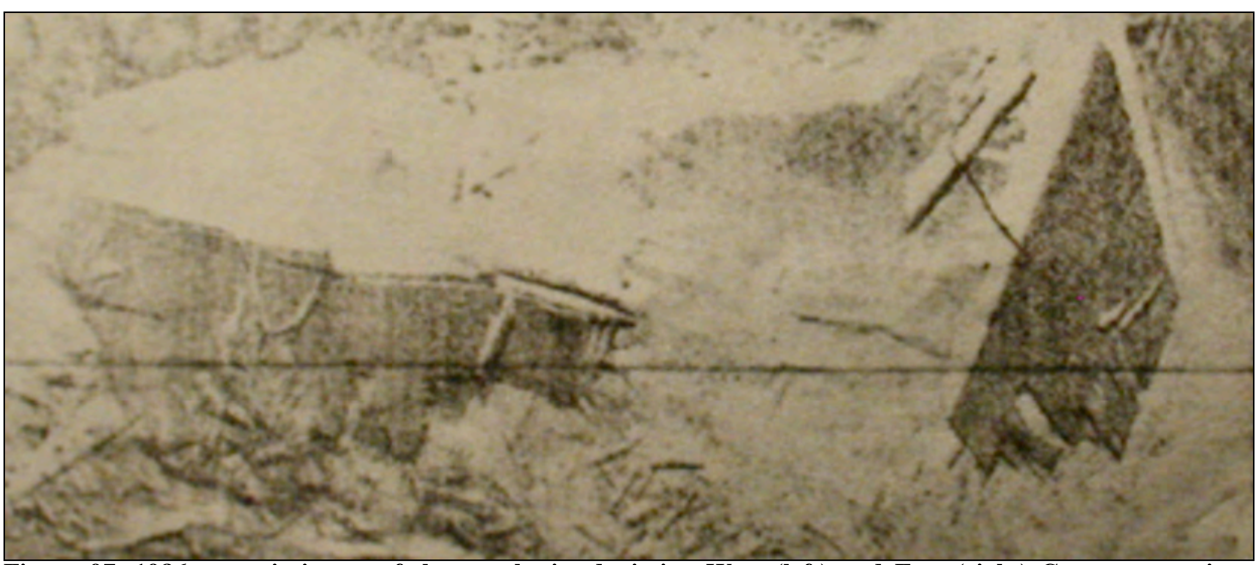


Figure 97. 1986 acoustic image of the wreck site depicting West (left) and East (right) Casemate sections (Courtesy of the U.S. Army Corps of Engineers, Savannah District).

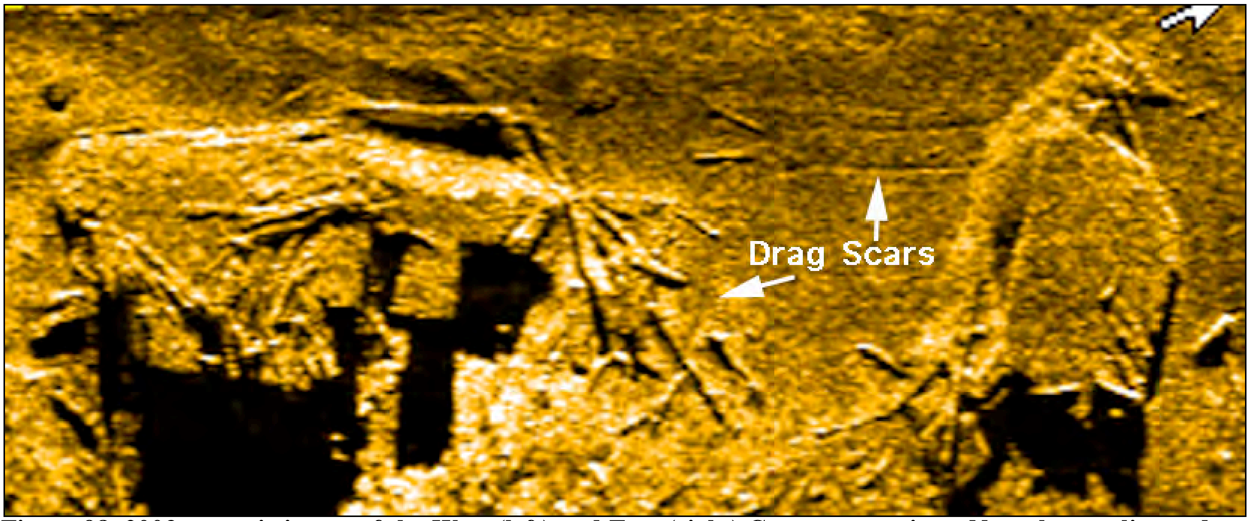


Figure 98. 2003 acoustic image of the West (left) and East (right) Casemate sections. Note the two linear drag scars at the top left of the East Casemate projecting toward the West Casemate, and a second fainter set running toward the channel to the right of the West Casemate. Also note 6 pdr cannon to the right of the East Casemate's midsection.

The 1986 image of the East Casemate shows its northern tip to be complete (Figure 99), and the 45-degree as-built angle depicted on this image is evidence that this section originally formed one end of a side of the vessel's casemate (port or starboard?). However, a comparison of the 2003 close-up shows that the section's northern tip, once complete, has been severely impacted with the tip now laying separated a slight distance from the section (Figure 100). A result of the fouled anchor, the drag scars are clearly visible and they indicate that the anchor was drug either from the east across and through this section transiting toward the West Casemate and then down toward the channel, or from the reverse direction.

In addition to the changes on the northern edge of the East Casemate section, the opposite or southern end of this section is also damaged or degraded. A rectangular gunport is clearly visible on the 1986 image and was later identified as such during a brief inspection of the site in the mid-1980s by Gordon Watts and Ralph Wilbanks (Gordon Watts Personal Communication 2004). The reason for the changes to this end is unclear and it is uncertain if the change represents a natural process or recent man-made damage. However, the latter is more likely as the 1986 image indicates this area was well-preserved and intact, and this amount of natural disintegration is unlikely. It is quite possible that this damage resulted from a second adverse impact episode not associated with the fouled wreck buoy.

A comparison of the 1986 and 2003 close-up images of the West Casemate section shows that a length of the section's eastern end has been impacted (Figures 101 and 102). Thought also to be a result of the fouled anchor, diving inspection of this area indicates that this short length of the casemate has fallen or been crushed downward onto the clay bottom from its original position. The remainder of the West Casemate section appears to have undergone little if any degradation or damage over the 17-year period.

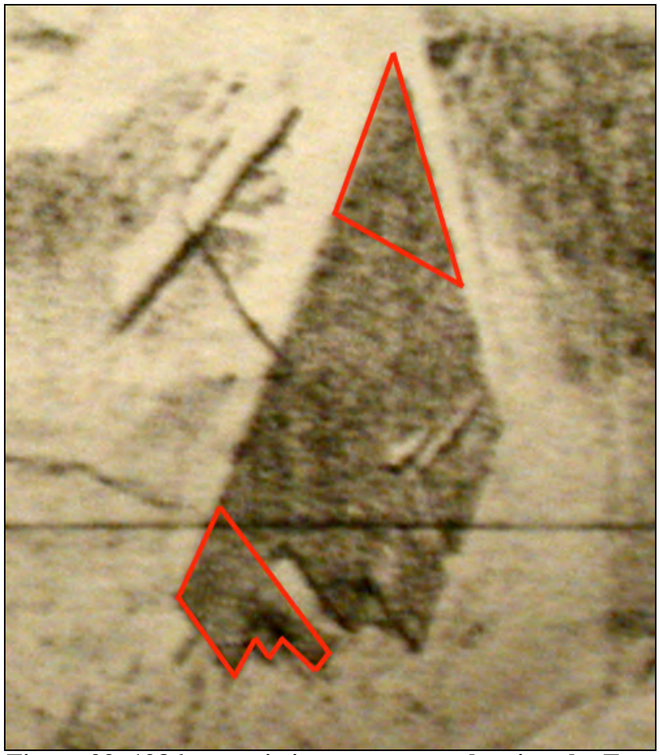


Figure 99. 1986 acoustic image excerpt showing the East Casemate section and missing or damaged areas bordered in red.

