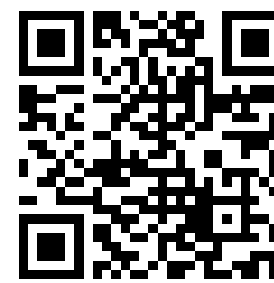


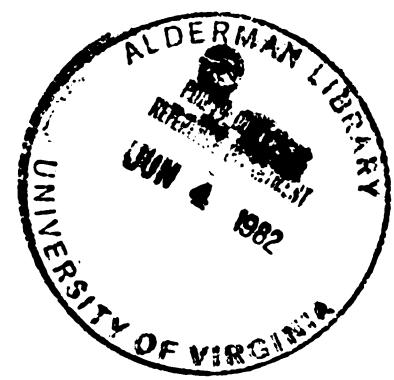
THE LOWCOUNTRY ENGINEERS

MILITARY MISSIONS AND ECONOMIC DEVELOPMENT IN THE CHARLESTON DISTRICT, U.S. ARMY CORPS OF ENGINEERS

by

James W. Moore

U.S. Army Corps of Engineers
Charleston District
Charleston, South Carolina
1981



PREFACE

My search into the character and accomplishments of the Charleston District, Corps of Engineers, began with two questions: What did the district do and why? What effect did the activities of the district have upon the region? This narrative is an extended answer to these questions.

I owe much to those who freely offered their assistance. My first thanks go to the personnel of the Charleston District: Colonel Harry S. Wilson, Jr., District Engineer, and Lieutenant Colonel Dale P. Gregg, Deputy District Engineer, who helped plan the project; their successors, Colonel William W. Brown, District Engineer, and Lieutenant Colonel William C. Mattei, former Deputy District Engineer and Chairman of the Historical Committee; Committee members Jack Lesemann, John E. Romanosky, Marieta Cade, Clela A. Brown, Robert J. Barnard, and Thurman Morgan, who deserves special credit for his patience as the manuscript went through its many drafts. I also thank former District Counsel Ann Marwick for her many valuable suggestions and for providing working space in her office.

No one can work without institutional support, which was provided by Lieutenant General George M. Seignious III, President of The Citadel; his successors, Vice Admiral James B. Stockdale and Major General James A. Grimsley; General Wallace E. Anderson, Vice President for Academic Affairs; and his successor, Dr. George Meenaghan. The Citadel granted me leavetime and provided funds for a sabbatical. Kenneth E. Toombs and C. J. Cambre made working space available at the Thomas Cooper Library at the University of South Carolina. The opportunity to accept a visiting associate professorship at the University of North Carolina, Chapel Hill, put the facilities of that university and the resources of the Louis Round Wilson Library and the Southern Historical Collection at my disposal.

I owe a large debt to those who guided my work by their comments and criticisms. At The Citadel, Charles Anger, Loring Himelright, and visiting professor Martin Blumenson were helpful at an early stage. My colleagues Larry Addington and Bill Gordon read portions of the manuscript and improved it with their understanding of military and naval history. Jay Fraser provided a pre-publication copy of his work on Charleston. Roger Bender used his position as Head of the Physics Department to render technical assistance. Bruce Ezell and Gus Marjenhoff shared the fruits of their research. I also thank Bob Seager, now at the University of Kentucky, and, at the University of South Carolina, John Sproat and Dan Hollis of the History Department, Olin Pugh, Albert G. Smith, Ronald Wilder, and Robert Graham in the Department of Economics, and E. L. Inabinett, Allen Stokes, and Eleanor M. Richardson of the South Caroliniana Library.

Those who work with documentary and archival collections know how much of the final content of any study is due to the advice of resident scholars and experts. My warmest thanks go to Jessie A. Remington, Chief of the Historical Division, his successor, John T. Greenwood; and to Martin Gordon, Charles Walker, and Dale Floyd, all of the Historical Office of the Chief of Engineers; to Rick Cox and Mike Musick in the Old Army and Navy Branch and Arthur Ryden in Cartographic Archives at the National Archives, Washington, D.C.; to Edward Bearss of the National Park Service; to Kathryn Manning, Base Historian, Charleston Air Force Base; to W. Pingree Crawford, Superintendent, John Dugan, and the staff at the Fort Sumter National Monument; to the staff at the Federal Records Center, East Point, Georgia; to Jason Cox, Director, and his staff at the Charles Towne Landing State Park; and to E. D. Sloan, Jr. for his suggestions. Linda Pope, Margie West, Rosalie Radcliff, and Briggs Hubbard typed various drafts of the manuscript.

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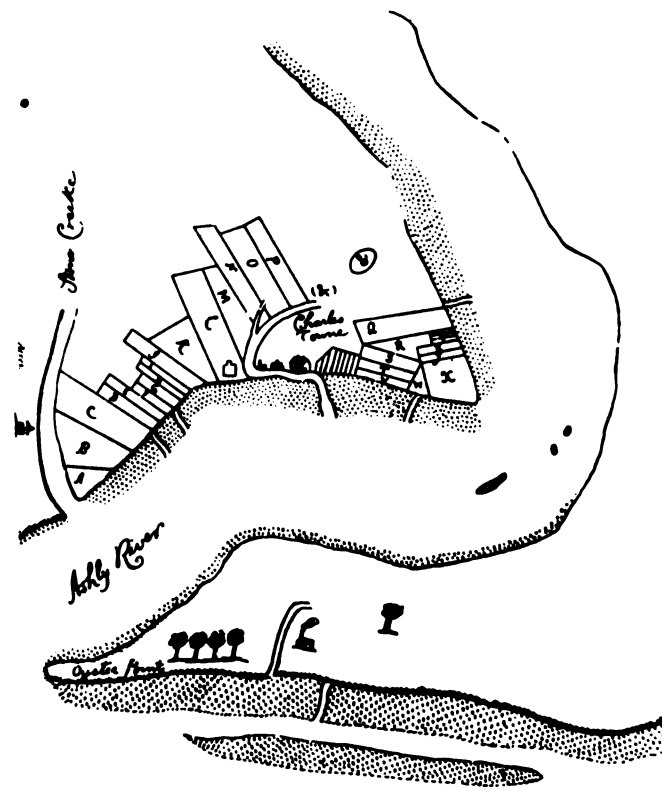
INTRODUCTION

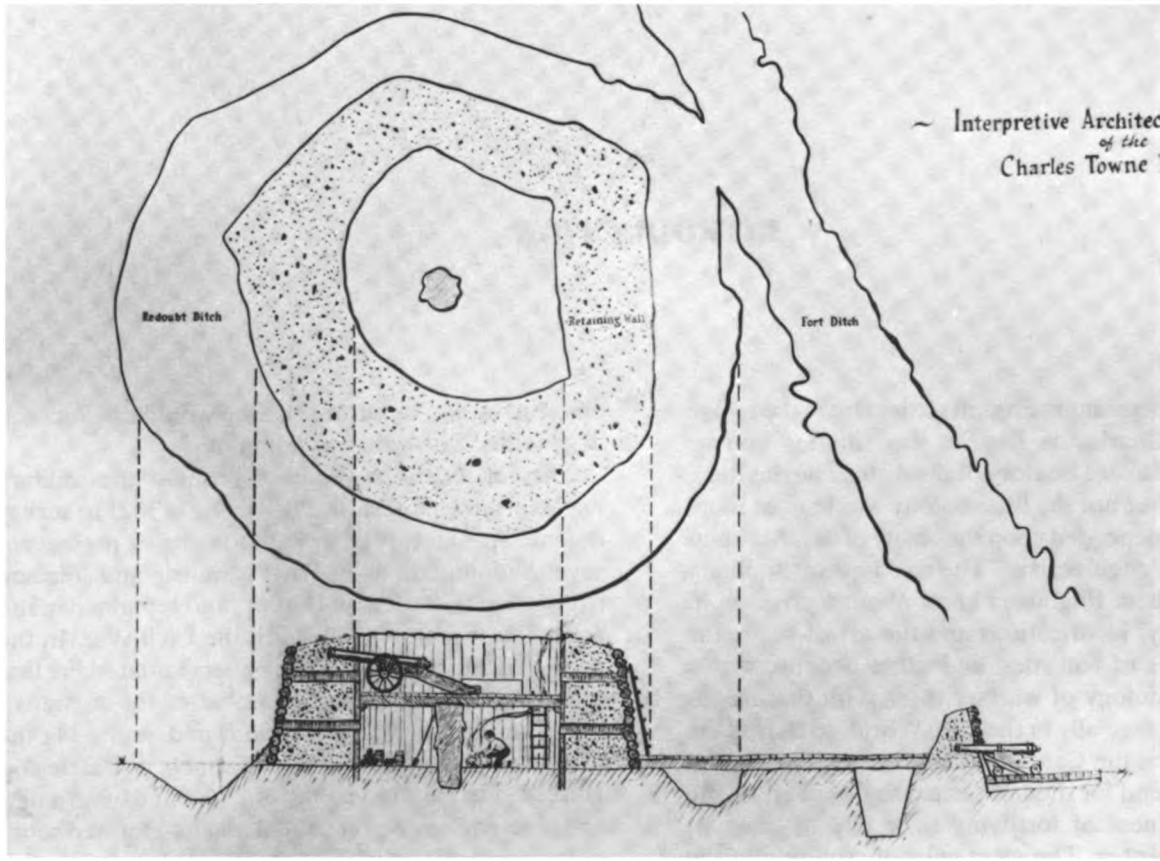
The first permanent English settlement in the region of today's Charleston District was Charles Towne, founded in 1670. The story of the district begins here, for whether or not the little colony would exist more than briefly depended upon the ability of its inhabitants to practice "engineering". The word meant "military engineer" then. Engineers knew about fortress guns and gunnery, fortifications and the art of seige, the mathematics of ballistics, and other accouterments of the technology of warfare. Men with these skills were rare, especially in the New World, so during the first 50 years, the Carolina colonists improvised and learned to fend for themselves as they went about the deadly business of fortifying their city in times of imminent danger. The most palpable solution to the problem of keeping the coastal frontier secure, however, was to depend upon the Royal Navy, and this too the Carolinians learned to do.

Beginning in 1775, Americans regained their appreciation of the need for engineering expertise. Fortification became supremely important as they struggled first to gain their independence and then to keep it. The experiences of the Revolutionary War, among them the successful British land-sea operation which led to the siege and fall of Charleston (the largest surrender of an American army until the fall of the Philippines in 1942), led to the establishment of a Corps of United States Engineers. The intent was for the military engineers to initiate action and supervise the erection of coastal fortifications by the army and state militias. But when the lessons of the War of 1812 had been absorbed, it was clear to everyone that the system had fallen far short of what was needed. In the aftermath of the shock of the burning of Washington, D.C., the U.S. Engineers acquired a national defense mission. A Fortifications Board proposed to Congress the construction of a complex of coastal fortifications to discourage attacks against American shores or, in the event that any enemy chose to strike, to ensure that he would not succeed in his aims. The plan was adopted.

The fortifications program brought the military engineers to Charleston. They came in 1821 to survey defense sites, returned in 1828 to oversee projects to save the foundations of Forts Moultrie and Johnson overlooking Charleston Harbor, and remained in the area almost continuously until the Civil War. In the course of their work, U.S. Engineers initiated the first projects which successfully combatted the erosion of the beaches of the barrier islands and assisted in the first attempts to improve the channels in Charleston Harbor. They shored up the old forts and build a new one, named Sumter, on a shoal that had formed south of the peninsula on which the city was located. In this way, they contributed to the completion of the defense complex that stood ready along the eastern seaboard



Detail from John Culpeper's "Draught of Ashley River," August, 1671. Present-day Charleston is located on Oyster Point.



The fortifications of Charles Towne. The palisade was made of heavy logs and stood 7 feet, protecting the northern flank. The ditch and parapet to the south had embrasures cut for artillery pieces. According to a report by Camanas, a spy from the Spanish city of St. Augustine, Charles Towne had 28 pieces of artillery in 1672, 12 pointed towards the river. A redoubt housed the large gun.

of the United States in 1861. Ironically, it was not foreign foes but Americans who first tested the system, in a prolonged Civil War campaign which pivoted around the fortifications of Charleston.

During Reconstruction, civil works began to take precedence over military missions in the newly formed Charleston Engineering District. The significance of the district's projects may be gauged by the fact that nothing else approached their degree of importance in determining what course the economic development of the Carolina lowcountry would take.

Almost from the moment of settlement, South Carolinians had assumed commerce was the key to their prosperity. Over time, lowcountry merchants traded in furs, indigo, rice, and cotton. A sophisticated commerical system developed, with three primary elements: commodities, which were either produced locally or brought to Charleston to be exported; a regional transportation network that connected the harbor to interior sources of goods and markets; and a usable port. Plans to promote commerce were put forward regularly. Those drawn up between 1815 and 1860 envisioned an improved and extended trading system which stretched from the Atlantic Ocean to the Ohio Valley. To implement this design, much time and money was invested in the construction of interior transportation links, and harbor improvement projects were undertaken when the channels across the Charleston bar began filling in at about the time steam technology threatened extinction for ports limited to shallow-draft vessels. Meanwhile, private enterprise and investment produced the complex of docks, warehouses, and processing facilities essential to carrying on the trade in cotton.

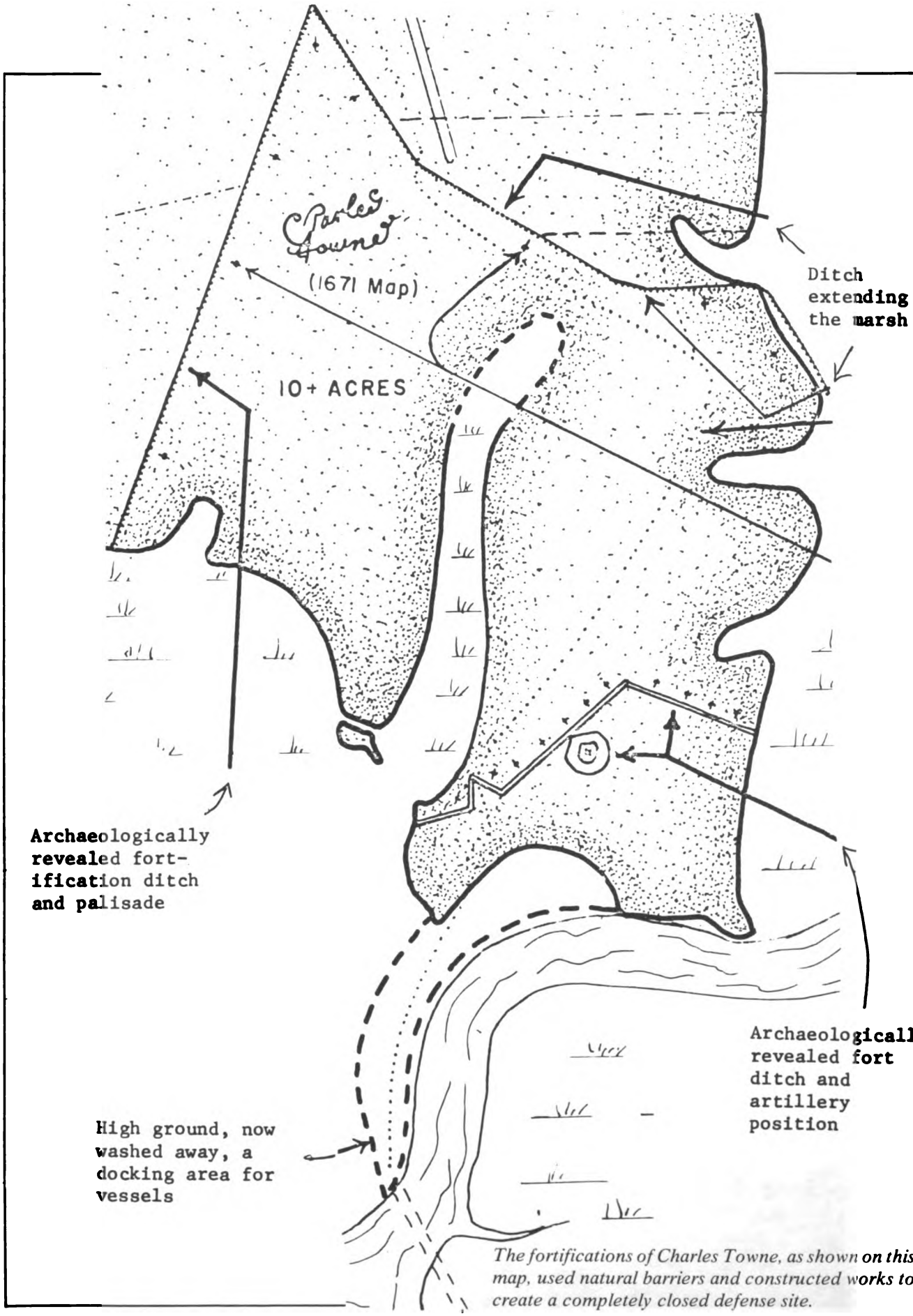
These ante-bellum activities were undertaken in the sincere (albeit somewhat misguided) belief that South Carolinians had the power to shape their region's future. The Civil War irrevocably altered both this perception and the framework within which economic development could occur. Local wealth disappeared—banking capital in Charleston shrank from $12 million to $1.5 million. The war left the city burned, battered, and poor, and assessments made of the comingled problems of reconstruction and economic regeneration were soberingly pessimistic.

Improving Charleston Harbor was the most pressing

problem, for without deeper ship channels the port would have been denied the modern ocean trade. Charlestonians turned to the engineers of the newly formed Charleston District for aid. District Engineer Colonel Quincy Gillmore, who had directed the methodical pounding of the city and its defenses during the wartime siege, drew up plans for using jetties to maintain a deep water channel. Then he helped maneuver the design through the corridors of power in Washington and oversaw the start of work. When Gillmore's jetty project was completed in 1895, Charleston was once again a viable modern port.

Yet, the city had not prospered. Charleston's future after the Civil War depended upon the growth of harbor commerce, the prosperity of the industries and shops that served the port, the output of small manufacturing establishments, and the general well being of an upcountry economy which was principally dependent upon one-crop agriculture. The lowcountry economy could be healthy only to the extent that the inland transportation network proved efficient, capital was returned to the region as cotton was sold, and investment was channeled into manufacture. Beginning in the 1880s, powerful forces unleashed by the industrial and technological revolutions buffeted the lowcountry economy and disrupted the system. Cotton production rose, prices fell, textile mills moved into the Piedmont region and began to consume more and more of the upcountry crop, and lowcountry revenues began to dry up. Simultaneously, the three rail lines which funneled traffic into Charleston fell into financial chaos. By the turn of the century, their operations were controlled by bankers and investment interests who were concerned with railroading and profits, not the future of Charleston. There was a financial panic in 1893, followed quickly by a nationwide depression.

The combination of adversities drove the volume of traffic at the Charleston port down so far by 1903 that it took a decade to regain dollar levels first reached in the 1870s. In 1900, Charleston lacked both industry and port diversity, and the lowcountry economy was tied to a limited tributary area and its depressed cotton economy. The dream of finding prosperity through commerce had soured.



The fortifications of Charles Towne, as shown on this map, used natural barriers and constructed works to create a completely closed defense site.

However, Charleston did possess the modern harbor the Corps of Engineers had developed, and the United States Navy had a problem. In 1894, a naval station had been established at Port Royal, but for a variety of reasons the location turned out to be unsatisfactory and the Navy's Bureau of Yards and Docks began making preparations to abandon the site and the state. Charlestonians desperately sought the facility, and with aid of Senator Benjamin Tillman, who happened to sit on the Senate Naval Affairs Committee, they succeeded in persuading the Navy to relocate. By 1910, the Charleston Naval Station was furnishing the city with a payroll of over half a million dollars a year.

The Army was back in Charleston, too. In 1886, the federal government authorized construction of a second nationwide coastal defense system with works at Forts Moultrie and Sumter budgeted at $3.4 million. The Corps of Engineers began the lowcountry construction program in 1891.

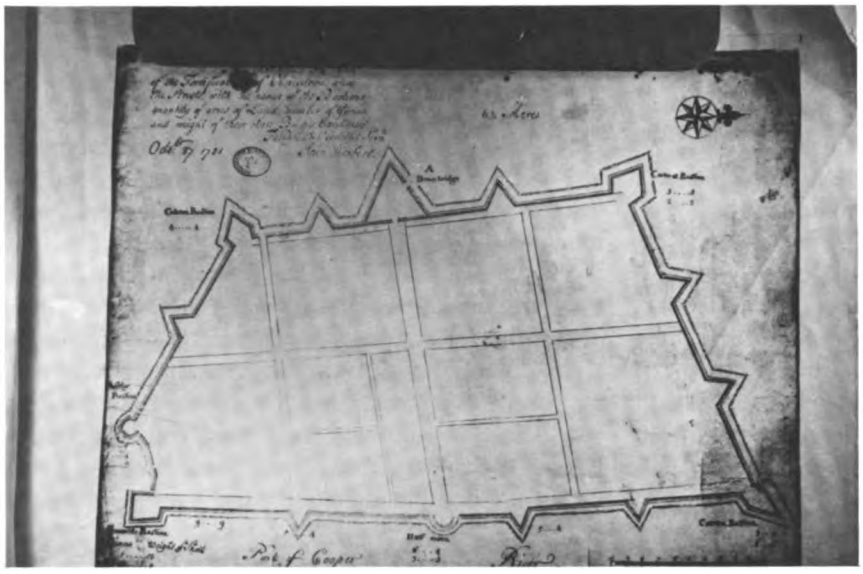
The nation's armed forces had made major investments in the Carolina lowcountry on the eve of World War I, and the great wars of the 20th century enlarged the federal commitments. Federal defense related appropriations in the Charleston area during World War I amounted to almost $20 million. The naval station became a navy yard; by 1941, it would be the most sizeable industry in the Charleston area and the third largest in the state. Fort Moultrie became a sub-port of embarkation for the Army in the 1930s as well as a part of the coastal defense complex. The Quartermaster Corps established a depot; that facility required new docks, piers, and other construction. With the buildup which preceded America's entry into World War II, defense related capital investments in the lowcountry began to generate self-sustaining economic growth. To the region came contracts to build ships, hospitals, docks, railroads, barracks, depots, schools, and public housing. The impact can be perceived in one statistic: In 1940, the yearly per capita income in South Carolina was $301. Between July 1, 1940, and June 30, 1941, federal expenditures in Charleston County amounted to $856.60 for every man, woman, and child.

The Charleston District of the Corps of Engineers was one of the most active and efficient agencies through which flowed the federal monies that built the social facilities lacking in the region. Lowcountry engineers helped rebuild the World War I Quartermaster Depot docks that were turned over to the city of Charleston after the war and then transferred to the newly organized State Ports Authority. The agency began operations with terminals built by the federal government as its chief asset, and from this base it would move forward to foment real commercial prosperity for the first time in over a century. Lowcountry engineers let contracts for and supervised the construction of flying fields, and, all over the Carolinas, paved runways replaced dirt airstrips. In time, many of the new facilities became municipal airports. In North and South Carolina, modern air transportation, like modern seaborne commerce, owes much to the work of the Charleston District.

Not all civil works missions were related to defense spending, of course. In addition to important work in developing rail systems, the engineers of the Charleston District carried out the first permanent harbor improvement project from which the rise of the modern, sophisticated, and rapidly diversifying lowcountry economy can be dated. In the 20th century, waterways development and flood control projects became important missions.

On the map, the Charleston District appears as a slightly skewed rectangle fronting on the Atlantic Ocean and stretching northwest to the Appalachian Mountains. The district includes all South Carolina, save the Savannah River basin, a large triangular wedge of the North Carolina Piedmont Plateau, and juts a short distance into Virginia. Two systems of waterways traverse the region in roughly parallel fashion, the Santee-Congaree-Saluda-Broad-Wateree-Catawba system in the central portion, and the Lynch's Creek-Great Pee Dee-Little Pee Dee system in the northeast. The rivers run to the Atlantic Ocean where their waters mix with the ebb and flow of the tides and the breaking action of the waves to form inlets, bays, harbors, and inland waterways. The action of the river and ocean waters determined the character of the enterprises in which the engineers found themselves engaged. These projects, in turn, shaped the development of the region. As the lowcountry engineers oversaw various harbor improvements, waterways, and flood control projects, they contributed to the rise of a modern Southeast, an "economic miracle" which, in retrospect, is alleged to have transpired in one generation. It did not. Growth rested upon the development of efficient sources of electric power, utilization of water resources, and the integration of local economies with the rest of the nation and the world through an efficiently operating transportation system. The contributions of the Charleston District were crucial in these areas.

The narrative presented here develops four theses. The first is that the history of the Charleston District, Corps of Engineers is, as the title suggests, inseparable from the fabric of regional and national development. The Corps and its subunits were created to act as agents of the American people, carrying out their will as directed by the Chief Executive and Congress. The story of the district, then, is more than an organizational history.



The Edward Crisp 1704 map of Charles Towne shows a walled city.

The second thesis is that the engineers in the Charleston District, like those in the parent Corps and its predecessor organizations, had different orientations at different times. Engineering in the district moved through distinct, though overlapping, stages, evolving from a focus upon purely military matters to today's concentration upon civil works. When laid against the backdrop of the often turbulent history of the Carolinas, the shift in organizational imperatives is particularly striking.

The common idea that among the events which affect men's lives some are more important than others constitutes a third thesis. No event affected the development of the lowcountry more than the completion of the Charleston Harbor jetties project, constructed between 1879 and 1895. Finally, this work proposes a thesis of the origins and natures of the stages of economic transition—from growth to regression to revitalization—in lowcountry South Carolina.

1721 map by John Herbert titled "Ichnography or plan of fortification of Charleston."

I

1670 - 1865: The Military Engineers

1

The Warrior Heritage

Driven before the fair winds of the April morning, the *Carolina* crossed the harbor bar at first light on the flood tide. The passengers looked on quietly as the lands they intended to make their home rapidly encircled them. Captain and crew responded to the signals of the pilot. He was a Kiawah Cassique, a great chief, and he had invited the English to share his lands in the hope that their presence would protect his people from hostile tribes in the interior and their Spanish allies. The fact that he was aboard the small craft testified to the gravity of the predicament of the coastal Indians.

Before noon, the *Carolina* was anchored in the tidal creek which had led to the place chosen for settlement. Here the densely timbered ground was elevated, roughly triangular in shape, hidden from vessels entering the harbor, guarded on one flank by an inaccessible marsh and on another side bounded by a steep creek bed. The site was fertile, but it had been picked because it could be defended. To this work the colonists set their hands as soon as the *Carolina* dropped anchor. First they moved the ship's cannon ashore and sighted it to cover the waters over which they had just sailed. Then they began cutting logs for the palisade which would protect against an attack from the exposed land side. The year was 1670. The settlers of Charles Towne were staking claim to lands granted them, through their Proprietors, by the English Crown.[1]

As more settlers arrived, the defenses of Charles Towne were strengthened. An area of about 10 acres was eventually enclosed, and seven great guns were mounted within the rude palisade and ditch fortification. Treaties were negotiated with local Indian tribes. Watch stations were constructed on the coast to the north and south and manned. Two militia companies were organized. The preparations took much time, hindered planting, and distracted the settlers from other tasks, but still such precautions were necessary. Charles Towne was 500 miles from the nearest English settlement, within 250 miles of the Florida outpost of Spain's empire, and surrounded by hostile Indian tribes.

The first probe at the settlement's defenses was not long in coming. In August, 1670, the Spanish governor at St. Augustine dispatched three armed ships northward, giving the commanders a rough commission to do away with the English settlement, while Indian allies of the Spanish moved toward Charles Towne by land. The assault was postponed when the attackers discovered the English had prepared defenses and secured the loyalty of local Indian tribes.[2]

The Spanish threat in 1670 was the first of many alarms which demonstrated to the colonists the utility of prepared defenses. So frequent were the rumors of attack, hostile thrusts, and clashes-at-arms that no generation of Carolinians lived without some vivid memory of a moment when there was a genuine danger of annihilation. The reason was that life in the New World reflected the turbulence of overseas imperial rivalries. Colonial Americans were at war more than a third of the time between the founding of Jamestown (1603) and the signing of the Treaty of Paris (1763) which marked the final English victory in the struggle to control North America. The wars were waged on land and at sea between the great powers of Europe and in the interior of North America by their Indian allies. Defenses were necessary to colony's survival.[3] That fact did not necessarily mean that colonists were willing to provide them. Fortifications were expensive and time consuming, and emplacements of earth and wood deteriorated rapidly. Thus, while each decade brought its own special challenges, Carolinians, while sometimes ready to meet an emergency, were frequently unprepared.

There were rumors in 1674 of a joint Spanish-Dutch armed expedition heading in the direction of Charles Towne, now relocated at the strategically and commercially more advantageous site at the foot of the peninsula which afforded a view of the harbor and commanded the traffic on the Ashley and Cooper rivers. The Carolinians were not prepared to fight, and when the Dutch decided to attack New York, a feeling of relief was universal in the lowcountry. In 1686, the Spanish moved from St. Augustine against the Scottish settlement at Stuarts Town (located at

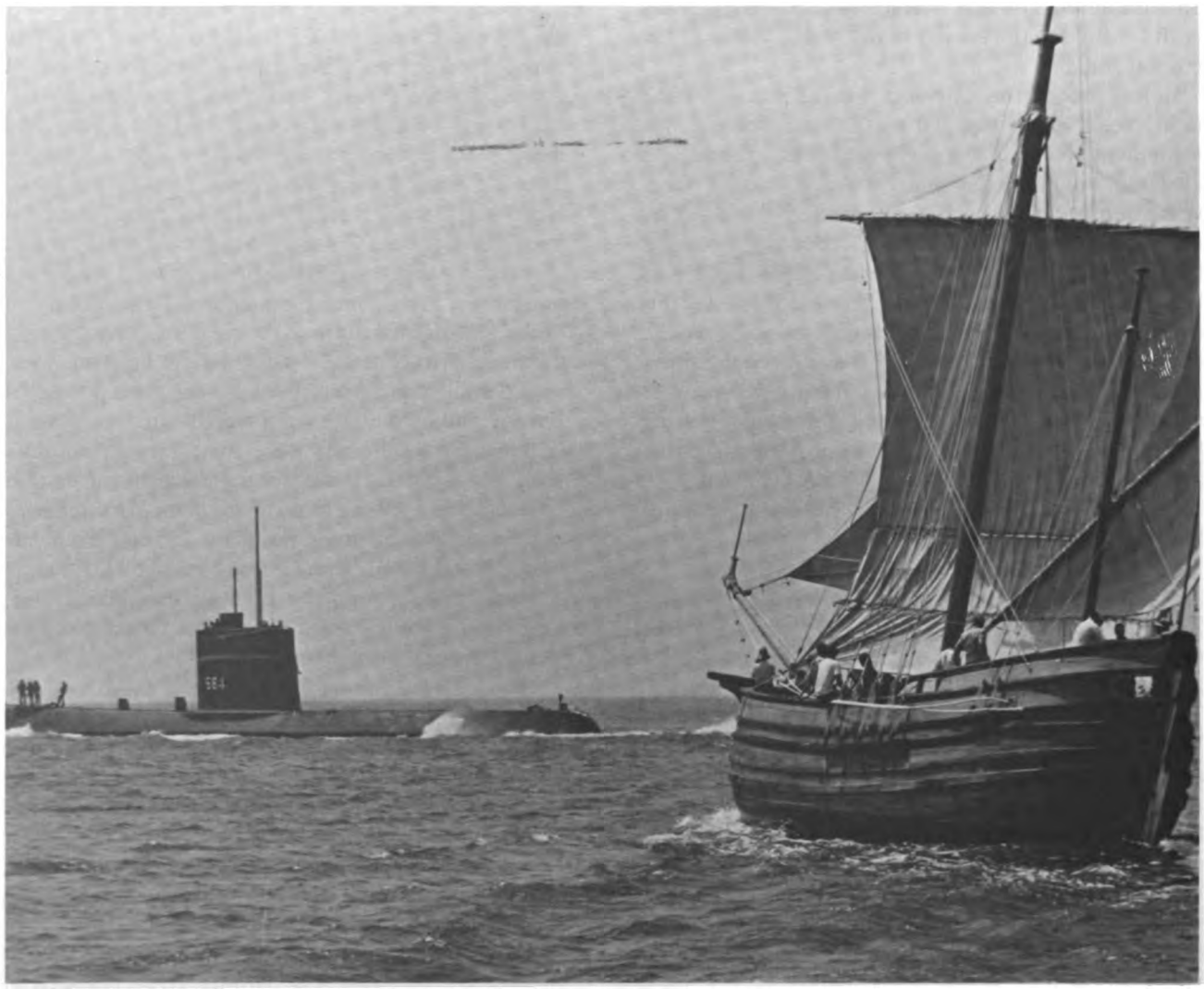
Port Royal) destroyed it, and advanced upon Charles Towne. Again no defenses were in place. Fortunately for Charlestonians, a storm turned back the attacking fleet.

Charles Towne was next threatened during two world wars, called in America King William's War (1688-1697), and Queen Anne's War (1701-1713). In each, England was pitted against the combined power of France and Spain. In 1706, a fleet of five French privateers reinforced by 800 well armed Spanish troops sailed against Charles Towne. This time over 100 great guns guarded the town and harbor. Preferring not to face them, the raiders vented their fury by attacking outlying plantations where they met stubborn resistance and eventual defeat.

Events then directed the colonists' attention to the interior, where the French had already begun constructing a string of forts in a continuing effort to block the southwestern penetration of the Carolina traders. Carolinians and their Indian allies dueled the French and their Indian allies for control of the old Southwest.

In 1715, as a result of abuses perpetrated by the Carolina traders, Carolina found itself at war with nearly every Indian nation in the region. The fierce fighting forced settlers from all over to flee to Charles Towne for safety. The city turned into a fortress and remained in a state of semi-siege for six months. Before the war was concluded, 400 Carolinians had lost their lives, £116,000 sterling had been consumed, and half the land under cultivation had been abandoned. The Indian War was followed by pirate raids. In June, 1718, Edward Teach, the infamous Blackbeard, blockaded Charles Towne port, seized ships, and held passengers for ransom. Expeditions were launched to destroy pirate strongholds.

A replica of the 17th century trading ketch **Adventure,** *similar to the early vessels which frequented Charles Towne, and a U.S. Navy submarine meet in Charleston Harbor.*



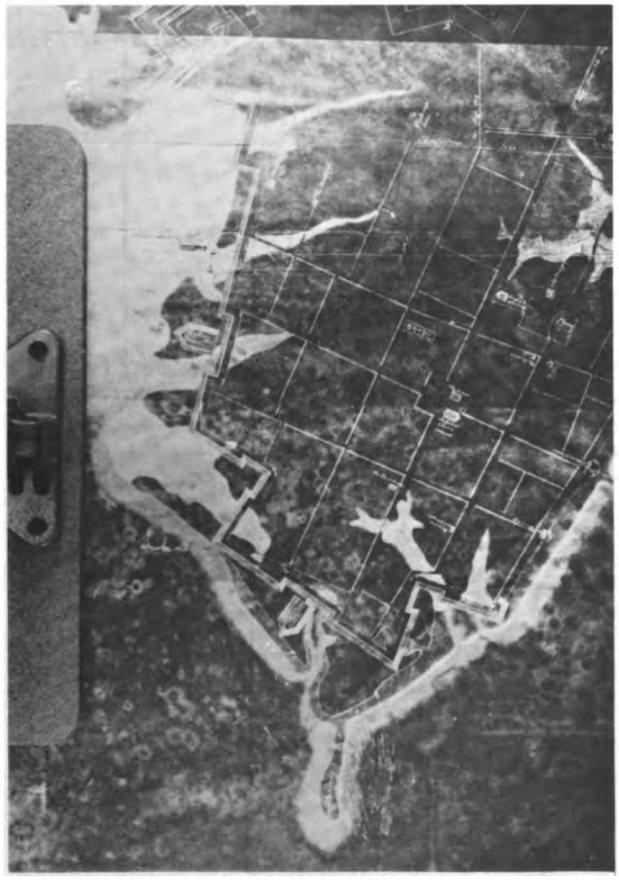
By the 1730s, Carolinians were founding townships in patterns which reflected the colony's defense needs. Surveyors selected sites with defenses in mind, and settlers occupied land that was easy to defend, even if it was hard to cultivate. During King George's War (1740-1748), another worldwide conflict, French and Spanish privateers infested lowcountry sounds and waterways. Their pillaging and looting forced freight and insurance rates to rise to unprecedented heights. The French and Indian War (1754-1763) brought rumors of French plans to encircle the English colonies and periodic warnings of impending attacks. In 1760, the Carolina frontier was afire with the Cherokee War. When it ended, a wholesale migration into the lands above the fall line, a region where governmental authority was almost totally lacking, took place. By 1766, outlaws had banded together to dominate whole communities, and there was an orgy of crime and violence. Terrorized settlers, unable to get assistance from Charles Towne, took matters into their own hands by forming vigilante groups. The power of the criminal elements was broken, but afterward, the backcountry was nearly dissolved by civil strife.[4]

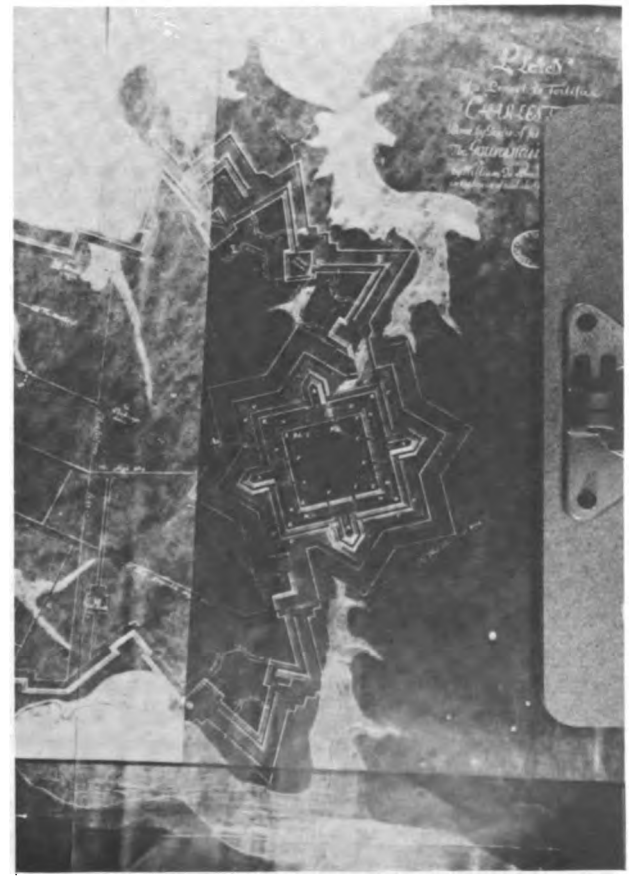
As the frontier moved upcountry, Charlestonians became less concerned with the dangers of Indian attack. Meanwhile, a solution to their coastal defense problem presented itself. In 1719, ships of the Royal Navy took up permanent station. British regulars were later garrisoned in and around Charles Towne. By no means was there ever enough military power locally available to allow Carolinians to feel completely secure, but they were freer than ever to neglect preparations for defense. This they promptly did.[5]

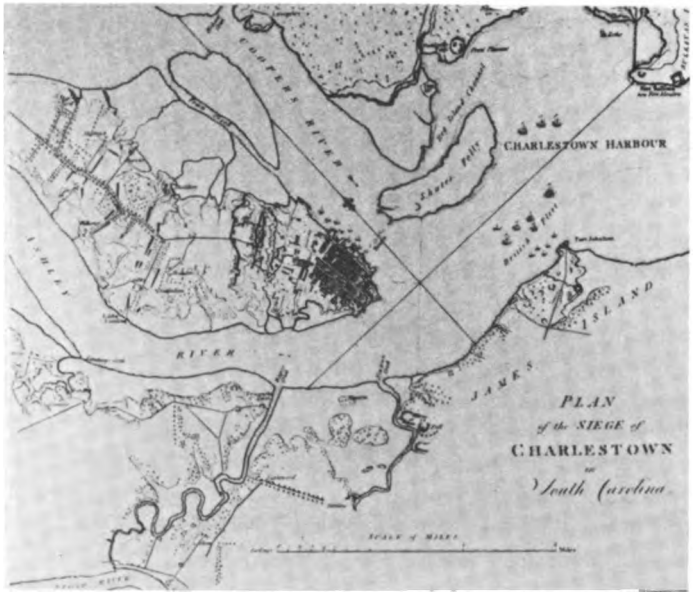
In 1775, the British army and navy turned from protectors to enemies as revolutionary fever swept Charles Towne. A bitter partisan struggle broke out in the backcountry, engaging loyalist and patriot factions which could meet each other on equal terms. The emergency generated efforts to prepare Charles Towne's defenses. Patriots quickly discovered that the task of harbor defense could be formidable.

Over the 200 years preceding the American Revolution, technology had advanced so little that the guns available for service in the British navy would have been familiar to seamen who sailed in

Detail from a British design, about 1755, to expand Charleston's defenses by constructing walls along the riverfronts and building a major fortification with protruding bastions at the neck of the peninsula where tidal creeks afforded a natural line of defense. The plan was too expensive to be considered practical.