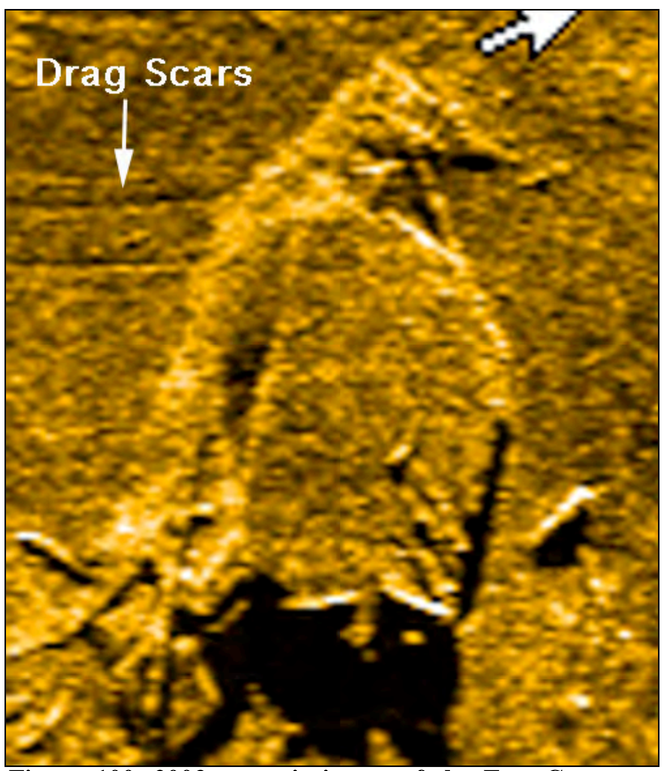


Figure 100. 2003 acoustic image of the East Casemate section. When compared to Figure 99 above, the damaged areas as well as the linear drag scars are clearly evident.

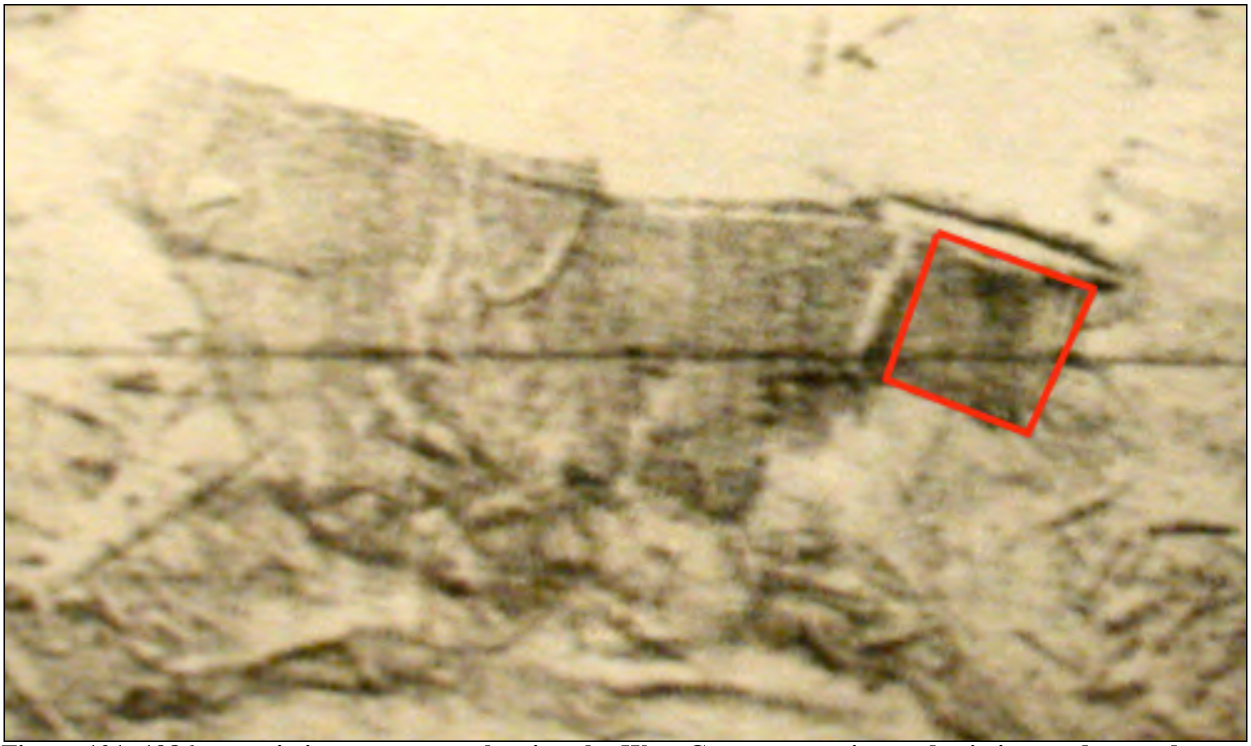


Figure 101. 1986 acoustic image excerpt showing the West Casemate section and missing or damaged areas bordered in red.

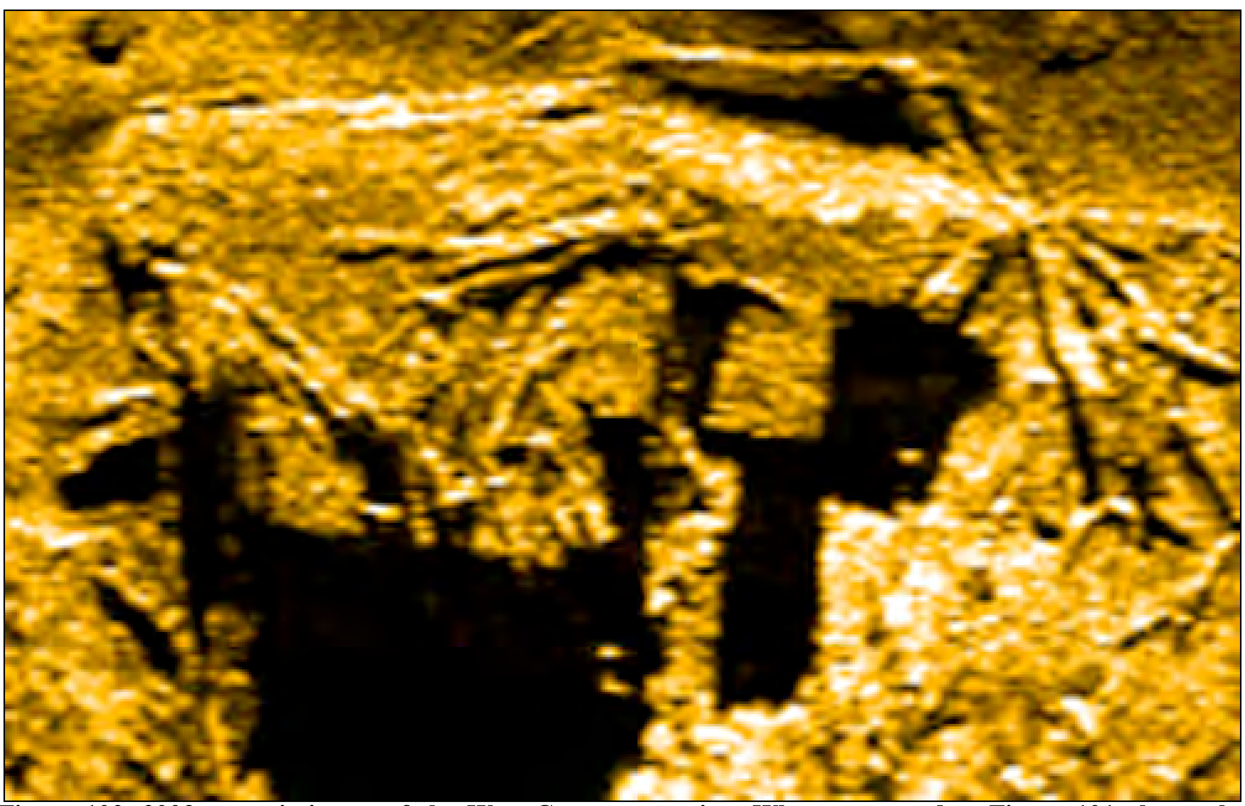
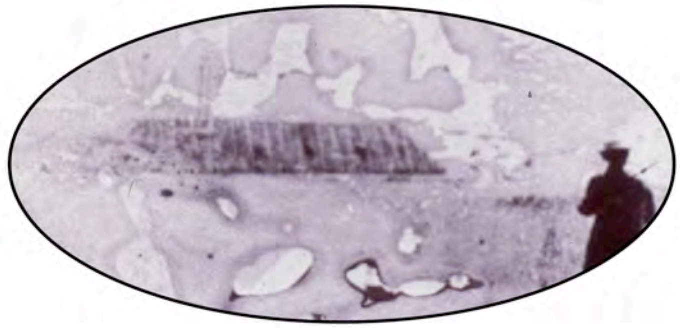