Plan of the siege of Charleston

1588 against the Spanish Armada. The large cannon of 1650 had a 7½-inch bore, fired a 40-pound round shot, and was accurate, if the gun were kept steady, at ranges of 150 to 200 yards. The random range was slightly better than 1,000 yards, but at this distance the cannon did not have the striking power to batter a ship. The guns of 1775 were little better. During the French and Indian War, the British began to standardize their ordnance, employing afterwards mainly five types of guns whose effectiveness varied appreciably between point blank and random ranges of fire. The guns were devastating at close quarters. A test made in 1763 shows that a shell fired from a 10-inch howitzer at a range of 150 yards pierced a 3-foot target made of fir and burrowed five yards into a bank behind the target.[6]

To be effective, the cannons of 1775 had to be close to their targets when fired. This meant that fortifications had to be placed as near the shore as possible, preferably

along a channel which had to be traversed by the attacking vessels, and this was where the new problem entered in. Naval architecture had advanced to the point where it was possible to pack up to 100 guns in a first-rate battleship. In no warlike structure on earth was there so great a concentration of artillery as in a British ship of the line. As there was no limit to the number of ships which might be brought to bear upon a point on shore except that imposed by the range of naval artillery and the area of navigable water, fortifications had to be strong enough to survive repeated battering.[7]

The patriot defenders of Charles Towne Harbor had an insoluble problem. They had only a small naval force to challenge mighty British fleet. Their defense guns, with a range of maximum effectiveness of approximately one-third of a mile, had to be emplaced on land, and no matter where the batteries were constructed, their field of fire could not intersect. The best that could be done was to prepare fortifications on Sullivan's Island (Fort Moultrie), James Island (Fort Johnson), and the tip of the peninsula to cover the main shipping lanes and hope that the combination of defensive works and difficulties normally encountered in navigating the sand bar across the harbor mouth would confound the British attacker. He held the real options. He could heave to, anchor to give his guns a stable platform, and attempt to dissect the defenses by reducing one of the island batteries; he could try to run past a fort; or he could put an army ashore north or south of the city and conduct his assault by land. Whatever was to be attempted, so long as the British carried out their plans methodically and professionally, their prospects for success were bright.[8]

In June 1776, the British conducted a raid in force, attacking the defenses at Fort Moultrie. Commodore Sir Peter Parker and General Sir Henry Clinton obliged the Charles Towne defenders by blundering repeatedly. In contrast, the Americans fought heroically and with far greater efficiency, and they beat off the assault.[9] But in the more carefully prepared and efficiently executed campaign of 1780-1781, the British succeeded in reducing the defenses of Charles Towne. The capitulation of the city, on May 12, 1781, was prefaced by panic. The defeat entailed the loss of the largest American army to surrender during the Revolutionary War. In the immediate aftermath, pledges of loyalty to the king were near unanimous in South Carolina. Only a few militant patriots managed to keep alive the revolutionary cause.[10]

After the struggle for independence had been won, Americans forgot how narrowly they had escaped defeat. The military reality, however, was that in battle the British army had proved to be technically the more capable fighting instrument. It was far superior to the American forces it usually faced. Normally guaranteed secure supply lines over seas commanded by the British navy, the British army could move fast and hit hard. Most British attacks on major American seaports were successful. The Continental Army was nearly captured in New York in 1776, and was almost wiped out before Philadelphia in 1777. The fall of Charles Towne was typical of the events of the war. The victory at Yorktown, where a French army and fleet turned the tables on the British, was a welcome exception to the general pattern.[11]

Equally disturbing to American leaders was the fact that throughout the war the British had been able to count upon the support of a large number of Americans. The fight the loyalists waged against their countrymen, particularly in the South, was fierce. The combination of strategic and political successes suggested that the British government had been pursuing a plausible design with their strategy of divide, hold, and conquer. The lesson, which no thoughtful American could fail to apprehend, was that another invading British army might smash ashore, win an easy victory, gain popular support, and exercise an influence far out of proportion to its size. Logically, an attacking force should be checked as quickly as possible, before it could seize a coastal port. But such protection required the building of a coastal defense system, and the new nation lacked the money and inclination to take up this task.

The explosive events of the French Revolution began unfolding in 1789. By 1793, the great powers were again on the attack. The worldwide struggle continued for two decades with the United States caught up in the maelstrom of global wars waged by the competing British and French empires.

The Anglo-French struggle at sea brought with it the seizure of ships and threats to the seacoast towns. People living near the Atlantic wanted protection, and they called for forts and guns. So few Americans knew anything about either that the government was forced to employ foreigners to erect seacoast defenses. This condition was as humiliating as it was dangerous, and to prevent its indefinite continuation, Congress authorized, on May 9, 1794, the establishment of a regiment of artillerists and engineers, and designated a school, to be located at the military garrison at West Point, to serve as a center for the training of personnel. At that time, however, prospects for creating an effective defense system were so bleak that a committee of the House of Representatives reported the measures required were probably beyond the normal means of the government.[12]

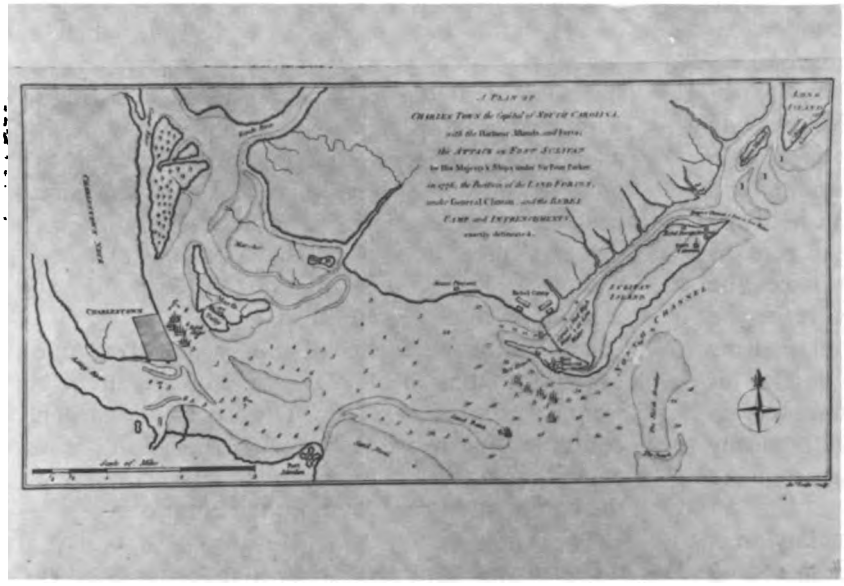
Conditions at Charleston typified the dilemma involved in planning coastal defenses. Adequate protection, according to experts, required 72 guns divided into three sets of batteries and redoubts, and a

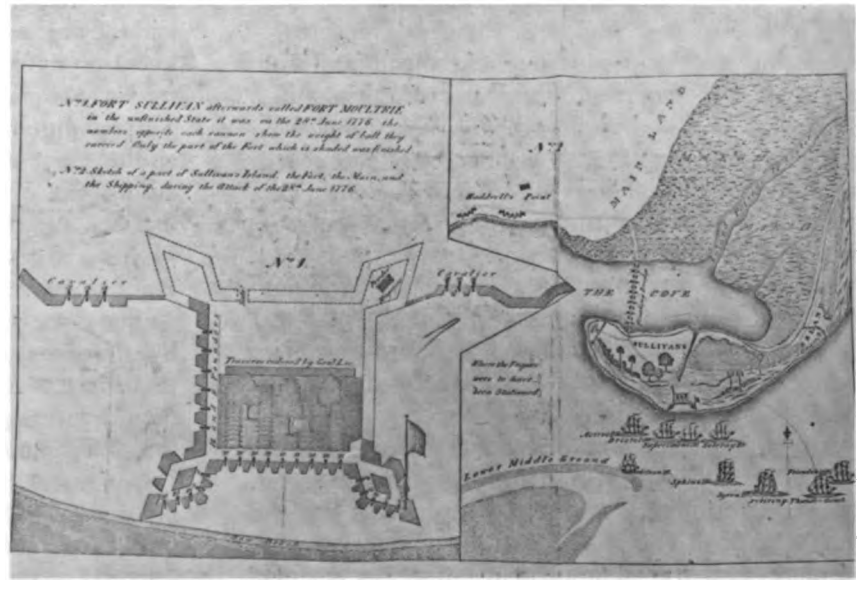
garrison of three officers and 95 men. The cost of emplacement alone was estimated at $11,212.32. In common with other port cities, Charleston would have to get along without the services of a trained engineer, although it was supposed "that some of the artillery officers . . . and part of the infantry officers . . . would soon acquire a tolerable degree of knowledge in the use of cannon."[13]

Under these circumstances, fortifications construction was sporadic. In 1794, incidents in and around the harbor and fears of a British raid galvanized citizens into frenzied activity. Even the governor of the state was found overseeing work on defenses at one of the wharves. Enthusiasm lapsed following the signing of Jay's Treaty with England (1795), but it was kindled afresh at the onset of the undeclared naval war with France.[14]

In 1798, President John Adams signed a bill appropriating up to a quarter million dollars for coastal fortifications, and he approved another measure allocating $800,000 for the purchase of cannon, small arms, and naval stores.[15] Fearing the federal effort would be too little and too late, South Carolinians had already begun their preparations, and by late fall Charleston had three completed forts which could lay down interlocking fields of fire. The gap in the harbor defenses that existed throughout the Revolutionary War was now closed by the guns of Castle Pinckney, a new work which had been constructed on a shoal in the harbor a short distance from the tip of the peninsula.[16] Work on the defenses halted abruptly when diplomatic efforts settled the Quasi-War in 1799.

The clash with France at sea brought Americans the rudiments of a coherent national defense policy. A plan reported to President John Adams, and sub-

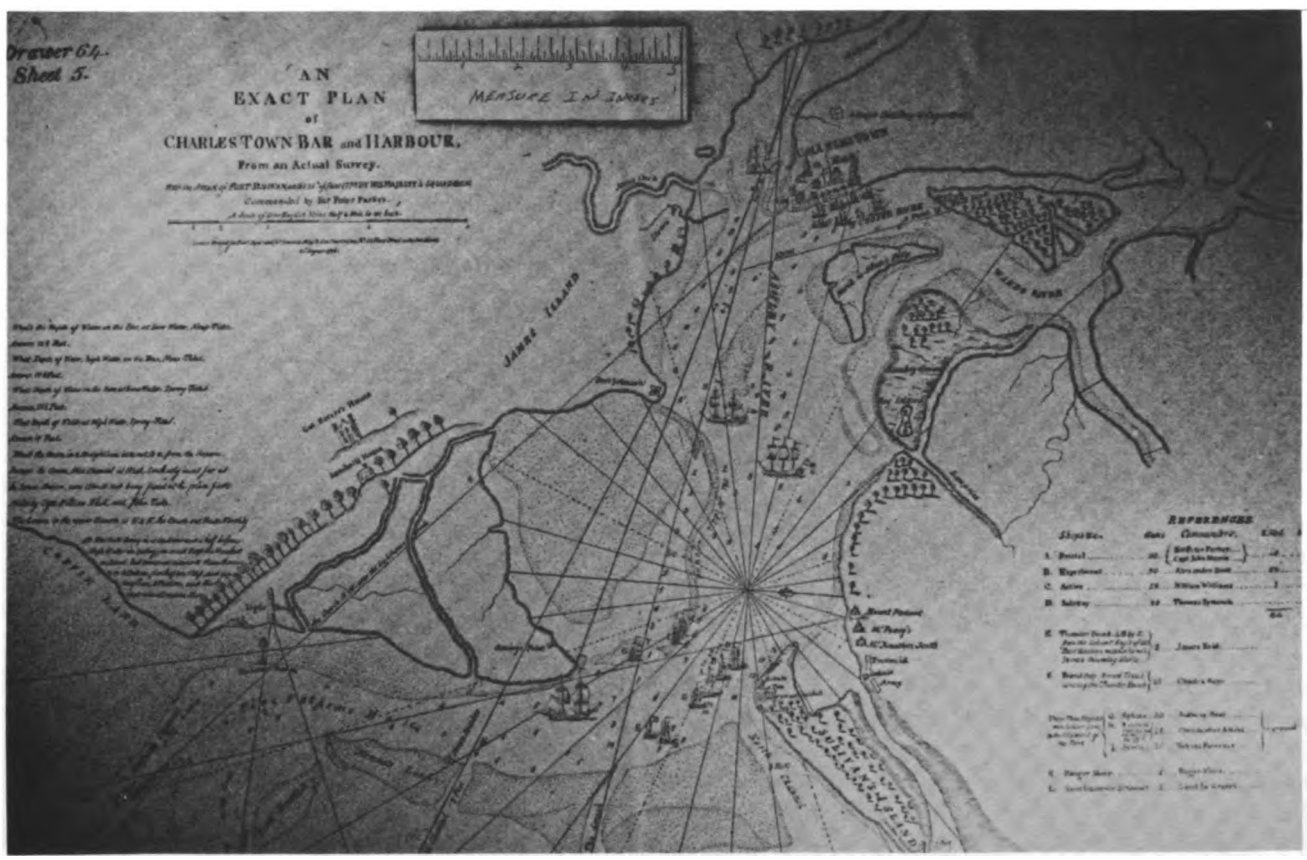




sequently submitted to Congress, noted the opposition of the American people to the maintenance of large standing armies, the absence of resources with which to match the British naval program, and the imperative of coastal defense. All this being the case, it was important for the federal government to arrange things so that in a state of emergency the militia could act efficiently. Because the militia needed time to organize, even under optimum conditions the enemy had to be kept at bay by coastal defenses. The "history of almost all, if not every, war contains undeniable proofs of the utility of fortifications, and the necessity of disciplined troops," the report advised. Yet, "the United States was without regular troops" and "may soon lose the military art." Moreover, there were no engineers, and without them, "not a little of the money employed on fortifications will be always hazarded, if not actually thrown away." Common sense dictated that "a competent number of persons be prepared and qualified to act as engineers, and others as instructors to additional troops, which events may successively require to be raised."[17] The plan led to the founding of a national military academy at West Point. It was to be a school geared to the fulfillment of a variety of national aims, defense predominant among them. Because engineering comprised the core of the school's curriculum, the Corps of Engineers was given the task of supervision. When it opened in 1802, the academy drew largely from French influences, particularly the *Ecole Polytechnique,* a prototype institution combining national dedication, military instruction, and practical education. The idea was to make available to the nation a class of professionals who could function as military or civil engineers, men who could build not only fortifications but whatever else the country needed.[18]

By 1806, the Anglo-French struggle had taken a turn wherein neither side could deal the other a decisive military blow. On the Continent, the French armies of Napoleon Bonaparte stood unchallenged. The British navy ruled the waves. Both London and Paris turned to economic weapons, each demanding the right to control certain activities of the neutral powers. There were incidents on the high seas, and the American government was often humiliated. Once more, along the seacoasts, the American people had reason to fear a British attack.

1776. The British attacked by sea and by land. Americans in the partially finished Fort Sullivan won the artillery duel, and the swift current at Breech Inlet, which was considerably deeper than British intelligence reported, prevented the army from crossing.



Both France and Great Britain had heavily armed battleships available in great numbers. Vessels with a broadside power of 50 guns were not uncommon. A well-practiced crew could fire each gun once every three minutes or 10 times in a half hour. Theoretically, the 50 guns could get off 500 rounds in that time. The high masts and rigging of the great ships-of-war enabled them to pour musket and direct ship's howitzer fire down upon their opponents, decimating gun crews fighting from exposed positions. Building fortifications that could keep stride with the offensive firepower now available in the great fleets seemed a necessary, although expensive, proposition that would be difficult to implement.

The alternative preferred by military experts involved construction of casemated fortifications which combined concentration of fire with protection. In these works, guns were placed in vaults abutting the wall and fired through funneled openings which allowed limited room for elevation and horizontal traverse. By stacking the batteries in tiers in a large structure, the defending forces could equalize the firepower of an attacking vessel while gaining for themselves the advantage of fighting from a more secure position. Some casemated works were built along the American coast; Castle Williams, Castle Clinton, and Fort Gansevoort (in New York Harbor), but it was beyond the government's means to finance similar construction elsewhere.[19]

Work on coastal defenses was resumed with lavish appropriations for that age, particularly in the defense buildup of 1808 and 1809 when Congress made more than a million dollars available. They produced some impressive results. By 1810, Charleston had a new defense system; it was garrisoned, armed, and complete.[20]

The War of 1812 retaught Americans some bitter military lessons. After the first year of fighting, the Royal Navy swept the American ships from the seas. Thereafter, the British fleet roamed at will up and down the North American coast, conducting raids, taking prizes, and occupying the mouths of harbors, bays, and rivers. Then the Allied victory over Napoleon in 1814 freed mighty British armies and powerful fleets for operations in North America. Throughout the year the prospect of destruction, defeat, and dismemberment of territory stared America in the face. Washington was burned in 1814. Opposition to the war brought threats of secession. In the end, the emergence of competent commanders and the heroic performance of semi-trained troops fighting in defense of their homeland turned back the tide of the British advance. But no victory could obscure the record of military inadequacies or the harsh fact that between 1794 and 1814 the American government had spent over $4.3 million on forts, arsenals, and armories and over $4.4 million to guard the coastline, and the crash programs neither deterred attack nor prevented the enemy from gaining the shore easily and in strength.

To be sure, attacking British armies had been defeated or turned back after battles at Plattsburg, Baltimore, and New Orleans. But the British had demonstrated once again the might of their land-sea capabilities. Once again the United States had narrowly averted military defeat and loss of territory. The concern the War of 1812 aroused may be gauged by the fact that in the six-year period 1815-1820, Congress appropriated over $4 million for coastal defense, a sum larger, by more than $400,000, than the amounts spent for the same purposes from 1794 to 1811.[21]

This reaction was a portent of things to come. After the War of 1812, it was no longer a question of whether or not the United States would prepare defenses in peacetime, but rather the nature, extent, and direction of the investment.

2.

Military and Civil Engineering in the Lowcountry

The harrowing experiences of war dominated the orientation of the U.S. Army Engineers between 1816 and 1865. Following the signing of the Treaty of Ghent ending the War of 1812, Congress created a Board of Engineers for Fortifications and instructed it to make examinations of the seacoast and prepare plans for defensive works.[1] Between 1816 and 1820, the board presented its findings to the Secretaries of the War and Navy departments and in 1821 to Congress.[2] The majority of the recommendations of the Fortifications Board were adopted, and Congress appropriated funds to begin the construction of a coherent national defense system. By 1861, over $31.4 million had been spent on arsenals, armories, and fortifications, most of which guarded the eastern seaboard.[3]

The Corps of Engineers was also a national resource, and as intended in the founding of the national military academy, its ranks were filled with skilled professionals, qualified to design and construct public works and conduct surveys. To these tasks, the attention of the engineers was soon directed. The Corps of Engineers became involved in repairing the Cumberland Road, a state-constructed, federally financed project, in 1825; in supervising lighthouse construction in 1831; and in navigation projects in 1824, with the passage of legislation authorizing President James Monroe to direct Army engineers to survey routes of roads and canals deemed important to the nation.

The first work of the Army Engineers in the Carolina lowcountry dealt with the public improvements. In 1817, the South Carolina Legislature created its own office of Civil and Military Engineer and commissioned him to administer an ambitious program of intrastate economic development. The legislative goal was to improve the three systems of waterways which traverse the state, open inland waterway connections, make lesser streams navigable, and construct a turnpike running from Charleston northwest to the Saluda Gap.[4] The massive program of internal improvement consumed $1.89 million by 1829, the bulk of the money being spent in constructing eight big canals around obstructions on rivers in the central part of the state. The benefits realized from the project were minimal and returned only a fraction of the total cost. The overambitious scheme soaked up most of the available revenues (the state budget was only a quarter million dollars a year), suffered from a lack of engineering expertise and management ability, and failed.[5]

The basic idea of linking the coast to the interior was sound, however, and as economic depression gripped South Carolina it took on the dimensions of an economic imperative. During the 1820s, commerce declined at the port of Charleston, revenues dried up, and land values fell. According to one source, conditions grew so desperate that "houses are tenantless, and the grass grows uninterrupted in some of the chief business streets."[6] The solution, as Charlestonians saw it, was to build a road on rails to intercept commerce going down the Savannah River.