Figure 102. 2003 acoustic image of the West Casemate section. When compared to Figure 101 above, the damaged area on the right or downriver-end, thought to possibly be a result of the fouled wreck buoy, is clearly evident.



CSS *GEORGIA* CONCLUSIONS

The 2003 investigation of CSS *Georgia* generated considerable insight into the nature and scope of the surviving vessel structure and the archaeological record associated with those remains. The most significant issue addressed by the on-site research was determining the amount and condition of surviving vessel structure at the wreck site. Based on previous investigation at the wreck site it has been assumed that a significant portion of the hull of the vessel survived underneath the sections of armored casemate that is exposed on the bottom surface. However, the investigation carried out in 2003 clearly established that this is not the case and that the surviving remains of the Civil War ironclad are limited, and that the lower hull of the vessel no longer exists. Two large sections and a smaller third section of iron casemate are present along with the vessel's propulsion machinery including steam cylinders and at least one propeller and shaft, three cannon, a possible boiler, and miscellaneous, small, as of yet unidentified components and artifacts.

The absence of lower hull and the impacts to the existing components are a direct result of historic salvage and to a much greater degree operation and maintenance dredging operations associated with the Savannah Harbor Navigation Project. With respect to dredging impacts, the previous dredging activities, especially the 1983 box cutting of side slopes and excavation of 4 vertical feet of channel bottom for advance maintenance dredging at the wreck site, have had an extreme and ongoing adverse effect on the property. Besides cutting or "chewing" into the wreck, dredging impacts have destabilized the site by removing protective sediments and have resulted in the continuous and ongoing degradation of the wreck through exposure (i.e. teredo damage, erosion, etc). Furthermore, the proposed channel deepening project as planned will most certainly have an adverse effect on this National Register property and will result in its destruction.

The surviving sections or armored casemate lie on a base of Miocene clay. This dense clay that forms the riverbed has and would prevent downward migration of virtually any material associated with CSS *Georgia*. Each section of the casement was found to be resting on top of a pedestal created by erosion and/or dredging of the adjacent clay deposit. Examination of the Savannah District annual survey bathymetry indicates that opening of the Back River channel has contributed to the erosion of the sand and mud that once protected the wreck remains leaving the surviving vessel structure and associated material exposed on the bottom surface. Hydraulic probing to a depth of seven feet around and in between the casemate sections confirmed that no evidence of the hull is present below the bottom surface.

Evidence that the CSS *Georgia*'s hull has been completely destroyed or does not exist in association with the casemate sections was reinforced by identification of the ship's steam machinery on the bottom surface south and southwest of the major section of casemate. That machinery included one of the vessel's propellers with an attached section of propeller shaft, strut and stuffing gland. To the southeast two of the steam cylinders were identified in three to four foot deep dredge scars. No wood was attached to either cylinder and the piston rod of one cylinder had been broken near the stuffing gland. Fragments of a boiler were also found in the area between the propeller and steam cylinders. The presence of machinery from the lower hull of the vessel, its heavily damaged condition and location on a systematically dredged bottom supports other evidence that the hull of the ironclad has been completely destroyed or possibly exists in part at another location.

Although the archaeological record associated with CSS *Georgia* has been virtually destroyed, small elements of the vessel's structure and cultural material associated with shipboard activities were found in association with the documented sections of armored casemate and machinery. Three of the vessel's cannon remain on the bottom in association with the surviving structure. Two large pieces lie southwest of the largest section of casemate and a third and much smaller cannon lies immediately east of the next to the largest section of casemate. In the vicinity of the casemate sections the bottom surface is scattered with fragments of railroad iron armor, fasteners, fittings and wood fragments. Ordnance associated with the ship's battery, tools and other cultural material was also observed. Much of this material was found in the scars left by dredging the channel south and west of the casemate sections.

Based on the data collected during the 2003 investigation of the wreck, it is apparent that the surviving remains of CSS *Georgia* are limited. Although the archaeological record has been virtually destroyed by salvage in the 19th century and dredging and erosion in the 20th century, the dearth of information about the ironclad's design and construction makes every surviving element of the structure valuable. Exhaustive historical research has demonstrated that the most important surviving source of information we have regarding the design, construction and operation of CSS *Georgia* is the wreck itself. For that reason additional comprehensive investigation of the remains is necessary. That is especially the case if the site is to be further impacted by additional maintenance or destroyed as a consequence of improvement of the navigation channel.

While important archaeological data remains at the wreck site, the 2003 investigation of CSS *Georgia* generated the first physical data concerning the design and construction of the ironclad. The most specific information concerns the dimensions and construction details of the armored casemate. Virtually all of the surviving structural evidence is associated with that distinctive feature of the vessel. Additional insight into CSS *Georgia* comes from documentation of the remains of the ironclad's steam machinery. The propeller, steam cylinders, boiler fragments and condenser provide important clues to the spectrum of designs for the hull.

With the archaeological and historical data available, an attempt at reconstruction of the casemate of CSS *Georgia* was possible. Based on the surviving structural remains, historical references and a contemporary image that does indeed appear to be CSS *Georgia*, a structure 120 feet in length and approximately 44 feet in width appears to be in order. Naturally, those figures represent a best-fit scenario considering all of the available historical, photographic, and archaeological evidence. The most difficult to determine factor is the length of the casemate. The 120-foot length is based on the height of the sides, their angle of repose, the actual amount of surviving structure and perspective dimensions determined from the single photograph of what is almost certainly CSS *Georgia*.

While reconstruction of the casemate is based on important clues that include data from the wreck site, reconstruction of designs for the hull are almost entirely hypothetical. The design of CSS *Georgia*'s steam machinery provides some important clues but in the final analysis there is virtually no specific data to support identification of the actual design. The hull designs that have been developed are based on the casemate size and configuration, the machinery that survives at the wreck site, displacement necessary to carry the weight of the vessel's casemate, machinery, fuel, ordnance, supplies, personnel and their equipage, simplicity and speed of construction and finally conventional wisdom.

The most elementary design and the simplest to construct would have been that of a barge. A heavy barge hull would have easily carried the weight of the casemate and served adequately as a floating battery, as CSS *Georgia* was not infrequently identified. However, that design would have been the most ineffective under power. It would have been virtually unmanageable underway due to the flow of water past the rudder and any rpm on the screws would have produced cavitation that would have seriously undermined the effectiveness of the propellers. Propeller vibration would have been a serious problem in the wooden hull. Although these problems could have contributed to or been responsible for CSS *Georgia*'s lack of performance, it would seem that the shipbuilders and naval contractors involved in identifying the design and building CSS *Georgia* would have been aware of these problems and opted not to build a barge hull regardless of the speed and simplicity of construction. They could not have had any delusions about the performance of such a vessel. While it is not impossible that circumstances dictated even this level of compromise, it could also explain the lack of hull structure fore and aft of the casemate in virtually all of the contemporary illustrations including the photograph.

Equally unlikely perhaps is a "ship hull" design. While that would have been highly desirable in terms of performance, it would have been considerably more complex to build. Not that it would have been beyond the capability of those involved in construction of CSS Georgia, more that it would have required more time and certainly more of the shipwright's skill. In addition, a "ship hull" design would have required an extensive amount of compass timber, undoubtedly oak, for framing the hull. Although there would have been a considerable amount of hull structure fore and aft of the casemate, like the CSS Virginia the deck could have been at or slightly below the surface of the water after ballasting. The "ship hull" would have provided the most efficient hydrodynamics and perhaps provided higher expectations for gunboat performance. While adaptation of a partially constructed hull could have significantly reduced construction time that would seem unlikely as the 44-foot beam required to support the casemate would have been significantly greater than anything likely to have been under construction in Savannah at the time. A hull approximately 200 feet in length would have been larger than most of the existing shipyards could have managed to launch without special arrangements. Although the possibility of a "ship hull" cannot be eliminated it would not seem to be one of the most likely candidates for construction.

Of the remaining three hypothetical designs, the Porter/Brooke concepts could be more likely possibilities. Both are based on a rectangular hull form under the casemate with sides canted outward to a maximum beam of 44 feet. Fore and aft of the casemate the decks have been rounded as was the bow and stern of Porter's plan for an armored harbor defense vessel but the hull has been extended fore and aft to permit a more hydrodynamic hull form fore and aft as Brooke suggested. Like the Brooke model, the fore and aft decks are at or below the waterline. Breakwaters on the decks protect the casemate from seas fore and aft. The method of construction suggested for the first Porter/Brooke design could be the most likely of the two designs. That design is based on the hull form and construction employed in other Confederate vessels such as CSS *Jackson* and CSS *Neuse*. Decreasing floor lengths fore and aft of the casemate and progressively changing angles of the side timbers provide an acceptable hydrodynamic form. In the stern, side timbers are also concave providing enhanced run to the propellers and rudder. This design and construction technique would have been accessible to the designers and builders of the CSS *Georgia*. In addition, construction would be much simpler than a "ship hull" form and virtually all of the necessary material would be mill-sawn timbers and planks. The popularity of this hull form would appear to make this shorter version a reasonable candidate for CSS *Georgia*.

The second Porter/Brooke hull form is also based on decks that are rounded as was the bow and stern of Porter's plan for an armored harbor defense vessel. Again the hull has been extended fore and aft to permit a more hydrodynamic hull as Brooke suggested. Like the Brooke model the fore and aft decks are at or below the waterline and breakwaters protect the casemate from seas fore and aft. In the bow the form of the hull is simply a semi-circular extension of the canted sides of the hull underneath the casemate. That configuration would be simple to build and the radial use of frames would have eliminated the necessity for compass timber. In the stern the angle of the sides has been progressively increased from 110 degrees to 150 degrees at the deadwood to provide a more efficient run to the propellers and rudder. As in the bow, the radial use of frame timbers would have eliminated the necessity for compass material. While this hull form appears as a possibility in the academic sense, there are no examples of use during the period. As a consequence, it does not appear to be a candidate for the CSS *Georgia*.

The hull forms of CSS *Mississippi* and CSS *Louisiana* provide another possibility for the hull configuration of CSS *Georgia*. CSS *Louisiana* was build with flat floors and vertical sides from bow to stern. Under the casemate the hull was a simple rectangle. Fore and aft of the casemate both bow and stern were triangular. Progressively decreasing floor lengths produced a crude but reasonably effective hydrodynamic form. In the bow the deck was literally a mirror image of the floors. It appears to have been at of near the waterline and was fitted with a breakwater. In the stern the deck extended out over the rudder and propellers for their protection and to minimize cavitation. The sides of the hull could have been built with stacked timbers that were notched at the knuckles where the bow and stern attached to the amidships section. While this hull form would not have resulted in efficiency of propeller operation, their function would certainly have been sufficient to support some degree of operational effectiveness.

This hull form would have been one of the simplest to construct. It would have provided at least expectations of operational effectiveness. While that was not demonstrated by CSS *Louisiana* as the combination of paddlewheels and propellers failed to provide virtually any propulsion, CSS

Mississippi was built with the same hull design and more powerful engines. CSS *Mississippi* was conceived by Georgian Nelson Tift suggesting that his ideas may well have been shared with the designers and builders of CSS *Georgia*. The fore and aft deck configuration of the CSS *Atlanta*, built at Savannah on the hull of the blockade runner *Fingal*, reflects the angular forms of *Mississippi* and *Louisiana*.

Given the speed with which CSS *Georgia* was constructed it would indeed appear that the hull form would have to be relatively simple. With any expectation for "gunboat" performance it would have to have had to have a nominally hydrodynamic design. To be a failure as a "gunboat", that hull design or a combination of hull form and propulsion machinery problems must have been inherent in CSS *Georgia*. Considering all of the historical photographic and archaeological data, it would seem likely that the two most acceptable hull forms would be similar to that of CSS *Louisiana* or that of CSS *Jackson* and CSS *Neuse* with an angular deck similar to that of CSS *Atlanta*. Both would have been relatively easy to construct with available labor and materials. Both would have supported expectations of "gunboat" performance. Both of those designs were considered acceptable for vessel construction. Finally, both were accessible to the designers and builders of CSS *Georgia*.

While academic exercises rarely solve problems they can be useful in analysis of available data and contribute to the design of additional investigation. While it appears that the hull of CSS *Georgia* has been effectively destroyed, additional investigation at the site could identify subtle elements of the hull structure that might contribute to a better understanding of how the vessel was designed and built. The base of the casemate is a critical area as examination as it might shed light on the way it was attached to the hull. Thus it could reveal something about the hull design. Fasteners employed to construct the hull, regardless of its form, could be very different from those used in construction of the casemate. That being the case, an examination of just the fasteners could help determine the form of the hull. For example, fasteners used in a traditional hull such as that of CSS *North Carolina* and CSS *Savannah* would be quite different from those employed to build CSS *Louisiana*. Likewise, those of CSS *Neuse* and CSS *Jackson* would differ from those of the above vessels. The basic difference would be found in the length, diameter number of the drifts. Unfortunately it appears that the hull form of CSS *Georgia* could remain a mystery.

RECOMMENDATIONS

A National Register of Historic Places listed property, the *Georgia* site has been adversely affected, primarily through impacts from repeated dredging operations associated with operations and maintenance. This has been clearly documented. Therefore, because of past adverse project effects, and prior to any future project activities that will also impact the site, mitigation of these adverse effects is necessary, and it is recommended that they take the form of a comprehensive investigation and recovery of extant remains.

Because of the limited amount of structural remains and the level of disturbance to the archaeological record, it is recommended that data and material recovery be designed as a systematic archaeological salvage including systematic site testing, and partial and full excavation and data recovery that builds cumulatively on the results of the current project. The archaeological salvage of data and material from the CSS *Georgia* wreck site will mitigate past impacts and the continued deterioration of the surviving structural remains and the loss of valuable historical and archaeological data preserved in the wreckage and associated artifacts. In addition, the Savannah River Navigation Channel will be cleared of obstructions to navigation and explosive ordnance that constitute a threat to both navigation and dredging in the vicinity of the wreck site. It should be stated that the employment of a cofferdam is not recommended for any future work. Rather, the site environment is such that it is both feasible and cost effective to conduct the data and material recovery operation with archaeological divers working from a fixed platform (i.e. barge). Regardless of the form mitigation takes, before recovery can proceed, funding must be in place to provide proper documentation and conservation of recovered materials.