Steam locomotion was in its infancy. Few knew much about it or the requirements of railroad building, so the organizers of the South Carolina Canal and Railroad Company turned to the Army Engineers for help. Chief Engineer Charles Gratiot promptly acknowledged the request by dispatching Dr. William Howard, the Assistant Civil Engineer, and five assistants, to make a survey and give recommendations. In 1829, Howard suggested a route which connected important points in South Carolina, terminated at the Savannah River across from Augusta, and was the most feasible roadline that could be designed to take advantage of level terrain. Keeping the grade even was most important. Railroad technology was still primitive and engine pulling power so modest that the South Carolina Company seriously debated whether two horses or a steam machine offered the most reliable power source. As the company intended to profit by hauling passengers and freight both ways, it could not afford a route which ran up and down hills.[7]

Construction of the 135.75-mile line followed Howard's precise recommendations. The railroad was built as a suprastructure (i.e., the rails were over the ties) of flat iron bars attached to wooden string pieces, most of which were supported on piles driven deep into the marshland and secured by crossties. The

railroad resembled a continuous and prolonged bridge. At a point 114 miles from Charleston, an inclined plane and stationary engine provided the power to traverse the 513-foot dividing ridge between the Savannah and Edisto river valleys. The decision as to a power source was resolved to the disadvantage of the horse. Two locomotives with a working speed of 16 to 21 miles per hour (less on grades) were purchased. The carefully planned rail line reflected thorough engineering competence and proved to be profitable.[8]

Military improvements were still deemed to be the primary mission of the engineers, however. The Board of Engineers for Fortifications had its origins in a political compromise. In the aftermath of the War of 1812, there was a general feeling within the American government that a systematic approach to the problem of coastal defense was needed. President James Madison instructed his minister in Paris, Albert Gallatin, to engage an expert in fortifications to direct the construction of new defensive works in the United States. The Marquis de Lafayette recommended Simon Bernard, a brigadier general under Napoleon. Reputed to be one of the best military engineers in Europe, Bernard was unemployed as a result of Napoleon's defeat at Waterloo. Gallatin extended the appointment and Congress confirmed it. Officers in the Corps of Engineers, meanwhile, made known their displeasure at having to serve under a Frenchman, and, to allay their dissatisfaction, it was decided that Bernard would not head the Corps but would instead preside over a permanent fortifications board. The controversy was not laid to rest. As appointed in 1816, the board consisted of Bernard, Colonel William McRee, and Lieutenant Colonel Joseph G. Totten. In 1817, at his own request, Totten was replaced by Brigadier General Joseph Swift, Chief of Engineers. Disagreements between Bernard and the American members, as well as the clear indication that Bernard had the backing of President James Monroe, led to Swift's resignation from the Army in 1818 and McRee's resignation in 1819. Totten was reappointed and thereafter, in effect, he and Bernard were the board, although other officers served in various capacities on the fortifications board from time to time. Creation of the Board of Engineers for Fortifications had long-term implications for the United States. In the beginning, the forts, and the ideas concerning national defense which justified their construction, were based as much on French experience as American. In time, the engineering genius of Totten, a theorist, inventor, scientist, technician, administrator, military officer, and consummate politician, was added. When Bernard returned to France in 1831, Totten so dominated the planning and contruction of the fortifications that, collectively, the completed works were known as the "Totten system."

In its early studies, the Fortifications Board had pointed out that the forts built during the Revolutionary War and the War of 1812 had been inadequate. They defended only single points, had been erected without regard for the defense of the national frontiers as a whole or as a component of a larger national security system, and were, with few exceptions, "improperly placed, inconvenient, and ineffective." The board recommended a defense system composed of mutually reinforcing components. The navy would patrol the coasts. Fortifications would protect naval bases, guard against invasion, close harbors, deprive an enemy of strategic beachheads, and, insofar as possible, prevent the avenues of interior navigation from being blockaded by a hostile navy. The system was to be manned by the regular army with the garrisons linked together by a communications and transportation network. The state militias would provide the supplementary force. A "worst case" scenario was prevalent in the reports of the Army Engineers and reflected official thinking that at some future time or date the United States would become engaged in another war with Great Britain and again face an attack spearheaded by the Royal Navy.

To defend the nation, then, a fortifications system was necessary. The typical proposed fort was a casemated work of closed masonry or brick, sited on the mainland or an island as close to the shore as possible and located where the conditions of navigation made it necessary for passing vessels to come fairly close. In the 1820s, plans were to arm the works with ordnance not much different from that used during 18th century wars: guns with an effective battering range of one-third to one-half mile. Where a waterway was quite wide, cannons had to be placed on both sides, due to the limited range, and if the distance across was more than a mile, complete closure of the waterway by land fortification was not possible.[9]

The best locations in Charleston Harbor for fortifications were on the barrier islands at Fort Moultrie and Fort Johnson, and on the shoal in the middle then forming in the harbor about a mile below the tip of the peninsula. The sites were examined in 1821, but the lowcountry system was not assigned a high priority for construction until 1826, and no funds for work were forthcoming.

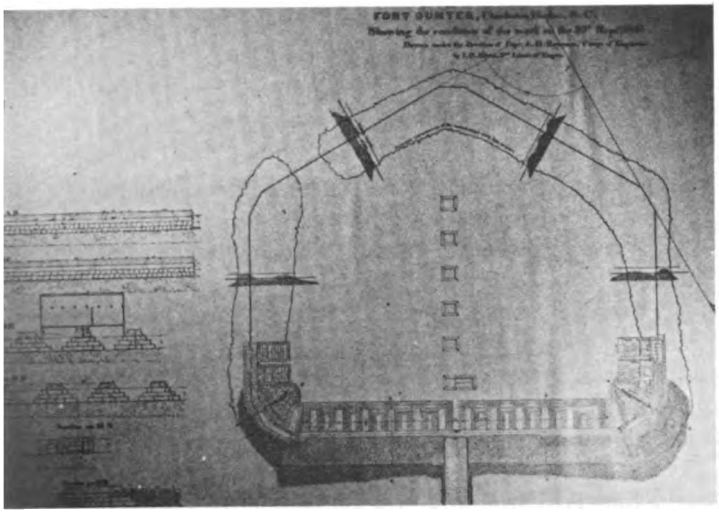
Charleston's barrier islands are of inestimable value. They break up the damaging fury of storms and dissipate their force. Severe storms had struck the Southeast coast in 1700, 1713, 1728, 1752, and 1804. Flood waters had risen as high as 10 feet above normal levels. According to one account of the hurricane of 1752, if the water had risen another foot the whole city would have been flooded. During the storms, areas of the city had been inundated, inhabitants were forced

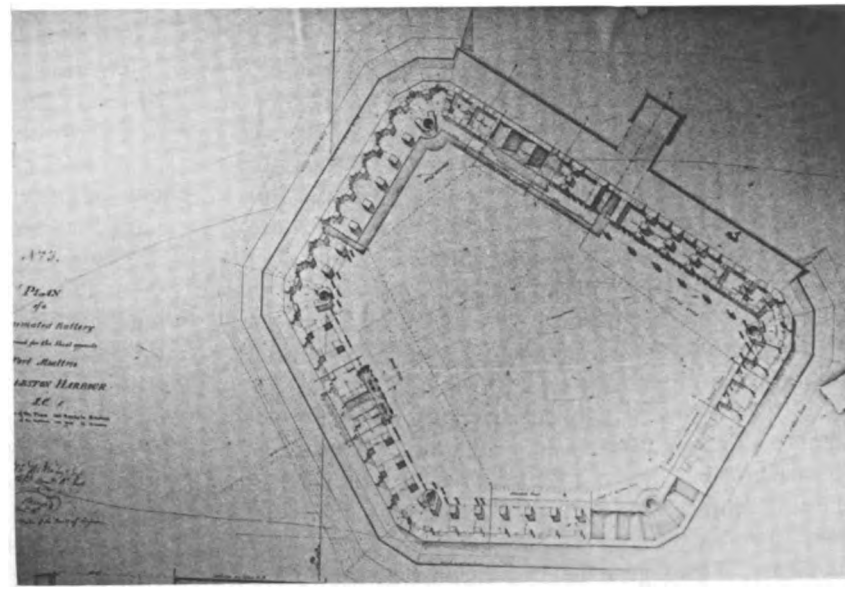
to flee, and the wharf and commercial districts had suffered great loss.

All this had occurred after the storms had first struck the offshore islands. No one cared to speculate what the consequences to Charleston would be if a substantial portion of a barrier island simply disappeared.[10]

For reasons no one could determine precisely, around the turn of the century the currents sweeping past Sullivan's Island began to erode its southern tip. Charlestonians attributed the change to the expansion of the wharf district and subsequent enlargement of the Hog Island Channel, and some wanted to block a shipping channel on the theory that diverting the ebb tide from Sullivan's Island would stop the erosion and possibly turn the power of the strong, scouring current to good use in cutting through the Charleston bar. Engineering studies concluded that this would be an unsatisfactory approach, but the Corps of Engineers had to find an answer to the erosion problem. The site of Fort Moultrie was being undermined rapidly. Nothing could be done until funds were made available, and none were until 1828. In the meantime, Forts Moultrie and Johnson deteriorated (living conditions for the Moultrie garrison were already among the worst in the Union) and erosion continued to wear away at the forts' foundations.[11]

In 1829, Lt. Joseph K. Mansfield was assigned to Charleston to ascertain Fort Moultrie's condition. The first engineer officer to come to the city on Army business since 1818, he reported that the situation called for urgent remedies. By 1831, the Corps was engaged in a struggle to preserve the sites of Forts Moultrie and Johnson. Fort Moultrie, which once was near, but not dangerously close to, the shore was now located two feet above the high tide mark. Mansfield recommended a $35,000-$40,000 project of planting log grillages filled with stone all along the low water mark to retain the beach. But before he could get the work under way, a gale stirred up the surf to the extent that high tide washed the foot of the fort. At that point, Lt. Henry Brewerton was ordered to the site to see what needed to be done to prevent further damage. Brewerton recommended beginning a more extensive project of beach reclamation and the construction of a breakwater. Before his recommendation could be acted upon, a storm buffeted the island and forced him into a series of improvisations to save the fort. Meanwhile, Gratiot dispatched Colonel James Gadsden to make further observations. Gadsden confirmed Brewerton's diagnosis, endorsed his recommendations, and suggested constructing a seawall. He assumed, as did the islanders from whom he got his information, that the main cause of the erosion was the incessant action of the sea upon the exposed





Fort Sumter foundation in 1843 and design.

beach which, accelerated by trade winds blowing nearly six months of the year, caused a constant battering to take place. Later studies would reveal that, although the high winds and tides caused damage, the tidal current was the real culprit, and to combat the tidal encroachments, a breakwater would be needed.[12]

Improvised measures were successful in staving off disaster, but offered no long term solution to the problem of erosion. A breakwater and two small jetties to protect the immediate shore were built, but the ocean continued to eat away at Sullivan's Island on either side of them. The citizens of Moultrieville petitioned the federal government to act to save the island, the fort, and the city of Charleston.[13]

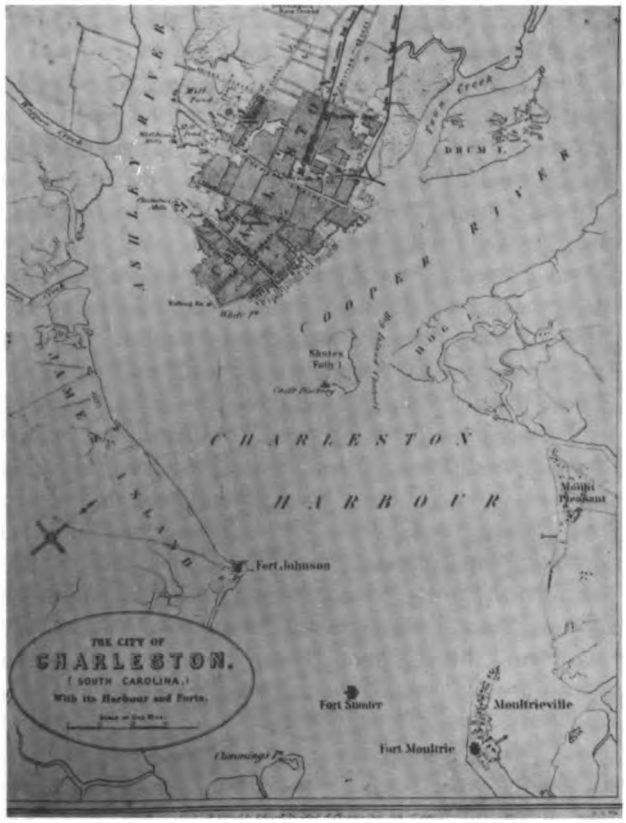
The major reclamation program began in 1837. The Engineers constructed a series of breakers and jetties and, finally, a breakwater extending from the shore to the nearby Drunken Dick Shoal. Over $100,000 was spent on the breakwater, which became known as Bowman's Jetty because Captain Albert H. Bowman supervised most of the construction. By the standards of the time, the entire effort was an expensive operation. By 1861, the engineers had spent a total of $808,641.35 on Fort Moultrie and the inseparable project of the reclamation of Sullivan's Island, but the results justified the expenditure. Not only did the erosion stop, but by 1845, the beach at Fort Moultrie had moved outward more than 100 yards.[14]

The second major project of the Corps of Engineers in Charleston was the construction of Fort Sumter. A revised report of the Fortifications Board, submitted in 1826, suggested that the shoal opposite Fort Moultrie might be occupied permanently, and if the plan proved feasible the harbor could be closed to an attacking force. A design was drawn up in 1827, adopted in December of the following year, and construction commenced in 1829. The original design was to lay a pentagonal foundation of granite over the shoal, place a timber foundation on top of the granite, and upon this erect a masonry fort of the casemate type. By 1834, the foundations had been laid, except for an opening on one side which allowed the barges to cross over the shoal with their cargo of granite. But active operations had to be suspended when one William Lavel secured a vague grant of 870 acres of "land", which happened to be the shoal, from the South Carolina Legislature. The General Assembly also exhibited a great curiosity as to exactly what the federal government was up to in Charleston Harbor, and a dispute over whether or not the federal government had any authority to build the fort ensued. South Carolina had a good legal case. Apparently under the impression that a formal deed of cession to "land" ordinarily covered with water had not been necessary, Washington had begun construction operations at the mouth of the harbor without consulting state officials.[15]

The whole business bespoke a hostility to federal authority and a way of thinking, rooted in the states' rights philosophy, that any increase in federal power was inherently dangerous. Adherents to this dictum included South Carolina congressmen who, generally speaking, voted against fortification bills. An exception was Congressman I. E. Holmes, of Charleston, who saw no reason why his state and district should not share in federal expenditures. It was his lobbying which finally convinced the Congress and federal bureaucracy to complete the Fort Sumter project.[16] Holmes' perseverence, the desire of the Corps of Engineers to complete the fort, some decline in the level of animosity state officials felt toward the federal government in the late 1830s, and a resolution of the legal complications allowed work on Fort Sumter to resume in 1841. A revised construction plan which called for completion of a solid foundation composed of 10,000 tons of granite and 60,000 tons of other rock was executed. The fort that was constructed upon the foundation cost $778,724.70, and like most of the other fortifications in the national system, was built of brick and stone in a straightforward manner marked by architectural simplicity. By December, 1860, Fort Sumter was a five-sided brick masonry fort designed for three tiers of guns. It had 5-foot thick outer walls which towered nearly 50 feet above low water and enclosed a parade ground of roughly an acre. Along four of the walls extended two tiers of arched gunrooms. Officer's quarters lined the fifth side. Three-story brick barracks for the enlisted garrison paralleled the gunrooms on each flank. Plans called for the emplacement of 135 guns, but in that critical December, only 15 were mounted. There was no permanent garrison at the fort. Fort Sumter was dormant, but unknown to its builders, would soon hold center stage in the tragic national drama that was rapidly unfolding.

The third area of engineering effort which engaged officers of the Corps was projects for the improvement of Charleston Harbor. From the mouth of the Chesapeake to the Rio Grande, all channel ways, Charleston's harbor among them, were more or less obstructed by bars. In the 1840s, new classes of steamers with deeper drafts began putting to sea. These vessels could not cross the bar to enter the port of Charleston. Simultaneously, the rapid development of railroad transportation greatly increased the commercial utility of harbors with usable channels. The need for an improvement project at Charleston Harbor was clear.

The problem in Charleston was to find some way to admit vessels drawing over 16 or 17 feet to the harbor. In 1851, the Charleston Chamber of Commerce appointed The Committee on the Improvement of the Charleston Bar. The committee was headed



As these Civil War era maps show, in the age of sail, warships had to navigate carefully and cross the Charleston Harbor bar only through the channels. But they could run past the guns at Forts Johnson and Moultrie. Castle Pinckney closed this gap in the defenses. The maximum range of effective bombardment, approximately one-third of a mile, and the maximum useful range, about a mile, are superimposed on an 1878 map of Charleston Harbor showing the sand bar and channels.

by Professor Hartman Bache, who had directed the coastal survey, and included representatives of the Navy and the Corps of Engineers. The committee dealt with the broad questions of the practicability of improving one or more of the entrance channels of the harbor to a depth which would allow modern steamers to enter, the expenses involved in completing such a project, and the possible need for other improvements within the harbor and along the wharves. The committee's examinations provided more information about Charleston Harbor than had ever existed—and pointed up the formidable difficulties of the task to which Charlestonians had now set their hands.

Tidal harbors along the eastern seaboard are formed in a particular way. The dynamic action of the tides and the angular movement of the breaking waves push great quantities of sand southward along the beaches. Where the continuity of a beach is broken, the sand is projected forward into the water and forms a spit or hook. The sand continues to travel in the direction of the flood tide drift until it meets with an ebb current, loses its velocity, and is deposited in the ocean. The action forms an outer, or drift, bar across the inlet or bay.

The entrance to Charleston Harbor, a little more than a mile and a quarter wide, lies between Sullivan's Island and Morris Island. Their configuration forms the spout of a gigantic funnel through which pours the Atlantic Ocean. In some places, the flow of the ebb and flood tides through the harbor gorge has cut channels 80 feet deep. The harbor bar stretches across the entrance like a great bow. For at least 300 years, several channels through it were maintained by tidal action, a caprice of nature which enabled Charleston to become America's most important southern port and the third largest city in the colonies.

In the 1850s, conditions were changing. No longer wholly benevolent, the sea was filling up the channels over the harbor bar with sand. The alteration was sufficiently noticeable to excite a reasonable amount of alarm in the minds of Charlestonians, for their livelihood depended upon the future of oceanborne commerce. To them, an engineering report of 1851 had come as the voice of doom:

> All the channels have not only decreased in depth, but have changed unfavorably in position .... This information imparts no hope for an improvement by the action of nature, and the demands of commerce call for artificial means to be adopted, even though the effect should result in but temporary benefit; for it may be many years ere such authentic information can be accumulated as will enable the scientific community to ascertain satisfactorily the law which governs the action of nature and produces the alarming changes on the shore and in the channel ways.[17]

After a thorough study, the committee reported that the best results could be obtained by cutting through the shoal separating the deep water of the Sullivan's Island Channel from that of the southwest approach to the North Channel. The plan was opposed by Bowman, who recommended a straight cut be made along the line of deepest water in the Sullivan's Island Channel directly to the harbor. The result of the differing opinions was the formation of a new commission; it made its own study and adopted Bowman's plan.[18]

Following federal approval of the commission's recommendations, and after getting assurances that the Corps of Engineers would participate in the project, the Charleston Chamber of Commerce authorized dredging operations. No dredge was available. To obtain one, city officials extended $25,000 to a contractor who agreed to build a bucket dredge and requested the engineers to supervise the trials of his machine. Examination judged the bucket dredge incapable of performing the work required, but as it was believed this was the best machine that would be available, and because the need was urgent, the recommendation to the Chamber of Commerce was that despite the dredge's limited capacity and high cost of operation it be put to work.

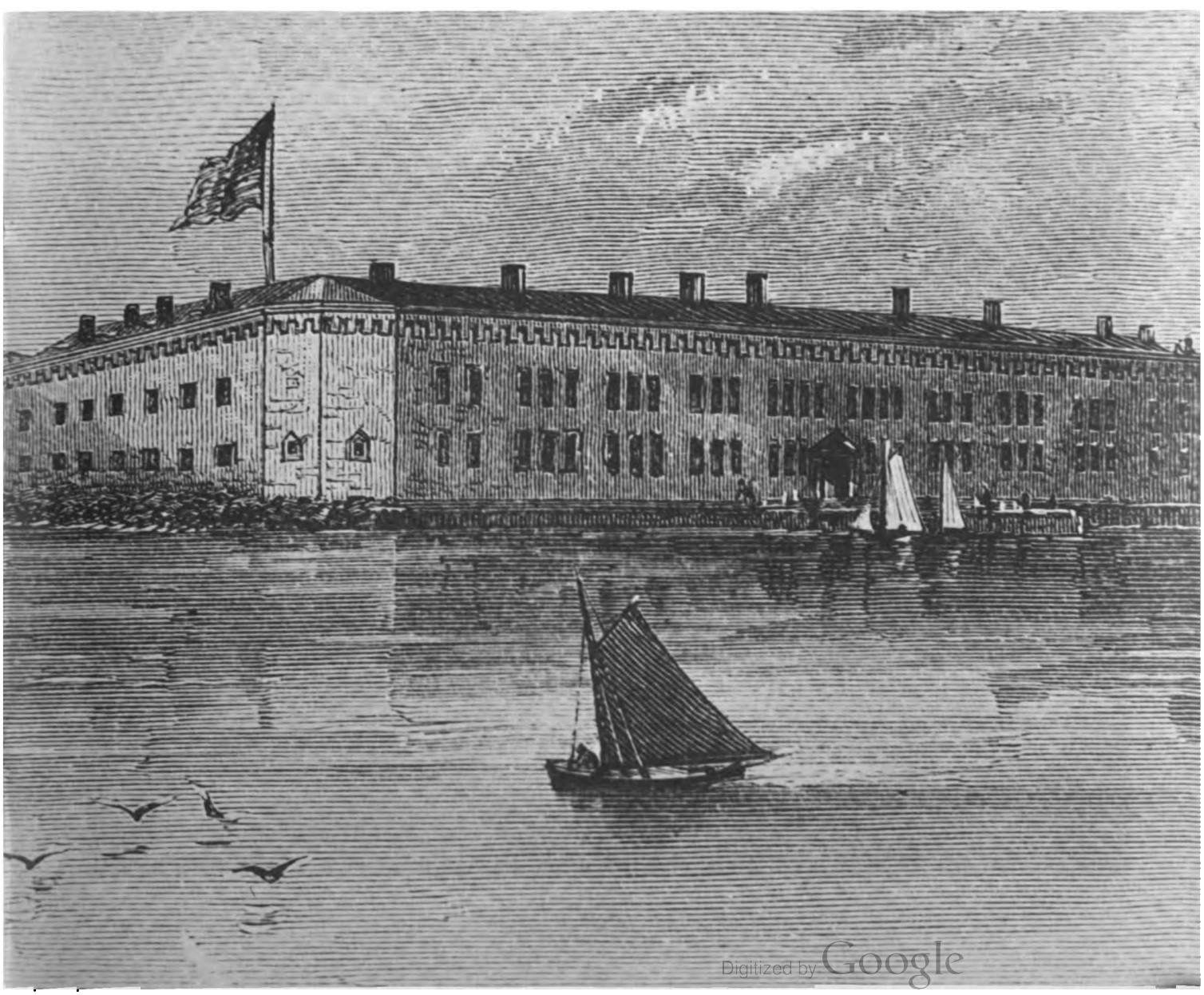
It proved impossible however, for a contract to be negotiated on satisfactory terms, and the dredge was taken from Charleston Harbor. At this point, Henry Gourdin, President of the Chamber, drew Captain George W. Cullum's attention to a working model of a dredging machine which had been invented by Nathaniel H. Lebby of the city. It featured hydraulic dredging using a centrifugal pump. Impressed by the promise of Lebby's method, Cullum encouraged the fitting together of a powerful propeller, a bin, and a pump six feet in diameter with a 19-inch suction. The prototype machine was built and the city signed a contract, in July, 1856, with James M. and Thomas D. Eason, to dredge a channel across 600 yards of bulkhead. This would remove an extension of Drunken Dick Shoal which obstructed the western entrance of the Sullivan's Island Channel by obliging vessels passing in or out to make a short and difficult turn that exposed them to the prospect of being forced by the tide on to the shoal on the one side or the jetty on the other. The city agreed to pay 66 cents per cubic yard of dredged material for the service.

Work began in February, 1857, but due to stormy weather, inexperience in operating the new machine, and frequent breakdowns, little was accomplished until June. From then on, progress was rapid. The cut to the main channel was completed, since the dredge worked beautifully. Three hundred twenty-eight cubic

yards of material were dredged up on an average day. On one occasion, 1,005 cubic yards were brought up. Hydraulic dredging proved to be the most efficient method of working in the heavy seas, thereby vindicating the work of the Committee on Harbor Improvement. This was no small matter. The commission had recommended dredging the Sullivan's Island cut because it seemed the safest thing to do. The lack of technical knowledge concerning the art of harbor improvement can be seen by noting that among the primary concerns of the commission was the fear that a project would be undertaken which would show no improvement or, equally possible, even worsen conditions, both of which would waste money.[19]

The onset of the Civil War brought the work to an end. The dredge, now the *General Moultrie*, began a second career as a blockade runner as federal interest shifted from opening Charleston Harbor to closing it. Military engineering again predominated. And hydraulic dredging techniques fell into disuse, a little-noticed casualty of war.

Fort Sumter, before the bombardment. This drawing illustrates the height of the fortification art before the Civil War; defensive firepower from casemated guns arranged in tiers.



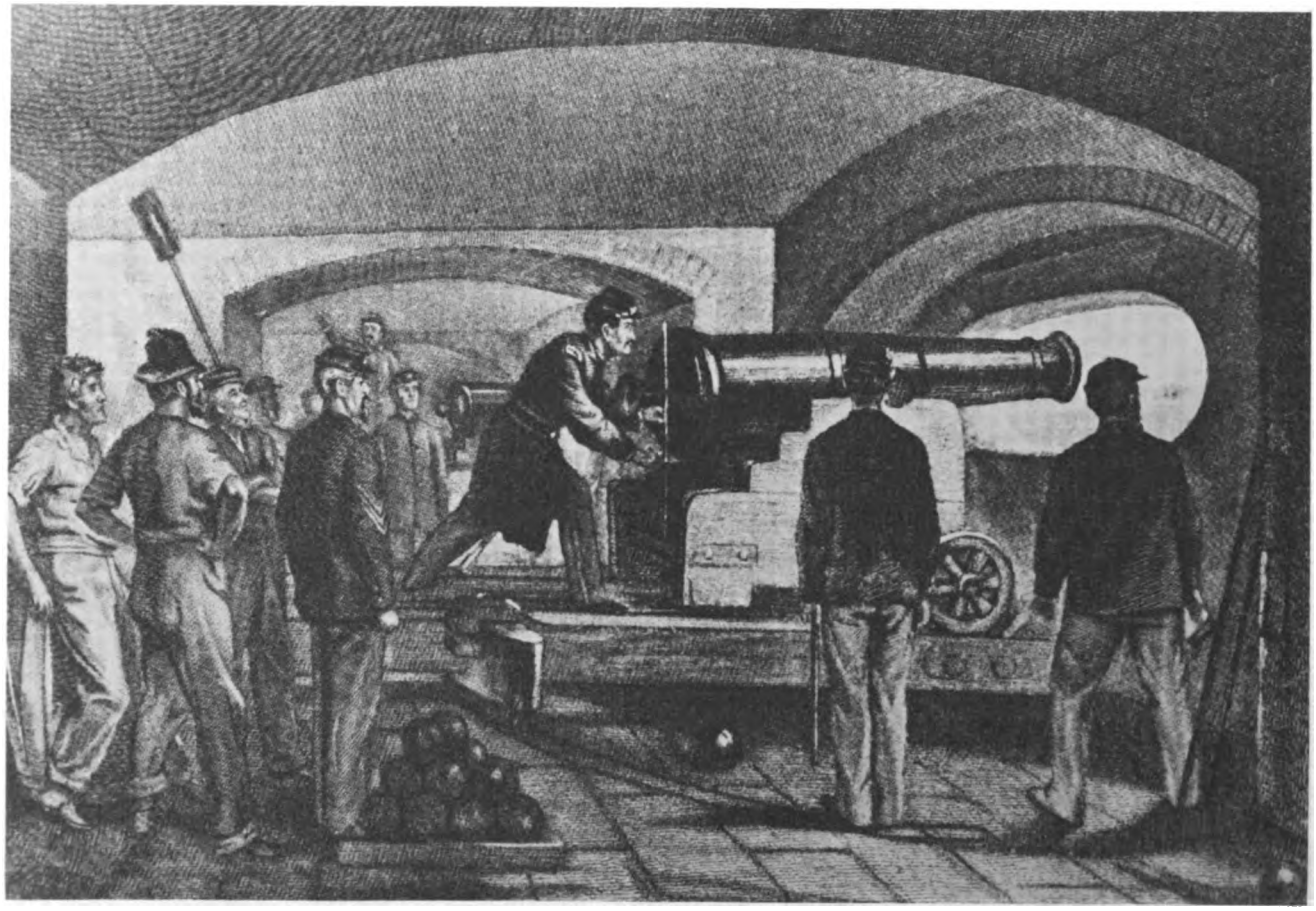
3.

The Coast Aflame

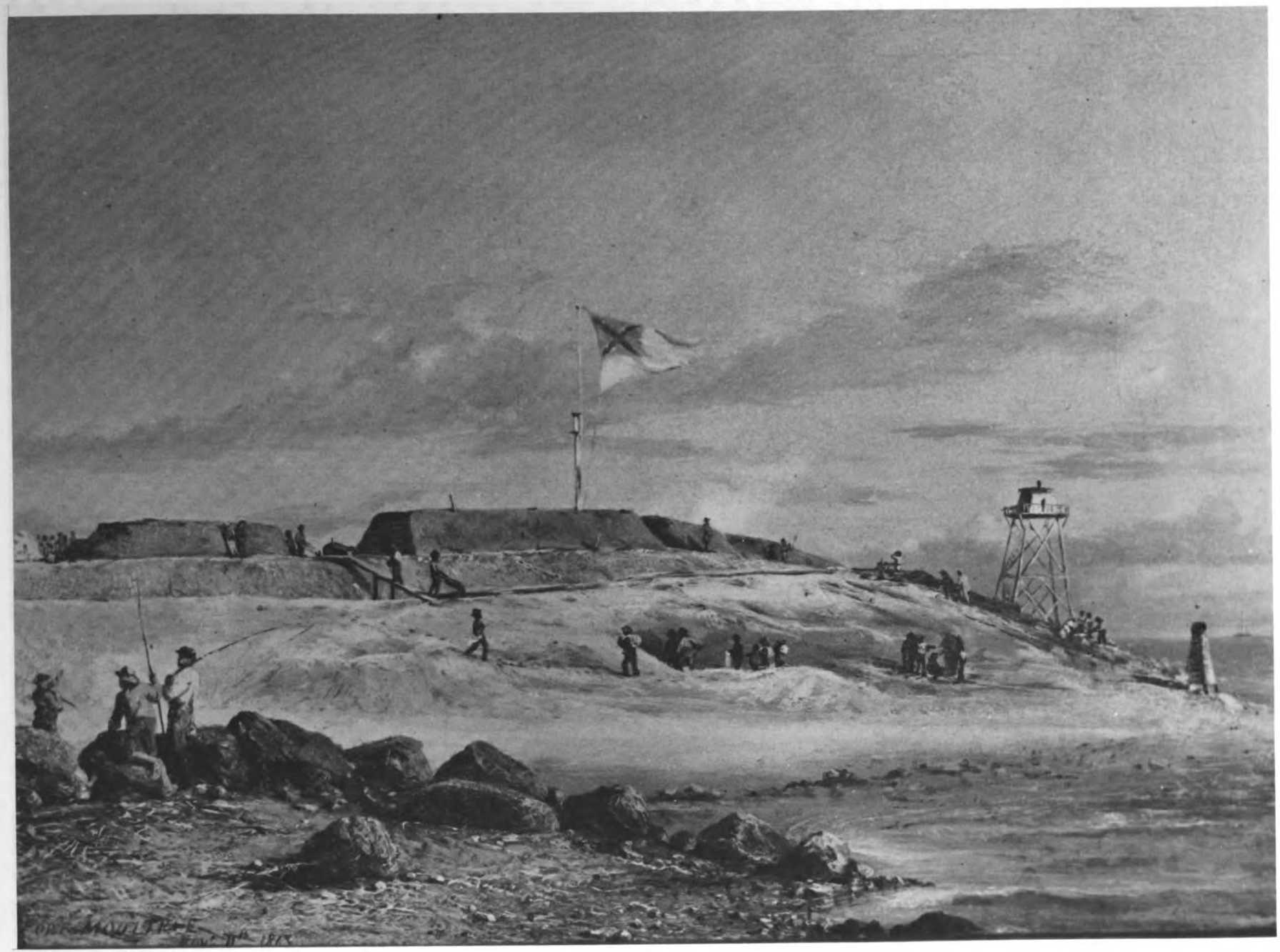
The Civil War turned the Carolina lowcountry into a testing ground for the theory and technology of fortifications and siege.

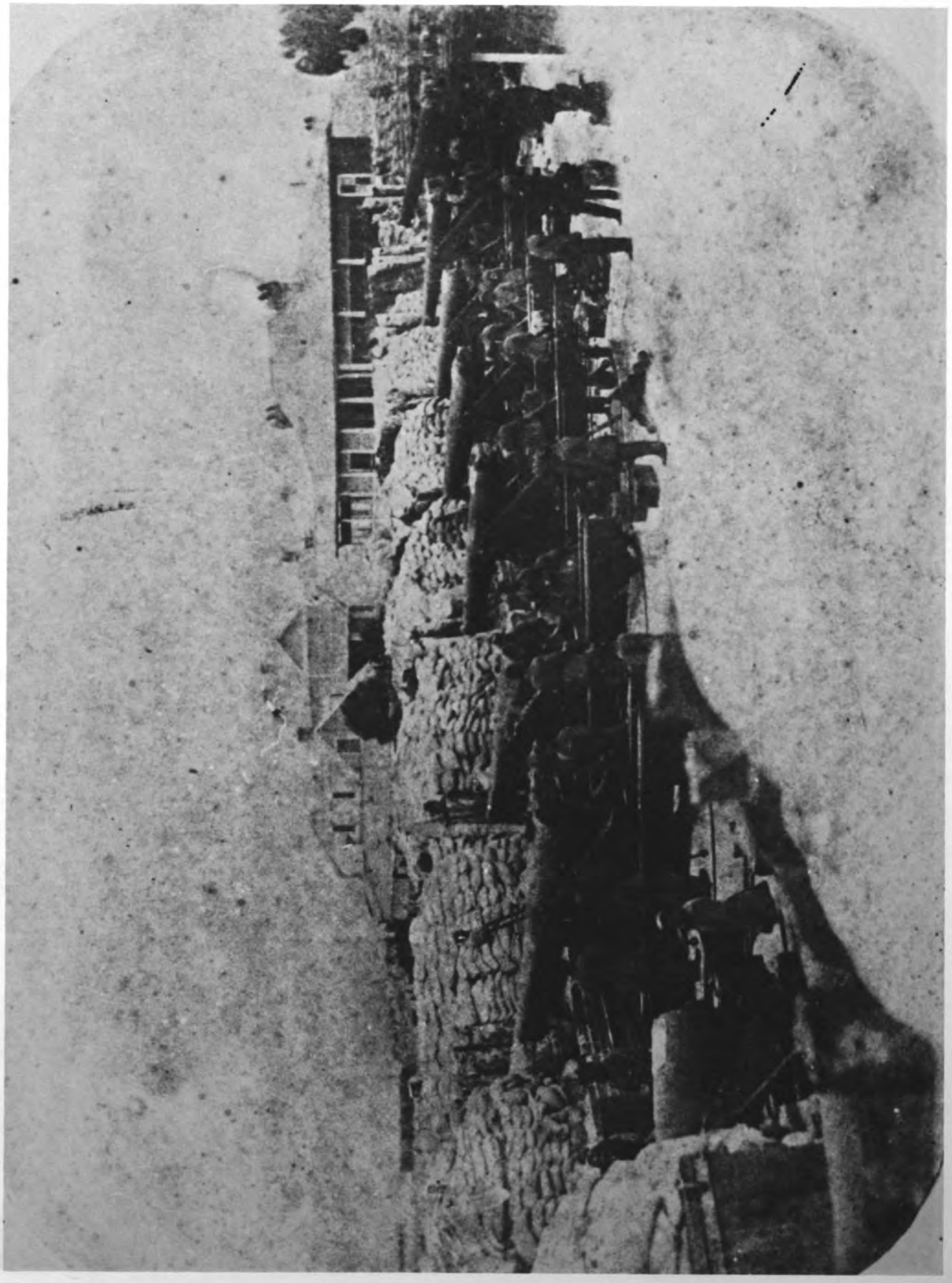
It is important to understand that prior to the Civil War the primary business of the Army Engineers related to military missions, although the Corps had become involved in civil works. Legislation passed by Congress in 1824 directed Army Engineers to survey routes of roads and canals of military or commercial importance. The same year, the engineers were authorized to begin waterways improvement on the Ohio and Mississippi rivers. By August 1, 1838, there were some 70 or more projects of harbor and river improvements along the coasts of the Gulf of Mexico, the Atlantic Ocean, and the Great Lakes. On this date, these were transferred to the Corps of Topographical Engineers, which had been reorganized the preceding year. Afterwards, most of the correspondence flowing in and out of the office of the Chief Engineer pertained to military works, with the fortifications program predominant among them.[1]

Union troops in Fort Sumter preparing to fire their first shot of the Civil War. Note the vault, thick walls, and narrow openings which were designed to give defenders maximum protection.



Fort Moultrie, 1863, from a painting.





The coastal defense concept was based on the supposition that fortifications could deny an enemy access to strategic centers and important cities at the outset of hostilities. Because the United States had no viable navy, an enemy could force a landing. But with fortifications, an attacking army had to choose the less preferable alternative of coming ashore at some undefended place and then marching to its objective which, because of the fortifications, had to be besieged. The resulting battle would be fought on terms advantageous to the American defenders.

The permanent emplacements built along the Atlantic Coast before the Civil War were designed to interdict the passage of ships and resist land attacks, two dissimilar and independent military tasks. Interdiction merely demanded an array, in suitable numbers and proper proportions, of heavy guns adequately protected against counterbattery fire. Inaccessibility required the ability to hold off an enemy force landed near the site, so the attacking force could not reduce the fort and proceed toward its main objective as if the fort had never existed. Theoretically, the permanent fortifications also allowed the War Department to employ the militia most effectively. In an emergency, the small garrisons of regulars at the forts would be augmented as militia units rushed to the threatened point. With permanent fortifications as the keystone, an effective, confident, and tenacious defense force would be brought into being quickly.[2]

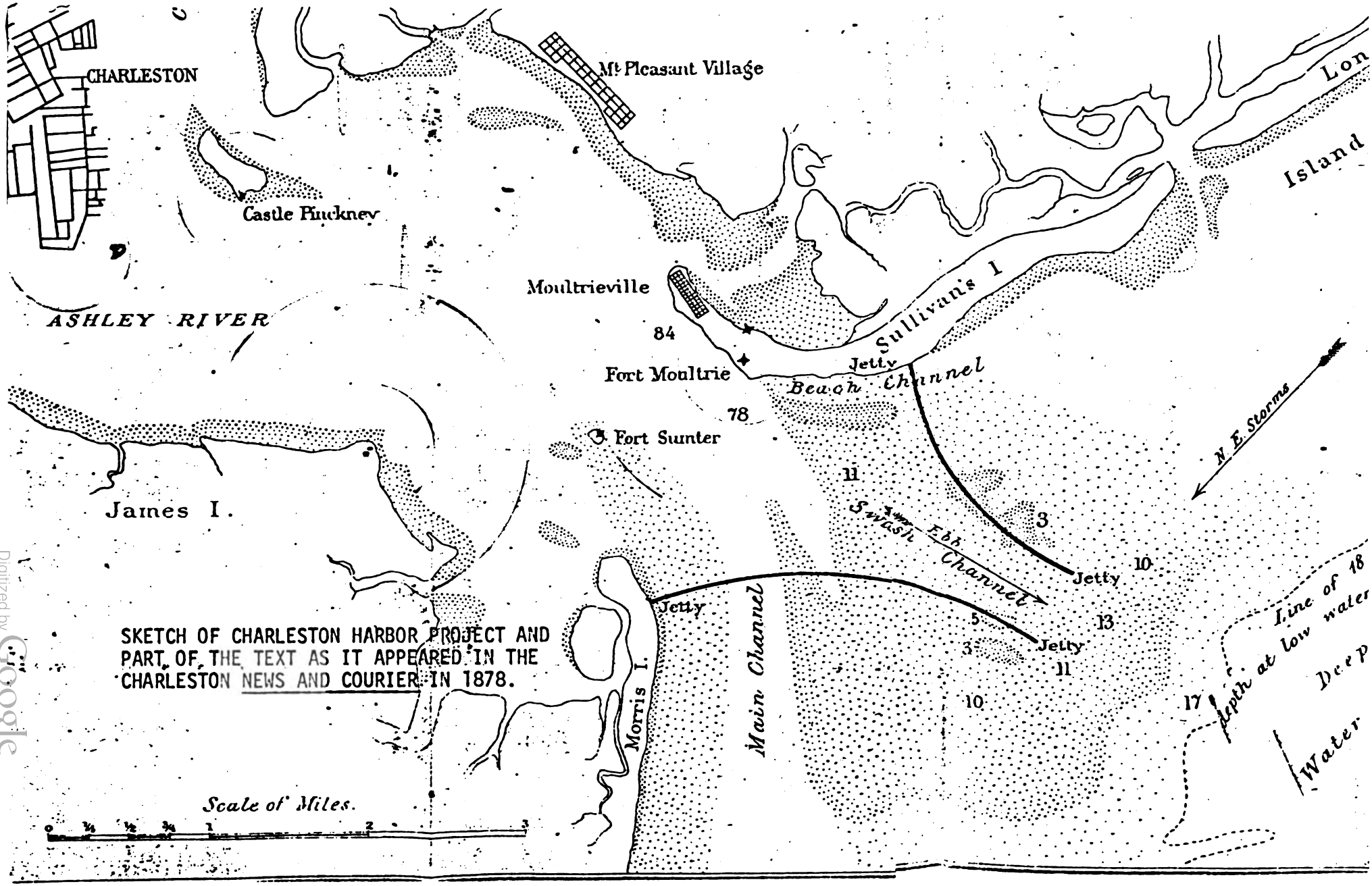
The original notions of coastal defense were derived from the experiences of wars which ended in 1815. Over the next two decades, technology molded warfare with the age-of-steam revolutions in land and sea transportation and communications and parallel advances in weaponry. Ships were refined as technical instruments. In short order, the sailing vessel was supplanted by the paddle-wheel steamer, then by the screw-driven ship, then by the twin screw. The rig of the ship was altered. Spars and sail spread were reduced until they were merely auxiliaries used mainly to save on coal. The ram reappeared as naval weapon. Fixed mines, called torpedoes, became an important weapon system. During the Crimean War these "infernal machines" proved that for the first time since the age of galley warfare it was possible to sink a ship by hitting it below the waterline. Guns became more powerful and reliable for ships and for shore batteries, as they were adapted to fire shells, a capability heretofore enjoyed only by mortars. Calibers were increased, and from rifling, which gave greater range, accuracy, and penetrating power to the guns, came the idea of protecting the sides of vessels with light armor. After experiments proved the technique effective, masses of steel 22 inches thick appeared on the sides of vessels. The first armored ships were considered only adjuncts to coastal defense, but it was obvious that further technical refinements would make possible the appearance of attacking fleets of unprecedented and awesome power.