Using the site plan being developed from data collected in 2003, a survey grid can be established over the wreck site. The grid can be either physical or electronic, or a combination of both, and would serve as control for the systematic identification, mapping and recovery on material associated with the wreck. Archaeological divers equipped with hand held underwater magnetometers or metal detectors would be able to identify ferrous material and search each grid area thoroughly for non-ferrous artifacts. Once mapped, material from each area within the grid would be brought to the surface, cataloged, documented and evaluated for additional analysis, cleaning, conservation, permanent curation or re-deposition in a secure non-destructive environment.

Once the bottom around the surviving sections of casemate had been cleared of material, those elements of CSS *Georgia* could be cradled and lifted intact for comprehensive documentation, and either conservation and display or re-deposition in a secure non-destructive environment. Recovery of the three sections of casemate could be accomplished by constructing an iron I-beam frame under each similar to those employed in transporting buildings. As each section has been pedestaled by erosion and dredging, placement of the primary longitudinal lifting beams might be feasible. With those in place additional elements of the lifting frame could assembled without extensive excavation. That method of recovery of the East Casemate Section and small section downstream would certainly be possible. While the West Casemate section would require more lift and a more complex lift structure that means of recovery is not out of the question.

The 2003 investigation of CSS *Georgia* established a series of datum stations and a baseline web that permits accurate geographical location of the major elements of surviving wreckage. The site plan included here provides the first accurate image of those remains and the associated cultural material identified during the survey. Future investigations can be designed to take advantage of the on-site baseline to correlate documentation of the wreck and the scatter of associated material with previous work. Before those baselines deteriorate, an effort should be made to place more permanent references at each of the stations. That will ensure continuity that has been absent in virtually all of the previous investigations.

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APPENDIX A:
SCOPE OF WORK

Scope of Work

In Situ* Archaeological Evaluation of CSS *Georgia
Savannah Harbor, Georgia

1. Introduction:

The U.S. Army Corps of Engineers, Savannah District, operates and maintains the Savannah Harbor Navigation Project (existing navigation project) and, in partnership with the Georgia Ports Authority, is examining the feasibility of deepening the Savannah Harbor navigation channel (deepening project). To ensure that the existing navigation project and the potential deepening project comply with the National Historic Preservation Act (P.L. 89-665, as amended) and the Advisory Council on Historic Preservation's regulations implementing this Act (36 CFR, Part 800), Savannah District is re-initiating studies of CSS *Georgia* to determine the effect of past, present, and future activities associated with the existing navigation project and the effects of the potential future deepening project. Although no dredging has been conducted close to the CSS *Georgia* wreck site since 1983, both the existing navigation project and the potential deepening project may adversely affect this National Register of Historic Places listed site.

CSS *Georgia* was locally built in 1862. Originally designed as an ironclad gunboat, it was soon designated a "Floating Battery," likely the result of being seriously underpowered. In use, *Georgia* was moored to cribbing in the Savannah River opposite Old Fort Jackson, where the river is restricted to a single channel, and was maneuvered with ropes to provide a broadside of fire to prevent Union ships from proceeding to Savannah. After a 20-month operational life, *Georgia* was scuttled in December 1864 to prevent capture by advancing Union troops.

No plans depicting *Georgia* have been located. Construction details are incomplete and contradictory. For example, vessel length has been variously described in six contemporary references as being from 150 feet to 250 feet. The vessel likely had no keel and had multiple screws.

Post depositional impacts have affected *Georgia*'s remains. Contemporary documents indicate the wreck was dynamited in 1866, and 80 tons of iron, most likely t-rail used for casemate armor cladding, were removed. The wreck site was rediscovered in 1968 when it was struck by a dredge during a navigation channel widening project. Maintenance dredging occurred in the study area in at least 1969, 1970, 1974, and 1982. In early 1982, a ship snagged a USGS buoy with a 10-ton anchor used to mark the site dragging it downstream, possibly impacting the site.

In 1979, Texas A&M University conducted archaeological investigations for Savannah District and prepared an archaeological and engineering assessment. This study produced a best estimate of site extension as a rectangle 300 feet by 150 feet. Bottom probing at this perimeter produced no contacts. Wreck relief was estimated at 7 to 9 feet above the bottom, with articulated casemate fragments greater than 200 square feet reported, and related shoaling and scouring observed. Armor plate was reported on the southeast side of the site. Investigators posited that the west side of the wreck might be the bow. Magnetic interpretation may corroborate this hypothesis since large anomalies appear to the east of the site concentration, which may represent machinery. Intact hull and deck areas were reported buried in cross-bedded sand and clay. Good artifact preservation was reported.

During the Texas A&M investigations and 1983 Savannah District diving, ordnance was reported and some recovered. Two guns, a 6.4-inch rifled cannon and a 24-pound howitzer were removed. Brooke projectiles, percussion fuses, spherical shot, including "strap shot," were also recovered. Laboratory examination of these materials showed that water had penetrated the chambers and the ordnance was inert.

2. Location:

CSS *Georgia* lies offshore of Old Fort Jackson on the north edge of the Savannah Harbor navigation channel at the intersection of the Back River Channel. The wreck appears to lie parallel to the navigation channel, with wreck materials dispersed down slope into the channel.

3. Environmental Conditions:

Environmental conditions are serious. Large vessel traffic in the navigation channel, tidal range, current, and low visibility hamper diving operations, and must be accommodated in planning and execution of fieldwork. Average tide range is 7.5 feet at mean low water; current velocities at ebb tide range from 3.8 to 5.1 feet per second. Visibility is low on the bottom at all times due to heavy silt load. Water depths range from 30 feet to 45 feet at mean low water. Recent current flow derived from acoustic Doppler transect data (FJ) near Fort Jackson will be provided by Savannah District.

4. Research Objectives:

The objective of the project described in this Scope of Work is to use minimum-impact techniques to produce GIS-based data in electronic format and a written Final Report that:

a. Characterizes and delineates the CSS *Georgia* wreck site incorporating remote sensing data and environmental context;

b. Ascertains the current state of preservation of the wreck site;

c. Accounts for the current state of the site in terms of natural and cultural site formation processes and rates;

d. Compares the present site distribution and state of preservation to that of past investigations and accounts for the variation;

e. Provides an interpretation of site features that incorporates historical documents and comparative historical and archaeological analysis of contemporary ironclads;

f. Projects most likely site impact from the existing navigation project, vessel traffic, natural processes, and the potential deepening project. Additional potential impacts resulting from either project will be identified. The description will include a prediction of what might happen directly or indirectly to the site and its environment as a result of activities associated with each project.

g. Reviews alternatives and recommends a course of action and methodology for mitigating impacts from the existing navigation project and the potential deepening project. This should include recommendations for future phases of intensive investigation and documentation of the wreck site, including systematic site testing, and partial and full excavation and data recovery that will build cumulatively on the results of this project.

5. Description of Services to be performed:

a. Site Characterization.

The contractor shall characterize site features identified by remote sensing. Site features will initially be determined through analysis of cumulative remote sensing records. Features will be uniquely identified for documentation.

The contractor shall determine the extent of the wreck site, including buried features, and create a site map. Completion of this task will require in-water diver positioning and monitoring with a precision of at least sub-meter, preferably in the 10- to 20-centimeter range. Technology employing short- or long-baseline sonic positioning and sector scanning sonar is required. Positioning must provide geographic coordinates in either real-time or as a result of post-processing. Positioning accuracy and precision must be checked during fieldwork, with results reported in the Management Summary and Draft Report.