Confederate defenses at Fort Moultrie. The technological revolution gave cannon such battering power that the casemated fortifications of the Totten system could not stand up. Earthworks, especially sandbagged emplacements, afforded better protection.

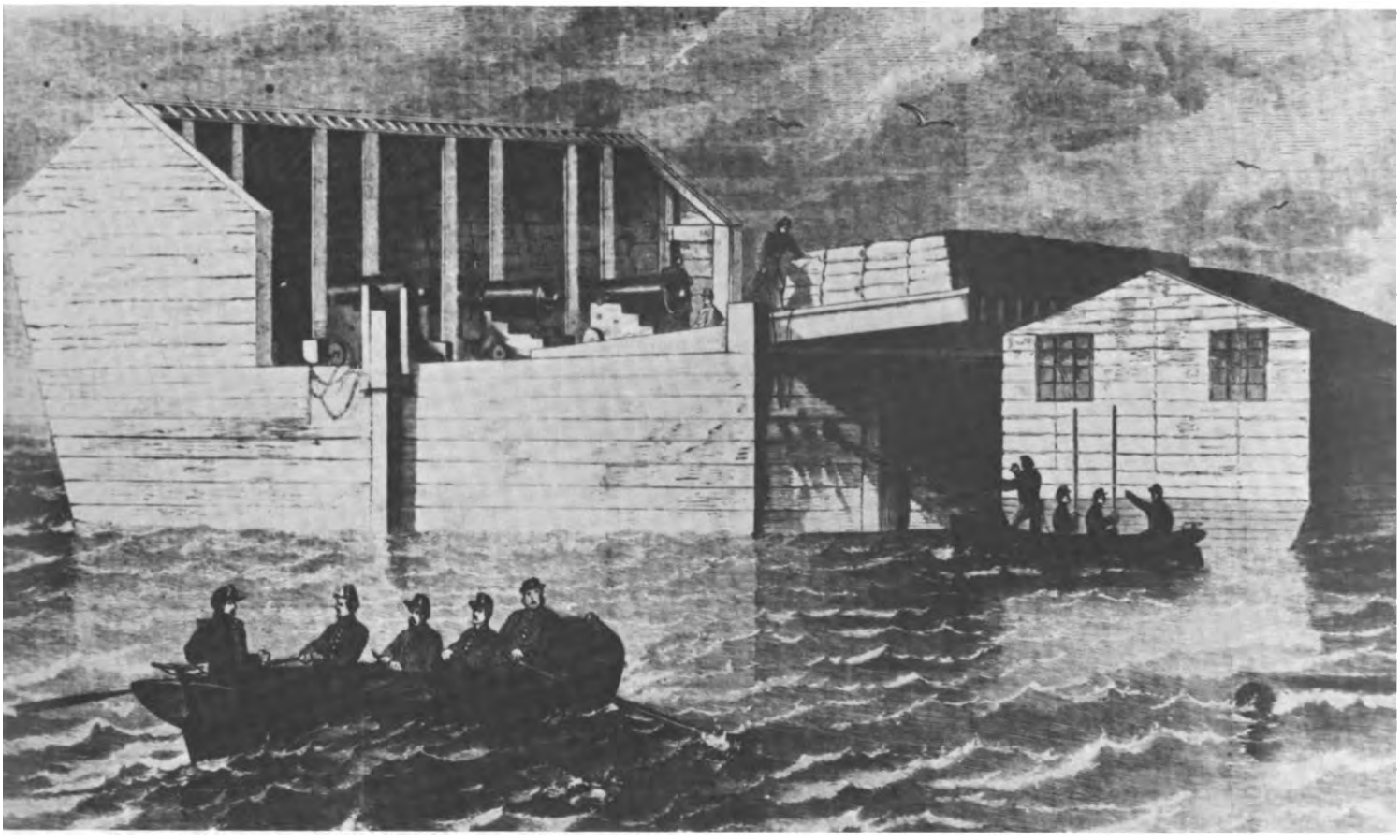
In 1816, the Fortifications Board had established a system of priorities. Projected works were divided into six classes, distinguished by the importance of the objective they protected, and construction proceeded in as balanced a fashion as funds, military predilections, and political conditions made possible. The bulk of the money appropriated for coastal defense was spent during the period 1854 to 1861, when appropriations for forts, arsenals and armories totaled $14.09 million. By 1860, the defense system dreamed of by the planners who had lived through the War of 1812 had come into existence.[3]

In the South, as in the North, that defense system was not in a state of operational readiness. Given the condition of the Union navy, however, it did not have to be.[4] In 1860, the Union fleet had a strength of 90 vessels. Fewer than that number were actually in service, though. None was an ironclad of the type proved useful in the Crimean War. Fifty were obsolete sailing ships. Of the fleet's 40 modern steamers, one, the *Michigan,* was on the Great Lakes, nine were laid up for routing repairs, 17 were on foreign station, and five were unserviceable. The home squadron consisted of seven steam vessels of war, a screwtender, and five sailing ships. Reaching the elements of the navy overseas took time, and even when they were gathered in, the Union navy had only 30 steamers. The Federal force did not have the capacity to launch an invasion, occupy Southern ports, or maintain an effective blockade—all of which it was shortly to be called upon to do.[5] The South, therefore, had time to devise its strategy, mount cannon, assemble troops, and create strong local defense systems.

Charleston Harbor had three permanent fortifications in various states of readiness. Fort Moultrie was in disrepair. The walls were cracked and sand dunes blown against them were high enough for cows to cross inside the fort to graze. Castle Pinckney had one tier of casemates, unmanned guns, and one sergeant on duty as caretaker. Fort Sumter, the most modern component in the system, had no heavy guns laid in for firing. The fortifications could be transformed quickly into formidable defenses, however. By April, 1861, Fort Moultrie was framed with logs, sandbagged, and supplied with a complement of 30 guns. Sixteen guns and six mortars were emplaced elsewhere on



SKETCH OF CHARLESTON HARBOR PROJECT AND PART OF THE TEXT AS IT APPEARED IN THE CHARLESTON NEWS AND COURIER IN 1878.



Floating battery in Charleston harbor.

Sullivan's Island. Across the channel on Morris Island, there were six guns and six mortars, and batteries were emplaced on James Island and the tip of Charleston peninsula. All the guns were manned and backed by a Confederate force gathered in Charleston. By previous standards of mobilization, this was an impressive force. Most of the men at arms were militia and volunteers. Their presence testified to the soundness of the assumption that partially trained troops could be rushed to the seacoast to augment prepared harbor defenses.

The armaments which sprang up around Charleston Harbor were designed to force the capitulation of Fort Sumter. This they did, at the cost of initiating a great civil conflict.[6] Once the fort fell, however, the Southerners neglected preparations for coastal defense, to the ultimate detriment of their aims.

Had it been followed by the Confederate command, the strategy for coastal defense proposed by the Corps of Engineers would have involved holding the ports of the South Atlantic and Gulf coasts. These port cities were the rail centers and key links to the inland transportation systems. Such a strategy might have preserved both the interior lines of communication and the links to the outside world upon which, ultimately, rested the ability of the Confederate states to equip and supply armies and shuttle them from one place to another. The South, however, lacked central political authority and unified military command, no Southern leader grasped the importance of holding the key coastal ports, and state governors and district commanders dissipated Southern resources by trying to defend the entire coast while at the same time trying to deal attacking Union armies a knockout blow.[7]

In contrast, Federal leaders showed a better understanding of the importance of a cohesive maritime strategy, planned more effectively, and eventually triumphed. One by one the Union took the South's coastal outposts: Roanoke Island in February, 1862; New Bern and other North Carolina coastal cities, except Wilmington, the next month; and in March, Federal troops occupied Fernandina, Jacksonville, and St. Augustine, severing the rail connections between Florida and its more lavishly armed Confederate sister states. By late April, Appalachicola, Pensacola, Pass Christian, Biloxi, and New Orleans had been seized. The entire seacoast south of Charleston went into Federal hands, and siege was laid to Savannah, where the defenders were bottled in. Only Wilmington and

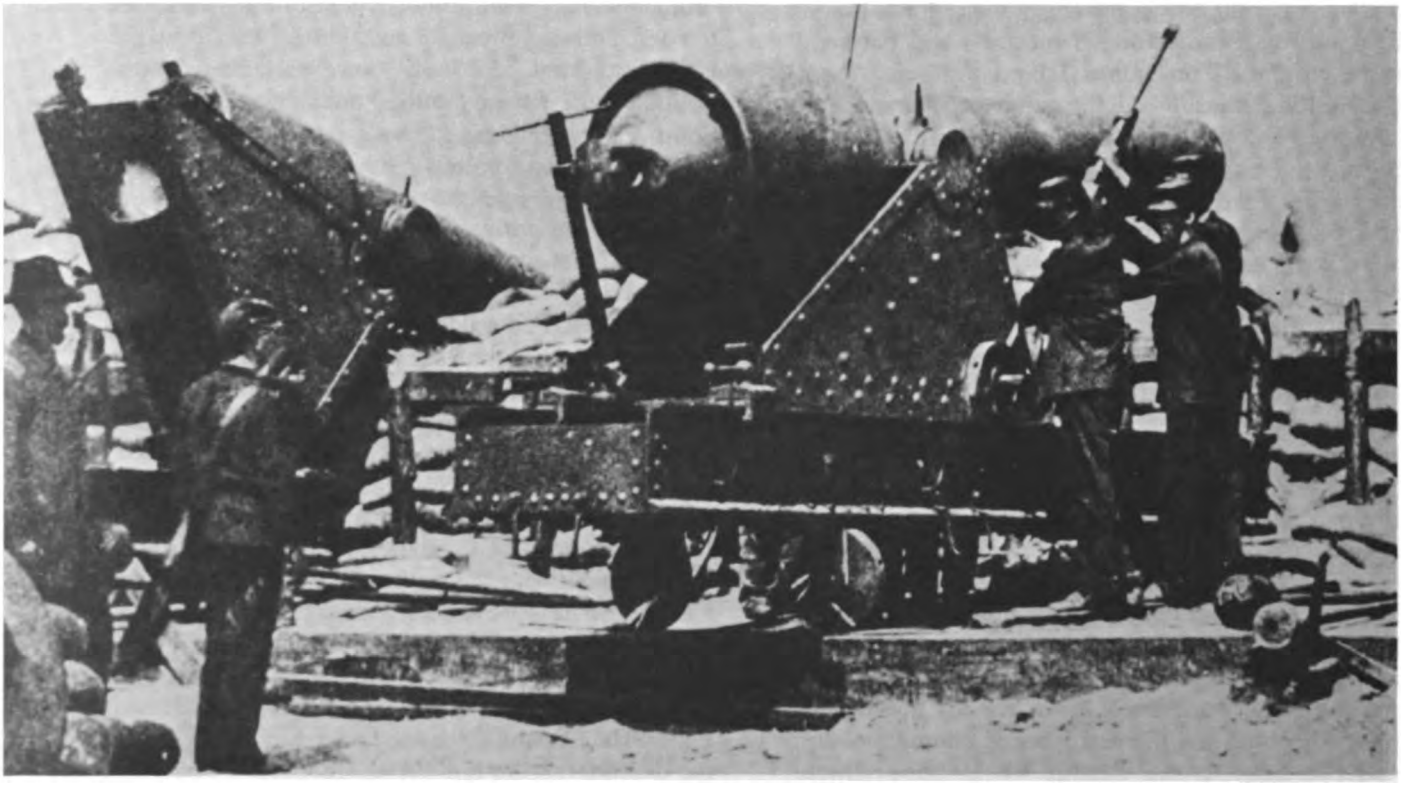
Charleston remained open as ports for the Confederacy.[8]

The attack was not long in coming. The Union navy acquired Port Royal as a base for ships manning the Atlantic seaboard blockade, and speculation commenced as to what new opportunities might be exploited. Charleston, the seedbed of rebellion, a haven for blockade runners, and an important symbol to the South, could be attacked. A successful assault here would require the recall of Confederate forces from Virginia, open the back door to Richmond, and give Union armies access to rail lines leading west to Augusta and north to Florence. Control of these railroads would eliminate the easternmost of the two rail routes that linked Georgia, Alabama, Mississippi, and Louisiana to the states of the upper Confederacy.

Charleston was an attractive and worthwhile military target, and the Union had several feasible military options. The port could be sealed off or approached in five different ways: by landing at Bull's Bay to the north and proceeding to Mount Pleasant; by coming up the Charleston and Savannah Railroad from the south; by advancing via James Island, as the British had done in 1779; by attacking the harbor forts, as the British did unsuccessfully in 1776; or by moving up the barrier islands to Morris and Folly islands at Charleston. The alternative means of attack could be employed separately or in combination.[9]

By 1862, the Union blockade had been laid. Evading it became important business in Charleston, and so proficient were its practitioners that one Federal observer declared that Southern vessels were running on a schedule. To try to seal the harbor, the Union army, in August, 1861, and January, 1862, scuttled the "great stone fleet", hulks loaded with granite, at the entrance to the main channel. The blockage lasted a while. Then the fleet slowly sank into the mud, lodged on the channel bottom, and changed the flow of the harbor currents in a manner which, much later, actually improved navigability. The second attempt to subdue Charleston came in June in the form of an overland assault, but the Confederate defenses at Secessionville turned back a Union army. The third attack took place on April 5, 1863, when Admiral Samuel F. DuPont sent nine modern ironclads mounting a total of 22) 11-inch guns, seven 5-inch guns, and three 8-inch Parrott rifled cannon against Fort Sumter, now strengthened to 95 guns and a garrison of 500 men. In the 2½ hour battle, the Federal ships fired 154 shots, 54 of which hit their target. The fort suffered no visible damage. Sumter's defenders fired 2,209 times and registered 520 hits. None penetrated the ironclads' heavy armor. The largest vessel, *New Ironsides,* floundered, took 50 hits, and then limped away. The attack was beaten off, and by any measure the outcome of the battle was a defeat for the Union navy.

Battery Brown on Morris Island about 1863. The Parrott cannon was directed against Fort Sumter. The one shown here later burst.



Federal fleet blockading Charleston Harbor.

One result of DuPont's foray was to alert Charleston to future dangers. Defenses were further beefed up, and soon Charleston Harbor had as a defensive system an interlocking complex of guns, fortifications, garrison troops, contact and electrical mines, booms, sunken pilings, floating batteries, gunboats, and deliberately sunken obstructions. Against it the federal forces arrayed a blockading fleet, 96 vessels at its height, and a land army.

The naval expedition having failed, the Federal commanders turned to siege tactics. Brigadier General Quincy A. Gillmore, a military engineer, assumed command of a Union force that varied in strength from 11,000 to 15,000 men. Rear Admiral John A. Dahlgren superseded Admiral DuPont on July 6. Gillmore moved northward along the barrier islands, secured a foothold at the southern end of Morris Island, and when an attempt to overrun the Confederate batteries on the northern end of the island failed, dug in and methodically attacked from this position between two and 2½ miles from Fort Sumter. He set up eight batteries of heavily rifled cannon. One was the "Swamp Angel", a gun which could reach Charleston, four miles away, with a 200-pound shell. The bombardment began on August 17, 1863. The first day 1,000 shells were hurled at Fort Sumter. Another 500 followed within the week. Then Gillmore added to his artillery a 13-ton cannon capable of throwing shells weighing 250 pounds. In a short time. Fort Sumter was reduced to rubble. The last cannon shots from the fort were fired on August 23 at a reconnoitering ironclad. When the bombardment ended on September 2, some 7,300 rounds had been fired.

Gillmore then shifted targets. On September 5, he turned his guns against the Confederate fortifications on Morris Island. Their garrisons abandoned them on the nights of September 6-7. One land side of Charleston Harbor having been secured, the Union Navy attempted another assault. Fire from Fort Moultrie and Sullivan's Island batteries turned Dahlgren's ships back on September 7. A commando-style attempt to slip small boats ashore at Fort Sumter was beaten off the following night. In late September, 1863, Union military policy shifted to pinning the Confederate defenders down and orders were issued that the city was not to be the object of another assault. From this time on, Washington dismissed any suggestion that the capture of Charleston had ever been contemplated. Official statements were that Charleston had never been a target of a major offensive.

The bombardment of Fort Sumter was resumed in October, but the object now was to neutralize its effectiveness. In the spring of 1864, the North began to draw off troops and ironclads for operations in Virginia. The defenses of the Confederacy had been breached in the West, and Charleston was no longer a

theater of operations critical to the Union war effort. Still, one more long bombardment was undertaken before the battle of Charleston turned into a holding action.[10]

What did the siege of Charleston prove regarding the fortifications concept the Corps of Engineers had urged upon the American people from 1816 onward? The evidence is mixed and capable of being interpreted in diverse ways, but some facts stand out. When the typical fortification of the system was planned and built, the engineers anticipated that it would have to cope with weaponry of the Napoleonic era. Technological advancement rendered old style cannon and masonry fortifications obsolete. During the Civil War, both the attacking and defending forces employed artillery with striking power clearly beyond the capacities which coastal fortifications had been designed to endure. Moreover, the Union navy had a mobility of a magnitude which would have been inconceivable when the first plans for fortifications were drawn up. Yet, despite technological advances, the navy had not been able to open a gap in the harbor defenses so that the army could take the city. As the walls of Fort Sumter were turned to rubble by Union guns, the fort, ironically, got stronger. Even rifled cannon could not penetrate the masses of debris and soft earth. It finally became attractive for the Northern forces to settle for a blockade. At Charleston, the concept of coastal defense envisioned by the Army Engineers was judged sound.[11]

The cost to the city was enormous. Commerce and trade had ceased. Local financial resources were depleted, and individuals, banks, governments, and business faced bankruptcy. Cash and credit facilities no longer existed, and business and public institutions had shut down.

Charleston Harbor was still usable for navigation, but its condition had deteriorated. All the channels leading over the bar had changed positions. One was now blocked by a large shoal. The old main channels had become so crooked they were dangerous to navigation. The Sullivan's Island Channel, the main outlet for the blockade runners, was filled with obstructions which hindered passage. The improvement cut from the Sullivan's Island Channel to the Main Ship Channel had filled in.

To put the harbor back in prewar shape, according to an engineering survey, it would be necessary to remove the wrecks in the Sullivan's Island Channel and dredge the cut again. The amount of earth to be raised was estimated to be at least double what it had been before. The financial costs involved in dredging the channel and taking out the wrecks would be more than four times the previous expenses. There did not seem to be any urgent need to get the work started. "At the present time the commerce of Charleston is almost dead," wrote surveying officer Charles R. Suter to the Chief of Engineers on April 2, 1866: "The main channels over the bar are better than they were before and quite sufficient for the service of the port. I cannot see what claims the City has on Government aid at the present. I also think that if at some future day it should be decided to renew the improvement of Sullivan's Island Channel, the Government should not be saddled with the expense of removing the wrecks which obstruct it. The City of Charleston should be made to bear this expense."[12]

It would take time for wartime passions to cool, and until they did, no permanent improvement for Charleston Harbor could be attempted. The Civil War had cost Charleston its wealth and it primacy as an American coastal port, in addition to wiping out local financial resources. Without the economic underpinning, local government could not attempt any great feats of engineering. The federal government now held the key to Charleston's future.

Part II

1865 - 1914: Military and Civil Engineering

4.

The Charleston Jetties

The harbors and rivers along the southeastern coast of the United States were usable in their natural state in the 18th century, but 19th century industrialization set new standards. The arrival of larger oceangoing ships with their deeper drafts was a signal to seaport communities that the old ways were obsolete. To grow, indeed just to exist, these cities would have to apply scientific, mechanical, and engineering knowledge to the reshaping of their natural environment. Charleston Harbor, with its great sand bar blocking the entrance to easy passage and denying it to the largest vessels, now demanded engineering. The best alternatives for channel improvement were the Sullivan's Island Channel, then better known as Beach Channel, and the Pumpkin Hill Channel, the best entrance to the main shipping channel because the scuttling of the "great stone fleet" had inadvertently increased the scouring power of the tidal flow. Serious interest in harbor improvement, though, could not be translated into activity immediately after the Civil War. Not until the 1870s could planning for the future of the port begin in earnest.

In 1869, Colonel Quincy A. Gillmore, architect of the artillery bombardment of Charleston, was placed in charge of coastal defenses from the Cape Fear River to St. Augustine. The following year, Gillmore became the supervising engineer for surveys of rivers and harbors in the same area. In 1871, an engineer office was established at Charleston and given the responsibility for all construction work at Forts Moultrie and Sumter, seacoast defenses, and river and harbor improvement projects. Engineers in Charleston reported to Gillmore in the New York City Engineer Office. At first, civil works projects in Charleston were limited to removing wrecks from the approach and harbor channels. The *Palmetto State, Charleston, Chicora,* and *Beatriece* were removed in 1871-1872, *The Stono, Prince of Wales, Juno,* and *Keokuk* in 1873-1874, and the *Minho* in 1875. The gunboat *Housatanic,* the first ship known to have been sunk by a submarine, and the iron-clad monitors *Weehawken* and *Patapsco* were also taken up. As the channels were cleared, the engineer officers began to consider what further improvements were needed.

Quincy A. Gillmore's career was intimately tied to Charleston. Gillmore was a member of the commission surveying the bar to recommend improvements before the Civil War, commanded the Union forces conducting the siege and ordered much of the battering the city took, and designed the harbor improvement which would finally make possible Charleston's economic renaissance.

Frederick V. Abbott was a First Lieutenant of Engineers when he arrived in Charleston in 1884. Abbott was in charge of the construction of the jetties, saw the work to completion, and was instrumental in bringing about the transfer of the U.S. Naval Station from Port Royal to Charleston.

The problem at Beach Channel was that a vessel entering from the ocean, after reaching four fathoms of water some six miles from Fort Moultrie, had to proceed cautiously until reaching a pass between the end of Bowman's Jetty and Drunken Dick Shoal. There, a narrow channel, less than 15 feet deep with a sharp turn to the south caused by the projecting end of the jetty, was encountered. A plan for improvement was drawn up which prescribed removing the jetty and dredging the channel to a depth of 15 feet. This would eliminate the dangerous turn and, it was hoped, increase the volume of the ebb tide flow through Beach Channel to the point where further dredging would not be required to maintain the channel. The plan was sound but difficult to execute. The work was arduous and unanticipated problems arose. The small stones in Bowman's Jetty, those under 1½ to 2½ cubic yards in size, could be taken up by grappling irons worked by manpower. But larger stones of three to four cubic yards had to be removed by a set of steam-powered claws attached to a scow. Heavy seas, the constricted channel, and the strong currents limited this work to an hour on either side of the slack water time. Moreover, the cutting back of Bowman's Jetty was followed by an immediate recession in the shoreline of Sullivan's Island, and additional spur jetties had to be constructed at once to check the erosion. The difficulties demonstrated the need for a better plan.[1]

The Pumpkin Hill Channel was now the gateway to the main shipping channel, but its 11-foot depth did not allow entry of large draft vessels. The Committee on Trade of the Charleston Chamber of Commerce endorsed a proposal to dredge to a depth of 22 feet using the Lebby pump. In part, the action was prompted by the hope that signs of local activity would attract federal assistance. But little progress was made. Quincy Gillmore, who directed all engineering projects in the Southeast from his headquarters in New York, examined the work in 1875 and reported that, although the depth of the Pumpkin Hill Channel had increased to 13 feet, the cost of maintaining the channel would be prohibitive.[2]

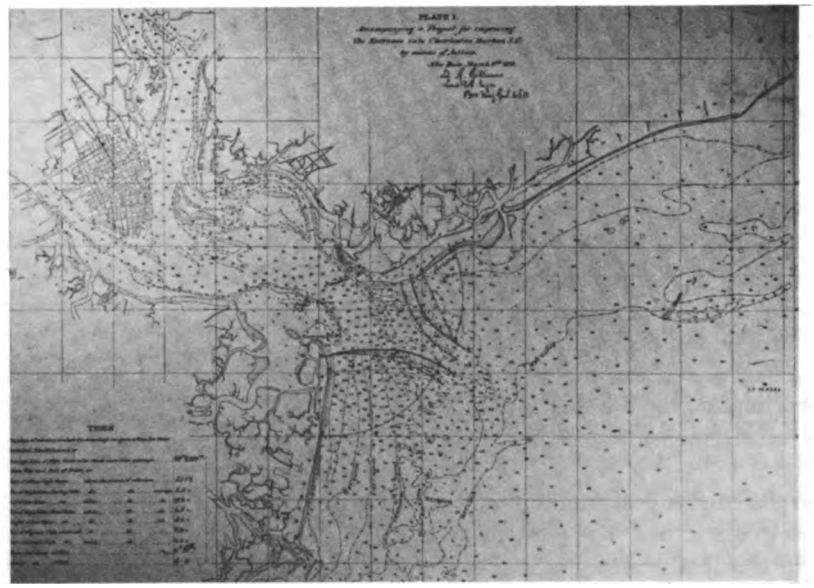
In November, 1875, before work on the Pumpkin Hill Channel was terminated, the Charleston Chamber of Commerce, without indicating any particular project, petitioned Congress for an appropriation of $100,000 for the improvement of the "Bar of Charleston" to "continue such projects as the engineer in charge shall deem most advisable." Following the 1876 national elections, the chamber petitioned Congress again, this time requesting $10,000 for a survey of the harbor by the Corps of Engineers. An appropriation was not immediately forthcoming, but Gillmore, at his own discretion, applied unexpended funds originally earmarked for work on the Beach Channel to a survey. He then designed a plan for the improvement of Charleston Harbor.[3]

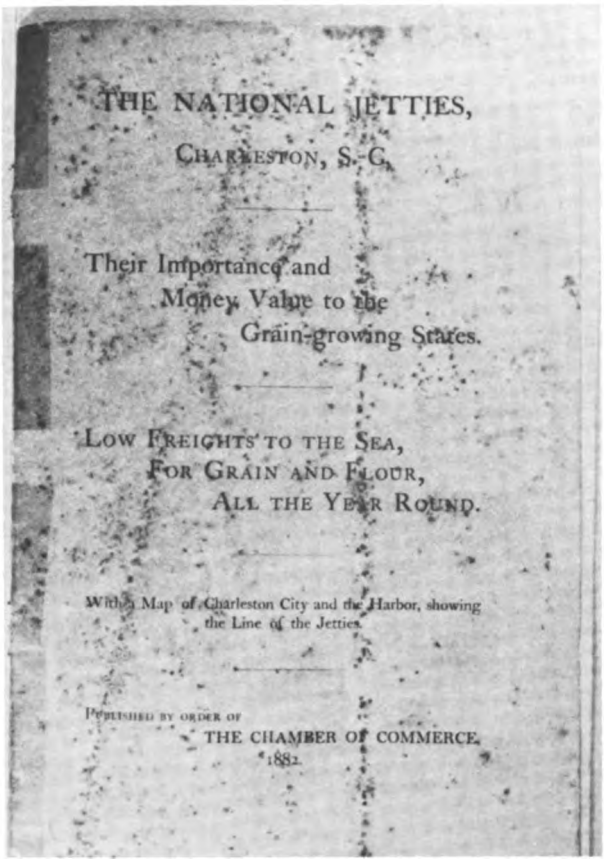
Once the survey and planning were completed, Gillmore, having been assured of local cooperation, went to Washington where he and newly elected Senator M.C. Butler moved skillfully through the corridors of power. Congress was experiencing a realignment of political forces in 1877. Among the changes was the emergence of a bloc of Southern Democratic votes solidly favoring river and harbor improvements for their region. The Southern coalition forced a shift in the procedure for allocating funds for federal projects. Since the Civil War, the Great Lakes states had received the lion's share of appropriations. Now, under political arrangements which would last

until the First World War, Southern and Midwestern delegations agreed to support each other's projects, and thereby assured themselves that the federal largess would be spread around.[4] Within this atmosphere of budding political realism, Gillmore, Butler, and holdover Senator John J. "Honest John" Patterson maneuvered a $200,000 appropriation for work in Charleston through the House of Representatives.[5]

Gillmore's plan was inspired, soundly conceived, straightforward, and offered a commonsense solution to the problem of Charleston Harbor. To begin with, he wanted to use the scouring power of the ebb tide to maintain a new 21-foot main channel. The ebb tidal flow had sufficient scouring power to keep a new channel clear; the average discharge was four million cubic feet per second. Already, in the unimproved condition of the harbor entrance, a channel 80 feet deep in its deepest parts and 3,200 feet wide between

Detail of Quincy Gillmore's plan to improve Charleston Harbor by using jetties.





THE NATIONAL JETTIES,

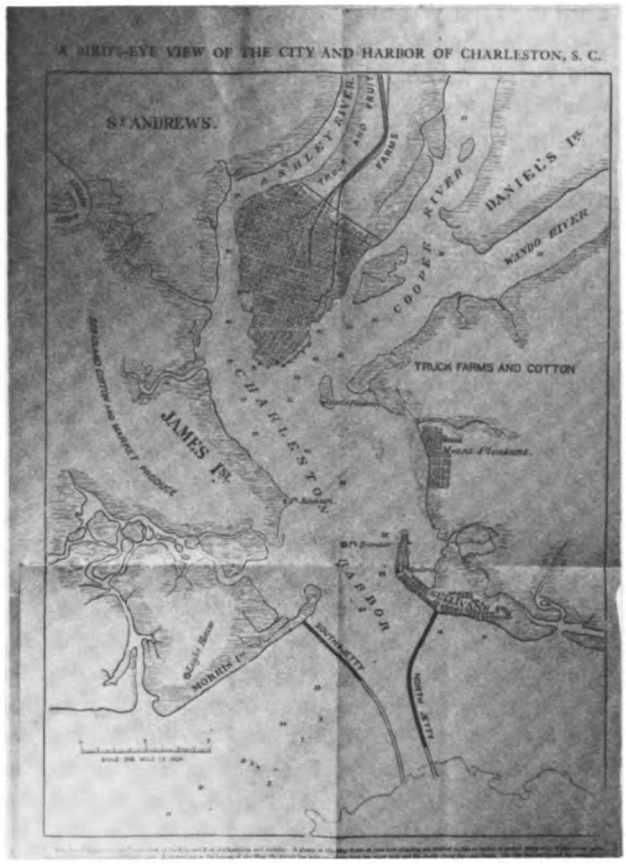
CHARLESTON, S. C.

Their Importance and
Money Value to the
Grain-growing States.

LOW FREIGHTS TO THE SEA,
FOR GRAIN AND FLOUR,
ALL THE YEAR ROUND.

With a Map of Charleston City and the Harbor, showing the Line of the Jetties.

PUBLISHED BY ORDER OF
THE CHAMBER OF COMMERCE.
1882.

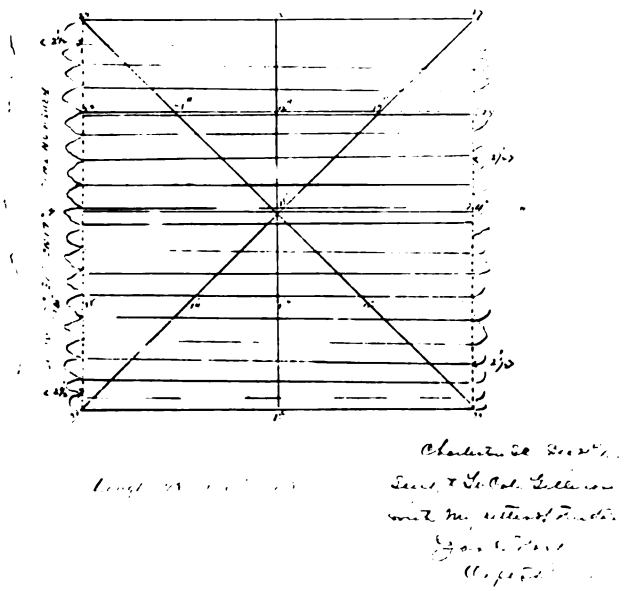


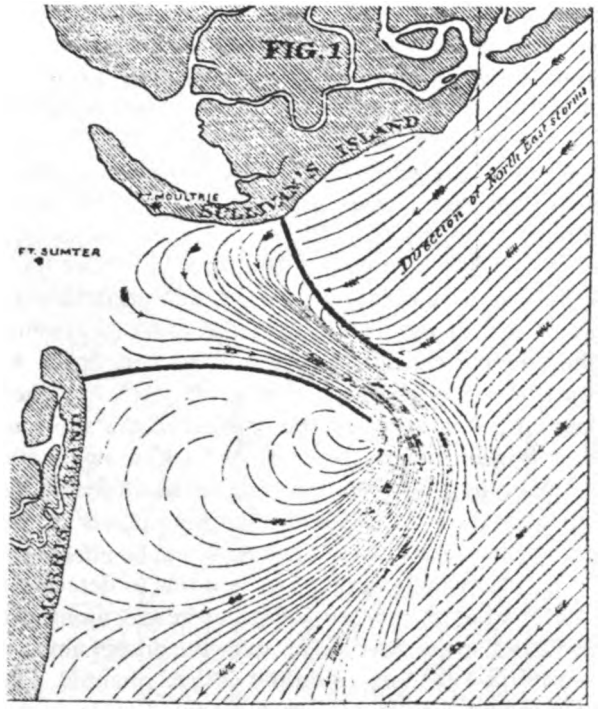
the 21-foot contours was maintained by the waters flowing out beween Sullivan's Island and Fort Sumter.

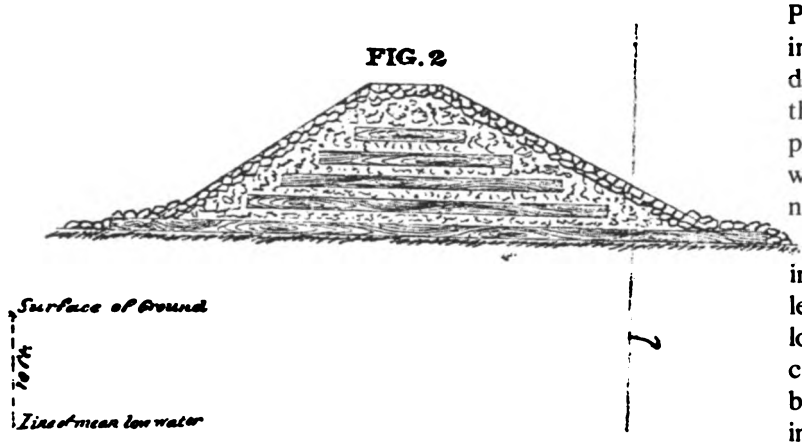
The problem was getting exactly the right tidal flow. If too much water were directed outward through a new channel, a new bar would form farther out from the entrance. If the flow of the flood tide were directed, both its scouring power and the movement of sand into the inner harbor would be increased. Extreme care had to be taken lest the prevailing northeast to southwest movement of sand on the Charleston bar cause a piling up in the new channel. Finally, the peculiar features of Charleston Harbor required expert evaluation. The funnellike configuration of the Sullivan's and Morris islands' shorelines forced the flood tides to pile up near the shore and then find their way into the harbor over the whole length of the bar in a quite even flow. What Gillmore had to do was to figure out how to harness and direct the natural flow of the ebb tide to a degree sufficient to maintain a channel of the desired depth while neither moving the Charleston bar nor interfering with the flow of the flood tide into the harbor.[6]

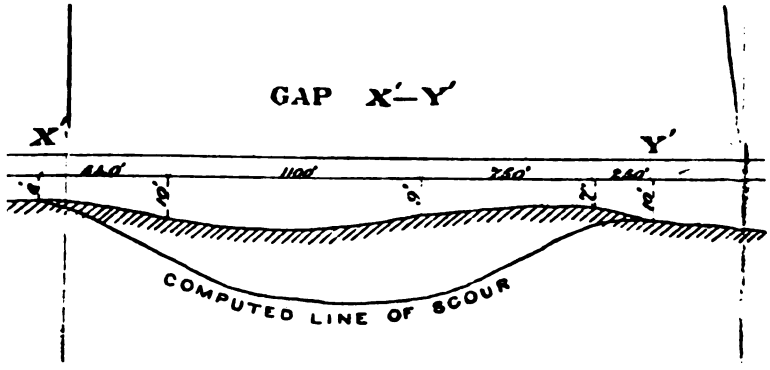
Gillmore's solution to the complex and undoubtedly interesting problem was to use jetties. The technique was no longer novel. In the 1820s, Army Engineers had begun using jetties to improve the entrance to harbors on the Great Lakes, and examples of the

Chamber of Commerce publication with a map of construction showing work in progress.









Drawing accompanying Quincy Gillmore's plan for the improvement of Charleston Harbor.

application of jetties for the improvement of a bar channel could be found overseas in Dublin's harbor. Swinemunde, Prussia (the out-port city for Stettin), and Kurrachee Harbor in the East Indies.[7] Gillmore's plan of improvement called for the construction of two jetties. They were the southern jetty, springing from Morris Island, and the northern jetty, from Sullivan's Island, both curving toward each other with the convex side toward the contemplated channel. At a point about 9,000 feet from Sullivan's Island and 14,000 feet from Morris Island, the jetties straightened to a parallel about 2,900 feet apart. The direction of their parallel pointed directly toward the city of Charleston.[8]

Many advantages were offered by this design. The jetties would channel the ebb tidal flow. Their placement guaranteed that the new channel would cross the northeastern end of the Charleston bar where it would not be affected by the southward movement of the sand. Fort Sumter, located slightly to the southwest of the center line between the jetties, would be available for an effective channel defense. The positioning of the jetties would permit use of the best possible navigational aid, the sensitive range of the Sumter light and the light in the belfry of St. Philip's Church some 3½ miles to the rear. Any change in the apparent position of the two lights was so easily detectable that it could be seen as one walked across the deck of a steamer crossing the bar. Finally, the plan preserved the old main shipping channel, which was a decided convenience for sailing ships and vessels not drawing over 12 or 13 feet of water.[9]

The problem of training the ebb tide without impending the flood tide flow was to be solved by leaving the inner half of each jetty (the center portions located in deep water across the direction of the current) and portions of the jetties near the shore below the surface. This would allow the tide to come in as before. In the ebb tide, the curved half of each jetty would channel only the bottom current while the straight half of the jetties, the parallel, built higher and for the last quarter of their length rising above sea level, would channel the water trapped between them. The hope was that an exact amount of power would be exerted by the tide to keep the channel clear, and this computation proved to be essentially correct.[10]

The jetties were constructed of riprap stone resting on mattresses of logs and brush. In practice, the building went this way: first, mattresses (aprons or platforms of logs 10 to 11 inches in diameter were placed side by side and held firmly together at right angles to the axis of the jetty. As much brush as the platforms could float was placed atop the logs and upon this wooden substructure (which was approximately 2 feet thick) "good sound stone" of random size and weighing a minimum of 30 pounds was fitted as

compactly as possible to a depth of 2½ feet within the jetty and one to 1½ feet on the side slopes. Neither the maximum weight nor the dimensions of the riprap stone were specified in the construction contracts, but the contractors adopted the practice of excluding stones larger than those a man could pick up and throw overboard from the scows used in conveying the stone to the jetty. The interstices between the large pieces were filled in with stones weighing less than 30 pounds. By mutual agreement between the Corps and contractors, revisions were made as special problems were encountered.[11]

The foundation platforms were fashioned at a mattress camp. Logs were maneuvered close together in the water and made into rafts. These were floated to moorings at the rear of Sullivan's Island, securely fastened between two stone scows, and towed into position. After the mattresses were loaded with from 30 to 60 tons of one-man stone, the supporting lines were slacked off and the mattresses settled into position. For easy positioning, each mat was supplied with a mast fastened to the outer edge of the front log. The masts were attached with a flexible joint to allow the flats loaded with stone to pass over it while the mat was being lowered. To mark the line of work after the mats were laid, permanent iron masts were secured to several of the mats before they were sunk. At first, the mattresses were sunk so they touched or overlapped slightly. Later it was found more practical to allow small spaces between consecutive mattresses. The whole operation required comparatively calm weather, but on good days the work moved fast, and enough mattresses could be set and partially loaded to keep crews at the mattress camp busy all the time.[12]

When the newly established engineer district began work on the harbor project, Charleston was enveloped in a optimistic glow. The *News and Courier* reported in 1878 that "the commercial effect will undoubtedly be great. There will no longer be any doubt... Charleston will soon become the receiving and distributing point for a vast section of the country now supplied by longer lines and at greater cost by Baltimore and New York. The field is open to Charleston."[13] Few people doubted the prophecy.