Diving will be conducted to locate and record site features associated with *Georgia*; record architectural features including scantlings, fastenings, iron cladding and machinery; record large or diagnostic artifacts on the bottom; and define extent and density of debris field associated with wreck site, including examination of the channel side and bottom. Direct voice communication with at least audio recording on the surface for feature description will be required.

Presence, extent, and nature of subsurface architectural features shall be determined and accurately positioned and documented. Minimal excavation is expected, most investigation may likely be done by probing.

Systematic intra-site in-water remote sensing with hand-held remote sensing equipment, including magnetometers, metal detectors, or sonar shall be systematically and selectively deployed to locate artifact concentrations, iron cladding features, engines, boilers, shafts and screws, and additional artifacts and structural elements not represented on remote sensing records.

The contractor shall document and map all wreck features identified through analysis of remote sensing data and any additional wreck features located during in water investigations to the level necessary to characterize features. Documentation must be to a level that allows detailed verbal description including the size and shape to be accurately mapped.

The contractor shall determine to what extent intact hull and superstructure remain. Intact hull sections shall be documented as to size, shape and height above bottom. Representative scantling measurements shall be recorded. When possible, structural pieces should be identified as to what portion of the hull or superstructure is represented. Interior sediments and artifact density must be characterized and interior artifact range and density evaluated.

The contractor shall relate wreck features to historical data in their descriptions and interpretations.

The contractor shall characterize current wreck distribution and preservation in terms of natural and cultural site formation processes. This task will require review of past impact, prior investigations and in-water collection of environmental data, minimally salinity, pH, dissolved O_2, E_{corr}, which are necessary to characterize active corrosion rates. Biological samples will be required, minimally to characterize wood borer infestation and bioturbation, and possibly microbiological activity. Characterization of sediment as well as water will be required to describe active natural processes affecting the site.

b. Analysis of Data and Recovered Materials.

All data will be processed, described, and analyzed. The goal of the data analyses will be to evaluate and synthesize information obtained as a result of the archival research (provided by Savannah District), Savannah District furnished GIS data, and fieldwork to address the research objectives and produce a quality research document.

Material remains must be stored, cleaned, catalogued and, if necessary, chemically treated for conservation, as appropriate so as not to preclude specialized analyses. Samples collected for analysis will be handled appropriately for that sample. All accessioning shall be in accordance with the standards stipulated by the University of Alabama, Archaeological Services, Moundville. Contractor shall provide detailed information on all materials removed from the study area.

All associated field notes and documentation shall accompany the collection. A duplicate set of all field documentation and laboratory analysis shall be produced, preferably on acid-free paper. All pertinent maps used and generated by the project shall accompany the collection. An inventory of all maps shall accompany the artifacts.

Archival and working sets of slides and prints shall be produced. All photographic materials shall be stored in archivally stable containers or holders. A photographic catalog listing materials by film type (e.g., roll film, sheet film, 35mm slides, prints, video media) and in chronological order shall be included with the material remains. Packaging materials and methods shall meet the standards stipulated in 36 CFR, Part 79, *Curation of Federally-Owned and Administered Collections*.

All maps, photographs film or digital, video tape, raw and processed electronic data, field notes, submitted reports and all other data procured or generated during this contract are the property of Savannah District.

c. GIS Database Preparation.

To the extent practical, all field data must be spatially related.

All data shall be compliant with the Spatial Data Standard for Facility Infrastructure and Environment (SDSFIE).

All data shall be registered to the Georgia State Plane, East Zone coordinate system, North American Datum 1983 (NAD83), Mean Lower Low Water (MLLW), Feet.

All data shall be accompanied with metadata.

Line and polygon data/products must be furnished in ArcView GIS format with the required minimum attribution.

Point data may be provided in an Access database or ArcView format.

d. Presentation of Results in Draft and Final Reports.

The information gathered as a result of this work effort shall be integrated into a graphically illustrated, scientifically acceptable report describing the project's purpose and goals, the environmental and historical contexts, research design and hypotheses, field and laboratory methods, and results. The archaeological data shall be integrated with the historical and environmental information to ensure correct site interpretations.

Page size shall be 8-1/2 x 11 inches, with 1-1/2 inch binder margin and 1-inch side margins. The document shall be printed with a letter quality printer; dot-matrix printing will not be accepted. All drawings will be presented in their proposed final form. All photographic illustrations will be high-quality black and with or color, whichever best depicts field conditions, artifact and sample character, etc.

If the report has been authored by someone other than the Principal Investigator, the cover and title page must bear the inscription Prepared under the Supervision of (Name), Principal Investigator. If the report is authored by another individual, the Principal Investigator must prepare a Forward describing the overall research context of the report, the significance of work, and any other related background circumstances relating to the manner in which the work was undertaken. The Principal Investigator shall sign the original copy of the report.

The following sections should be included in the reports. Additional chapters or sections shall be added as needed to accurately and thoroughly report the results of this work effort.

Title Page. The study type, location (project name and counties), report date, name of Contractor, author/Principal Investigator, and Corps of Engineers contract and task order numbers.

Abstract. A brief synopsis of the work conducted, number and types of cultural resources identified, overall significance, and an overview of the management recommendations, which shall not exceed 150 words.

Acknowledgements. A listing of individuals and organizations who contributed to the success of the project and a brief synopsis of those contributions.

Introduction. Identify the Contractor, the purpose and type of investigation performed, and the location, disposition of artifacts and associated field records. Discuss report organization.

Environmental Setting. The project setting should be described from regional, harbor, and site specific perspectives incorporating detailed site-specific data acquired during the fieldwork.

Historical Background. The historical background of the site shall be described in detail. Historical information covering the period 1860 to 1872 resulting from work now being conducted by New South Associates under contract to Savannah District may be incorporated whole or in part in this chapter, with credit given to the authors of this material. Additional historical information generated as a result of this task order covering the post 1872 period shall also be incorporated into this chapter. This information should minimally include historical and recent changes in the operation and maintenance of Savannah Harbor that may have affected the wreck site.

Methods. Specify the personnel who conducted the field work and the tasks that they performed and identify the field director. Describe the field and laboratory methods used and the reasons for their selection. Discuss obstacles that may have caused deviations from any standards described in the scope. Discuss artifact sampling and collection procedures.

Results. Describe the results of the field and laboratory effort including, but not limited to, the present environmental and geological setting, aerial and subsurface extent of the site, location and condition of structural features, stability at a micro and macro level, artifact distributions, present impacts, etc.

Interpretations. Provide a description of the wreck site and its environment prior to its rediscovery in 1968, identify past, present, and future operation and maintenance to the site and how each has affected or will affect the site. Provide a description of the effect of the proposed deepening project upon the wreck site.

Review of Alternatives. Identify and evaluate alternatives to mitigate impacts of past, present, and future operation and maintenance activities, identifying costs and personnel and facility needs for further studies, recovery and/or stabilization measures, and conservation and curation of data. Identify and evaluate alternatives to mitigate impacts of the potential future deepening project identifying costs and personnel and facility needs for further studies, recovery and/or stabilization measures, and conservation and curation of data.

Recommendations. Make recommendations for mitigation of past, present, and future operation and maintenance impacts and for mitigation of impacts associated with the proposed deepening project.

References. The reference (and in text citation) format shall follow "Editorial Policy and Style Guides for *American Antiquity*," *American Antiquity* 57 (1992): 749-770. The manual can be found at http://www.saa.org/Publications/StyleGuide/styframe.html. Spelling in the report shall be in accordance with the U.S. Government Printing Office Style Manual, dated 2000. A copy of this manual is available at: http://www.access.gpo.gov/styleman/2000/browse-sm-00.html

Appendices. This shall minimally include a list of all artifacts collected and the scope of work.

6. Reporting Requirements/Deliverables.

a. Dive Information. Diver physicals, certifications, and resumes, Dive Plan, and Contractor's Safe Practices Manual prepared in accordance with EM 285-1/1, 3 September 1996.

b. Monthly Progress Reports. These reports may be in brief letter format and should document progress to date and any problems that occur. In addition, any matters requiring an action or decision by the Contracting Officer's Representative (COR) shall be reported by expeditious contact with Ms. Judy Wood at (912) 652-5794.

c. Management Summary. The Contractor shall prepare a report briefly describing the project goals, methods, preliminary findings, initial analysis, preliminary conclusions and draft recommendations.

The summary shall present information in text, graphic (e.g. field sketches, illustrations, photographs, and drawings), and tabular formats. The reference format shall follow the standards presented in *American Antiquity* (1983), Volume 48, Number 2, and spelling shall be in accordance with the *U.S. Government Printing Office Style Manual* dated March 1984. Page size shall be 8-1/2 x 11 inches, with 1-1/2 inch binder margin and 1-inch side margins. The document shall be printed with a letter quality printer; dot-matrix printing will not be accepted.

d. Draft Report. The contractor shall prepare a draft report that conforms to the standards in Section 5.d.

e. Revised Draft and Final Reports. The Contractor shall address and/or incorporate any comments made by Savannah District, the Georgia and South Carolina State Historic Preservation and State Archaeologist's Offices, and other reviewers designated by Savannah District into a revised draft report. Upon acceptance of the document, the contractor shall be required to submit the final report.

f. Artifacts and Field Documentation. Artifacts will be delivered to Savannah District along with all field documentation and two copies of the final report printed on acid-free paper.

7. Savannah District Furnished Equipment and Information:

a. Detailed descriptions of past dredging activities performed under the Savannah Harbor navigation project and those planned for the potential deepening project.

b. Positioned or georectified remote sensing data in electronic format. This includes: aerial imagery; construction maps and charts; hydrographic survey data including bathymetry, both single and multiple transducer (multi-beam); magnetometry; side scan sonar; sub-bottom profiler; geological and geotechnical data and characterizations; and tidal and current data.

c. Historical documentation currently in possession and that resulting from the on-going archival research project.

d. Previous publications and reports of the study area, including uncirculated internal reports.

e. Information from the on-going conservation and curation study.

8. Point of Contact:

The technical Point of Contact (POC) for work conducted under this contract is Judy Wood, (912) 652-5794; e-mail: judy.l.wood@sas02.usace.army.mil; fax: (912) 652- 5787.

The dive safety POC for work conducted under this contract is: Walt Lanier, (912) 652-5064; e-mail: walter.e.lanier@sas02.usace.army.mil; fax: (912) 652-5065.

9. Contractor Responsibilities:

The Contractor shall provide full cooperation and coordinate with Savannah District POCs , including site access for periodic inspections of work in progress. The Principal Investigator shall be the principal contact and liaison for the POC. The Principal Investigator shall be responsible for the final report and directly supervise field work, analysis, and report preparation and shall be held accountable for conclusions and recommendations.

The contractor shall coordinate all fieldwork schedules with the Savannah District POC, Judy Wood.

The Contractor shall provide all transportation, materials, and equipment required to perform the work described herein. The Contractor shall provide all professional and technical services required to collect data, perform data analyses and interpretation, provide Savannah District with appropriate data gathered during this study, and prepare the reports and maps (including editing and proofreading). The Contractor will be responsible for accomplishing all work in a timely and professional manner. Any work deemed inadequate or nonconforming by the COR shall be re-accomplished by the Contractor as necessary to comply with the Task Order requirements at no additional cost to the Government.

If the Contractor expects to publish any part of the final report, the Contracting Officer must be provided a letter specifying the expected date, place, and name of publication. Neither the Contractor nor any representative shall release any sketch, photograph, report, or other material of any nature obtained or prepared under this task order without written approval of the Contracting Officer prior to the time of final acceptance of the report by the Government.

Copyright will not be claimed by the Contractor for any materials produced under this Task Order. All such materials are to remain within the public domain.

No Archaeological Resources Protection Act (ARPA) permit is required. However, the Contractor shall meet all requirements necessary for archaeological work under ARPA, including the Secretary of Interior Guidelines as they pertain to project execution and personnel qualifications, and the guidelines of the Georgia and South Carolina State Historic Preservation Offices. These requirements include: professional qualifications; research design; research strategy; recording standards, reporting, and curation. Consultants and subcontractors must possess credentials and experience appropriate to their task.

All work shall be performed in strict conformance with the US Army Corps of Engineer's *Safety and Health Requirements Manual* EM 385-1-1, 3 September 1996. All diving shall conform to Section 30 (pp545-560) of the Manual (Attachment 1). Failure to meet these requirements will be cause for cessation of operations. Current physicals, certifications and diver resumes that include training and experience shall be submitted along with the project specific *Dive Plan* and Contractor's *Safe Practices Manual* to the District Dive Coordinator for review. Dive Coordinator must accept Contractor's *Safe Practices Manual,* and the project specific *Dive Plan* must be implemented prior to initiation of contract diving operations.

10. Inadvertent Discoveries:

Archival research has indicated that there were no lives lost when the vessel sank or during the aborted salvage attempt. However, in the unlikely event that human skeletal remains are encountered during the course of this project, they shall be temporarily stabilized in place, and the Savannah District POC notified immediately. Further disturbance of the remains shall be minimized. If long-term in place stabilization of the remains is not possible, recovery of the remains may be included as an amendment to this Task Order.

Previous archaeological investigations have shown that ordnance is located along the toe of the existing navigation channel side slope and in the navigation channel bottom. Additional ordnance may be located within the site. If ordnance is encountered, it shall be identified as to type (if such identification can be made without excavation, probing, or other disturbance), it's location mapped, and the ordnance left undisturbed.

11. Coordination:

The Savannah District archaeologist shall be responsible for all coordination with the Georgia and South Carolina State Historic Preservation Offices, Georgia and South Carolina State Archaeologist's Offices, the Advisory Council on Historic Preservation, the United States Navy, and other state or Federal agencies.

12. Meetings/Public Relations:

On-site meetings may be scheduled as necessary during the course of fieldwork. Meetings will be scheduled at any time following 24 hours notice by Savannah District archaeologist Judy Wood.

The Contractor shall not speak or grant interviews of any kind to any newspaper, radio station, or television station, or other media without the approval of the Savannah District archaeologist, Judy Wood. All requests for information or interviews shall be directed to the Savannah District archaeologist.

13. Schedule and Quantities:

a. Diver Information. One copy of the dive information including diver physicals, certifications, and resumes, Dive Plan, and Contractor Safe Practices Manual shall be submitted within 7 calendar days after award of this task order.

b. Fieldwork. Fieldwork shall commence within 30 calendar days after award of the task order, pending approval of the dive information by the District Dive Safety Officer.

c. Monthly Progress Reports. Monthly Reports shall be submitted by the Contractor no later than the 15th day of every month following the award of the task order throughout the duration of the project.

d. Management Summary. Ten hard copies and one electronic copy of the Management Summary shall be submitted within 100 days after completion of fieldwork.

e. Curation Information. Within 110 days after award of the task order, the Contractor shall provide a letter report containing information concerning the nature of archaeological and archival collections generated by the project.

f. Draft Report. Within 145 calendar days after completion of field work of the task order, the Contractor shall prepare and submit to Savannah District 10 hard copies of the draft report, one copy of the draft report in electronic format, and one copy of the GIS data. The Government, any reviewers designated by the Government, and the Georgia and South Carolina State Historic Preservation and State Archaeologist's Offices shall review and comment upon the draft report. Savannah District shall compile the comments and submit them to the Contractor.

g. Revised Draft and Final Report. Upon receipt of the review comments, the Contractor shall incorporate or resolve all comments and submit one copy of the revised draft report and one copy of the revised draft report in electronic format within 45 calendar days. Within 30 calendar days after acceptance of the revised draft document, one copy of the "camera ready" original, one electronic copy, and 15 hard copies of the final report, and one copy of the GIS data shall be submitted to the Savannah District.

h. Artifacts/Field Documentation. Within 60 days after acceptance of the revised draft, artifacts and field documentation shall be submitted to Savannah District. Two copies of the final (camera ready" report original shall be printed on acid-free bond paper and shall accompany the collection.

14. Period of Service:

All work under this Task Order shall be completed within 365 calendar days of the award of Task Order.

APPENDIX B:
DIVER LOG

Date	Dive	Diver	Min.	LOCATI0N/COMMENTS	Measure	Datum	Art.	Wreck	Video	Wood
						Info	Sktch	Sketch		Samples
				MOORING						
JULY										
19	1	Duff	57	Set West Casemate Mooring						
	2	Elliot	37	Check West Casemate Mooring						
20	3	Rawls	56	Set East Casemate Mooring						
	4	Duff	56	Set East Casemate Mooring						
21	5	James	38	Set Baseline between Moorings						
	6	Krivor	39	west casemate orientation						
	7	Watts	40	west casemate orientation						
				EAST CASEMATE						
22	8	Elliot	42	east casemate orientation						
	9	Rawls	54	measured baseline - 84 ft to w.casemate edge from downriver mooring, find Cannon #1	XX					
23	10	Watts	60	Cannon #1 measurements/description (6 pounder)	XX					
	11	Duff	59	clean section of E casemate/ cannon to mooring measurements	XX					
24	12	Whall	60	cannon #1 measurements	XX					
	13	Watts	33	aborted						
25	14	Krivor	27	test datum placement methods at E casemate						
	15	Whall	56	cannon #1 measurements	XX					
	16	Duff	52	E casemate measurements	XX			XX		
28	17	Elliot	53	Establish Datum #1 north of baseline and East Casemate Datum adjacent E. casemate		XX				
	18	Rawls	58	Clearing concretion from E casemate						
29	19	Watts	62	E casemate measurements	XX			XX		
	20	Whall	64	E casemate measurements and Video	XX			XX	XX	
30	21	Krivor	59	Clearing concretion from E casemate and Wood Samples						XX
	22	James	52	Hydroprobe baseline adjacent E casemate	XX			XX		
31	23	Duff	59	E casemate measurements	XX			XX		
AUG	24	Elliot	24	Probing/aborted/Current						
4	25	Elliot	12	Probing/aborted/Current						
	26	Rawls	58	Begin Establish South Datum (#2)		XX				
5	27	Whall	60	Aquameter (AM) readings at E casemate Distance and Depth	XX					
	28	Watts	52	Continue Establish South Datum (#2)						
	29	Krivor	60	Clearing concretion from E casemate						

Date	Dive	Diver	Min.	LOCATI0N/COMMENTS	Measure	Datum	Art.	Wreck	Video	Wood
						Info	Sktch	Sketch		Samples
6	30	Watts	106	Aquameter readings at E casemate Distance and Depth	XX					
	31	Whall	72	Aquameter readings at E casemate Distance and Depth	XX					
	32	Duff	3	Aborted/Current						
7	33	Elliot	57	Complete Establish South Datum (#2)/ begin set W Casemate Datum	XX	XX		XX		
	34	Rawls	62	Probing downriver edge of E casemate				XX		
	35	Duff	48	Clearing concretion from E casemate						
8	36	Watts	86	Aquameter readings at E casemate Distance (Datum 2 and 3)	XX	XX				
	37	James	35	Probing baseline to Datum 2	XX			XX		
11	38	Watts	89	Aquameter readings at E casemate Distance (E Casemante D) Christmast tree=D#1						
	39	Whall	87	Aquameter readings at E casemate Distance (E Casemante D) Christmast tree=D#1	XX					
12	40	Krivor	42	Measure E casemate fasteners	XX					
	41	Whall	90	Measurements on E Casmate / Video / Recovered Fastener/ Construction detail	XX		XX	XX	XX	
				WEST CASEMATE						
13	42	James	57	Establish West Casemate Datum (WC) - 8' from mooring, Identify Gunport on WC	XX	XX		XX		
	43	Elliot	39	line from mooring to WC Datum WC Datum to Datum #3 = 66'5", inspect debris field	XX	XX				
	44	Rawls	24	Aborted/Current						
	45	Watts	77	Establish Datum #4 41.6 ft north or WC Datum	XX	XX		XX		
16	46	Krivor	58	Debris field inspection, tied line to what will be prop		XX				
	47	Whall	64	A.M. measurements on WC, wood sample	XX					XX
	48	Elliot	42	Buoy East Casemate and West datums for surface GPS reading	XX	XX				
15	49	Watts	69	Search Debris Field, Identify and measure propeller and shaft (see dive 46)	XX		XX			
	50	Rawls	62	Search Debris Field,						
18	51	Duff	60	Additional Prop measure, Search Debris Field	XX					
	52	Whall	67	Additional Prop measure, Video Prop	XX			XX		
19	53	Krivor	58	Search Debris Field,						
	54	Elliot	46	Set Datum #5 adjacent to Propeller and shaft	XX	XX				
20	55	Watts	103	AM readings of Datums 2, 3 and WC Datum. Christmast tree=D#1	XX	XX				
	56	Rawls	57	Tape measurements from all major datums and wreck points	XX	XX		XX		
	57	Whall	60	AM readings of Datums 2, 3 and WC Datum. Christmast tree=D#1	XX	XX		XX		

Date	Dive	Diver	Min.	LOCATI0N/COMMENTS	Measure	Datum	Art.	Wreck	Video	Wood
						Info	Sktch	Sketch		Samples
				DOWNRIVER OF EAST CASEMATE						
21	58	Elliot	38	Searching downriver and channel side from E casemate	XX			XX		
	59	Duff	54	Searching downriver and channel side from E casemate	XX			XX		
	60	Watts	63	Searching downriver and channel side from E casemate	XX			XX		
				WEST CASEMATE						
	61	Krivor	62	Locate first cannon south of W Casemate = Cannon #2	XX			XX		
	62	Whall	79	Measure Cannon #2 south of W Casemate, locate adjacent Cannon #3	XX	XX	XX			
				DOWNRIVER OF EAST CASEMATE						
22	63	Watts	48	Searching downriver and channel side from E casemate	XX			XX		
				WEST CASEMATE						
	64	Rawls	36	Start mooring on Cannon #2						
	65	Tuby	23	West casemate orientation						
25	66	Whall	62	Record Cannon #3	XX		XX			
	67	James	54	Estab mooring at Cannon #2, possible machinery, boiler plate, sabot adjacent cannon		XX				
	68	Elliot	4	check damaged prop on Nautilus						
26	69	Watts	93	Record steam cylinder adjacent Cannon #2, possible boiler plate	XX	XX				
	70	Duff	55	Tied lines from Cannon #2 to West Datum and to Upstream Cylinder						
27	71	Whall	62	Tape measurements from all major datums and wreck points near cannon/debris field	XX		XX			
	72	Krivor	60	Tape measurements from all major datums and wreck points near cannon/debris field	XX		XX			
	73	Elliot	63	Tape measurements from cannon #3 to Datum #2 also items in debris field	XX		XX			
	74	Watts	72	Additional Recording of steam cylinder adjacent Cannon #2,	XX	XX				
28	75	Watts	88	Recording of steam cylinder "2 towards or near propeller	XX	XX				
	76	Rawls	34	Failed attempt to get mooring off Cannon #2	XX		XX			
	77	Whall	100	Examine Measure West Casemate especially wood	XX		XX			
	78	James	22	Removed Cannon #2 Mooring						
29	79	Watts	54	Distance from Datum 5 to WCD = 50' 7", removed WC Mooring	XX		XX			
	80	Duff	14	Recovered iron rail section, removed EC Mooring						
			4399							