In 1882, the Corps of Engineers approved Gillmore's request to build a powerful $50,000 dredge for work on the bar, the cost of the new machine to be divided equally among the Charleston Harbor, the Cumberland Sound (Georgia and Florida), and the St. Johns River projects.[14] When time came to clear the channel, the self-loading, self-propelling pump dredge, the *Charleston*, was ready. The ship's plant was typical of the new dredging technology. The vessel had a centrifugal pump with suction and discharge openings and bins on the deck to hold the materials raised from the bottom. The engine for operating the pump was connected directly to the ship's boiler. The materials pumped up were first discharged into the bins and then washed overboard at the dumping grounds. Dredging was done as the vessel moved across the bar at a low rate of speed.[15]

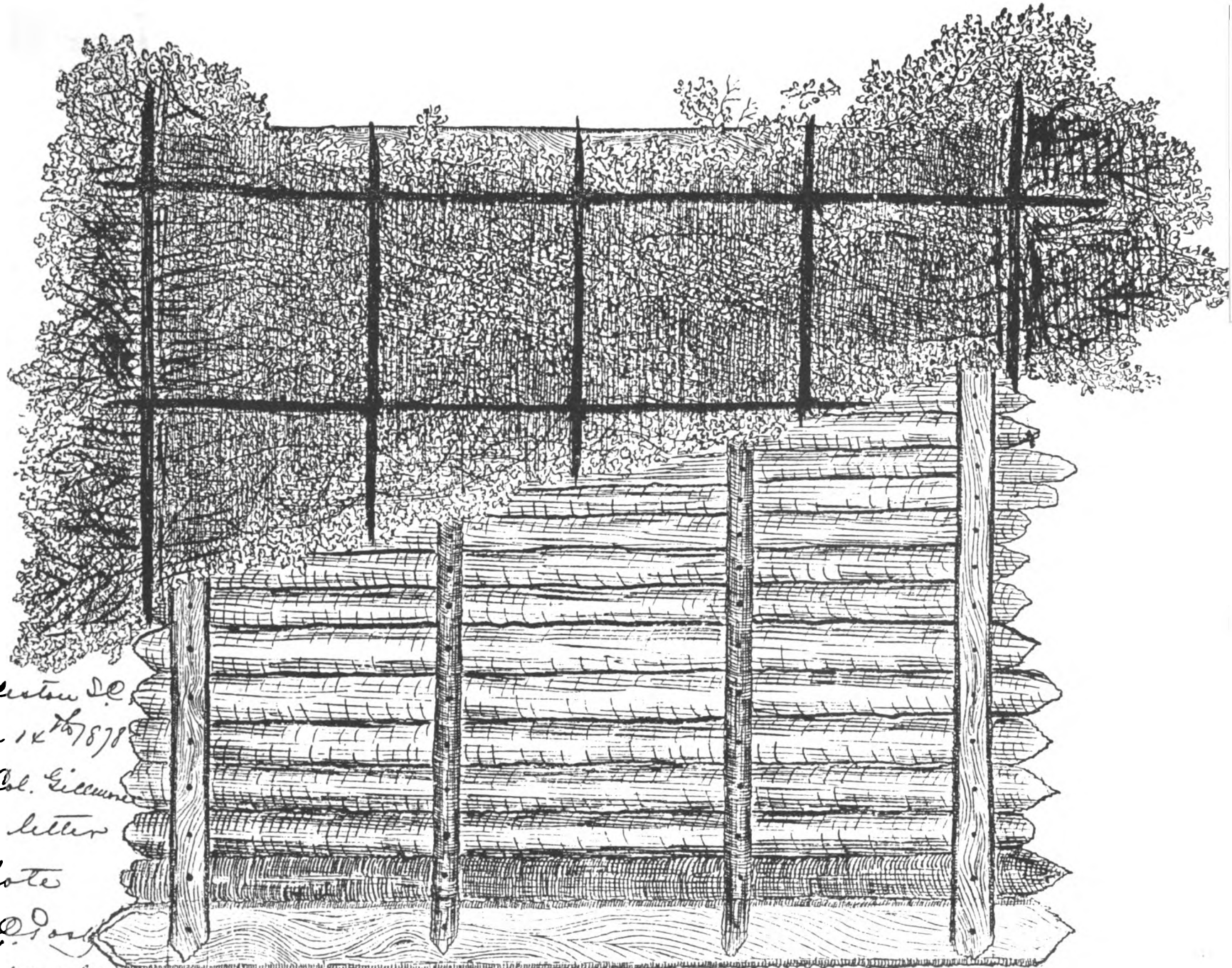
A survey made in 1883 showed the expectations of the Corps were being fulfilled. Jetty stones were cementing together in the water as barnacles and other shellfish covered the structure. The shore lines of Sullivan's Island held their configuration despite the effects of the jetties upon the harbor currents. The changes that did occur seemed beneficial. As construction proceeded on the south jetty, evidence pointed to a slowing of the erosion of the shore at Morris Island where beaches had withdrawn 1,500 feet since the coastal survey of 1823-1825. Observations indicated the plan to use the scouring power of the current to maintain a new channel would be effective.[16]

The major engineering problem was to determine exactly what proportion of stone height along the length of the jetties would produce the proper amount of waterpower to maintain the desired channel. The man who would solve it, First Lieutenant of Engineers Frederick V. Abbott, arrived in Charleston in 1884. The first-honor graduate of his West Point class of 1879, Abbott took over the jetties project at a time when there were doubts that Gillmore's plan would succeed. Abbott did not doubt, and he stayed in Charleston to see the jetties finished.[17]

Channel dredging began in 1885.[18] Work on the jetty foundations was completed the next year, and then the task of raising the jetties commenced. As trade and commerce at Charleston continued to increase and freight and insurance rates to decline, a general optimism settled over the city. Abbott offered his opinion that none of the positive economic effects could be ascribed to the federal project, but this cool appraisal was little noticed. Progress in the harbor project coincided with the completion of the last rail link between Charleston and Asheville, North Carolina, the gateway to the transmontane region, and Charlestonians found it difficult to doubt their city was on the verge of achieving a long-sought commercial breakthrough.[19]

In 1888, the project was revised. The new specifications called for dredging a navigation channel 350 feet wide to at least a 15-foot depth at mean low water and raising the outer ends of the jetties to concentrate the currents for channel maintenance. Still the work went slowly. Until 1892, appropriations averaged only $166,591 yearly, less than 4 per cent of the estimated total cost. The lack of money seriously interrupted and delayed completion of the project, as all the

Detail showing design for mattresses.



Charleston S.C.
Dec 1st 1878
...y & Lt. Col. Gilmore
...with my letter
...this date
Jas. D. Ford
Copy of supra.

[Form 18.]

PROPOSAL FOR Improving Hell Gate 1885 &c

New York city
January 24th, 1885

To Col G. A. Gillmore
US Engineers Corps

SIR:

In accordance with your advertisement of January 5th, 1885, inviting Proposals for Dredging in the Board Entrance of Charlestown Harbor &c and subject to all the conditions and requirements thereof, and of your Specification, dated January 5th, 1885, copies of both of which are hereto attached, and, so far as they relate to this proposal, are made a part of it, ~~we~~ (or) I propose to furnish Machinery and labor to dredge material at the rate of Thirty four Cents (34/100) per cubic yard Measured in Scows; This price referring to the main cut and any side cuts the US Engineer may order to be dredged

Commence work thirty days (30) from date of notification of Award of Contract

Process, Centrifugal pumps

I agree to remove from one to three [illegible], when [illegible]; that is twenty five thousand (25000) cubic yards [illegible]

We (or) I make this proposal with a full knowledge of the kind, quantity, and quality of the articles required, and, if it is accepted, will, after receiving written notice of such acceptance, enter into contract within the time designated in the advertisement, with good and sufficient sureties for the faithful performance thereof.

[Signature.] Hugh McLaughlin

[Address.] 63 [illegible]

[Signature.] _____

order of work was governed exclusively by the uncertainty of appropriations.[20] Almost every step had to be taken not with view of obtaining results as quickly and efficiently as possible but with the idea of doing such work as would be necessary eventually without interfering with existing commercial traffic. Abbott and Chief Civil Engineer James P. Allen approached the engineering problem by deciding to lay jetty foundations along almost the entire length of the project to maintain the general level of the bottom and make the outer apex of the funnel formed by the jetties secure before attempting to shape the flow of water.[21]

Slow progress in getting the larger stone deposited on the jetties and the need for economy led Abbott to recommend that the government operate its own plant. Authority to obtain the facilities to do the rock work by hired labor, formerly done under contract, was granted in 1890. In short order, a tug, 80-foot scows, a derrick scow, hoisting engines, and the Trenton quarry site near Edgefield, South Carolina, were procured. Arrangements were made with the South Carolina Railway to provide a terminal wharf for transportation of the stone. The quarry plant, capable of loading 15 25-ton railroad cars in a day with compact granite, began work in September, 1890 and paid for itself in less than a year.[22] Although the operation worked, the method had to be revised almost immediately. The Rivers and Harbors Act of 1892 placed the Charleston project under the continuing contract system, which meant that all work under new appropriations had to be done under contract. To conform to the legislative provisions, the government plant was rented to contractors. They, in turn, charged for the work performed. When accounts were balanced, the new arrangements proved beneficial to both parties.[23]

Work on all engineering projects was interrupted in 1893 by the hurricane of August 27-28. Winds measuring up to 126 miles an hour hurled gigantic waves against the shore and raised the tide 11½ feet above the low water line.[24] The engineer office in the customs house lost its roof and windows were smashed in. The storm destroyed or swept away homes on Sullivan's Island, and a large number of people managed to save themselves only by taking refuge in Fort Moultrie. At Fort Sumter, 7,000 cubic yards of parapet were washed into the sea and two guns were undermined. The lighthouse keeper's home was wrecked, but he and his family, together with the ordnance sergeant and his wife, saved themselves by spending the night in one of the powder magazines. Contractors had 23 lighters loaded with rock when the hurricane hit. Most dumped their loads, many drifted into the marsh, and one was destroyed. The tugboats and government equipment were not damaged, however, and the jetties remained intact, although some stone was knocked off the top of the north jetty and distributed along the sides. No marked changes occurred in the jetty channel. The project had survived the blows of nature.[25]

The final stage of the work was raising the jetties. Harbor currents were carefully measured as stone was added along the length of the jetties. When it appeared a sufficient excess of ebb tide over flood tide was moving through the jetties, the laying of stone was stopped. Said Allen later:

> We built up the outer ends of the jetties first. Having done that we worked our way backwards, and quit building when we had achieved a volume of water flow sufficient to complete the scour. We did not want to push sand out beyond the jetties. Every pound of material that we moved out... had to be attended to afterwards, so it was important to get no more water than we needed in this portion of the work, and that was done not by any mathematical process, or by any fancy engineering reasoning, but by measurements as we went along.[26]

By 1895, a channel 17½ feet deep at low water had been obtained. Harbor lines were established in 1897.[27]

From an engineering standpoint, the project was essentially finished in 1895, and a complete success. True, the final cost had overrun the initial projections; slightly over $3.9 million had been spent. But careful management had saved more than $200,000 in construction costs, and it was calculated that another $40,000 had been saved by making available plant and quarry facilities which could furnish stone for the harbor defense construction program, now in progress. More important, however, was the fact that Charleston at last had a modern harbor, one which could admit the largest vessels afloat. Physically at least, the city was in a position to regain commercial prominence.[28]

1885 contract for dredging at the entrance to Charleston Harbor at the rate of 34 cents a cubic yard to remove from 1,000-3,000 cubic yards of material per day to a minimum of 25,000 cubic yards per month.

5.

Port Royal, Georgetown, and the Rivers

Charleston was not the only place harboring dreams of a commercial future. Civic bodies in Beaufort and Georgetown entertained similar visions.

Beaufort had the least to work with, but compensated for its lack of size, facilities, and money with enthusiasm and Port Royal Sound, the best natural harbor on the Southeastern coast. Port Royal had attracted Union forces in 1861, and during the Civil War, they constructed a naval base, made it headquarters for the blockading fleet, and maintained an army facility of considerable size. After the war, though, the Hilton Head Island base was abandoned. During Reconstruction, the economy stagnated. Local entrepreneurs pointed to the fact that the nearest rail connection was 26 miles from the harbor. When this deficiency was remedied, they proclaimed, Port Royal could become a commercial center.

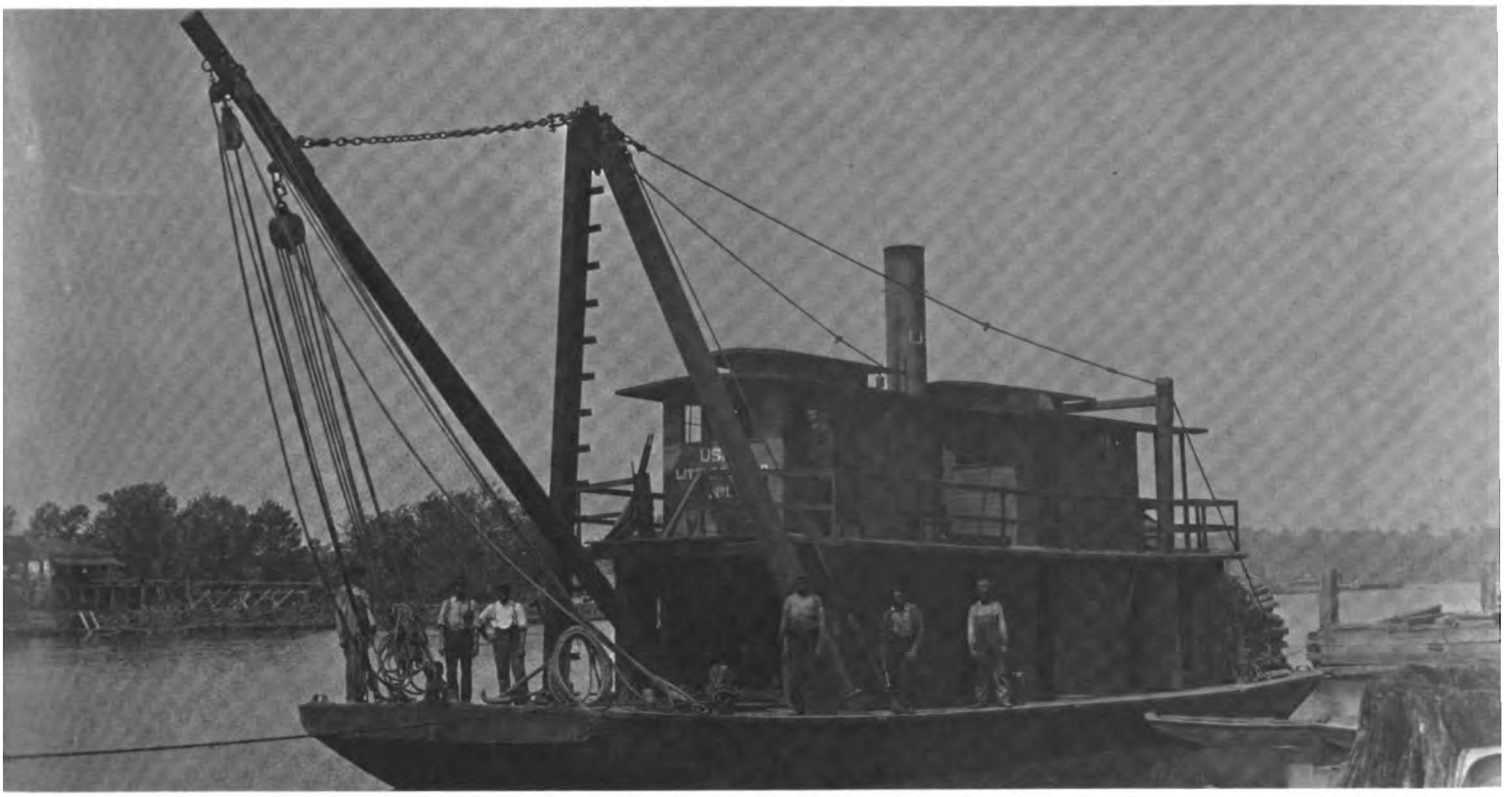
The advantages conferred by nature brought a benefit in 1889 when a joint Army and Navy commission, then searching for site for a naval dry dock and station on the Atlantic Coast south of Cape Hatteras, was compelled to select Parris Island in Port Royal Sound over Charleston solely because Port Royal offered a 21-foot channel way.[1] A naval station was constructed in 1894-1895, but the facility was plagued by ill fortune. There were failures in portions of the structure, and by 1900 the cost of repairs had become prohibitive. No rail connections to the interior appeared.[2] Beaufort remained a sleepy community, and nothing developed which would justify a large-scale capital investment by either government or private interests.

The situation was different at Georgetown. The port there was accessible through Winyah Bay, a long, narrow, shallow estuary covering about 25 square miles. The bay communicated to the sea through a 2½-mile passageway. Two principal channels made their way through the sand bar at the mouth of the bay. The better one had a depth of 7 to 10 feet over the bar at low tide, but large vessels could not get to the port. From the harbor bar to the mouth of the Sampit River, 12 miles distant, there was only a 12-foot channel. At the river mouth, the Sampit bar reduced the available depth to 9 feet. The river and sea currents fluctuated widely, and navigation was always difficult. Upriver was Georgetown, in 1890 a small community of 2,895.

The harbor and bay served as an outlet to over 900 miles of potentially navigable rivers and 100,000 square miles of adjacent lands, half of which were beyond the reach of railroad transportation. Approximately 450 miles of river were suitable for navigation. If the harbor could be improved and the inland water passages opened, the port would be connected to the Congaree-Wateree-Santee, the Black, and Pee Dee-Waccamaw river systems. It was assumed Georgetown exports would double or triple as soon as vessels of 12-foot draft could cross the bar.[3]

Georgetown had an active civic group, the Committee of Georgetown Board of Trade, working for local betterment, and it requested the assistance of the Corps of Engineers. Captain W.H. Bixby made an extensive survey of the harbor in 1895-1896, concluding that it was worth improving. He recommended a jetty project, saying the only questions that needed to be settled were which of the bar channels should be selected for engineering and how much money the federal government would commit at Georgetown to develop the commercial potential of northeastern South Carolina. In Bixby's view, the fullest plan of development offered the most efficient return per dollar of engineering investment; any compromise in expenditures would result in a compromise in quality.[4]

The project envisioned by Bixby was endorsed by the Georgetown Board of Trade and adopted by the Corps of Engineers. Operations for the improvement of navigation in Winyah Bay began in December, 1884, under a project to secure a channel through the Sampit River bar immediately below Georgetown. The proposed channel traversed a submerged cypress swamp, and the cost of dredging soared. In 1886, a project to secure a harbor channel of not less than 15-foot depth was authorized. Plans called for the construction of two jetties, one springing from North Island and the other from South Island, crossing the main channel to converge at the 18-foot curve. The



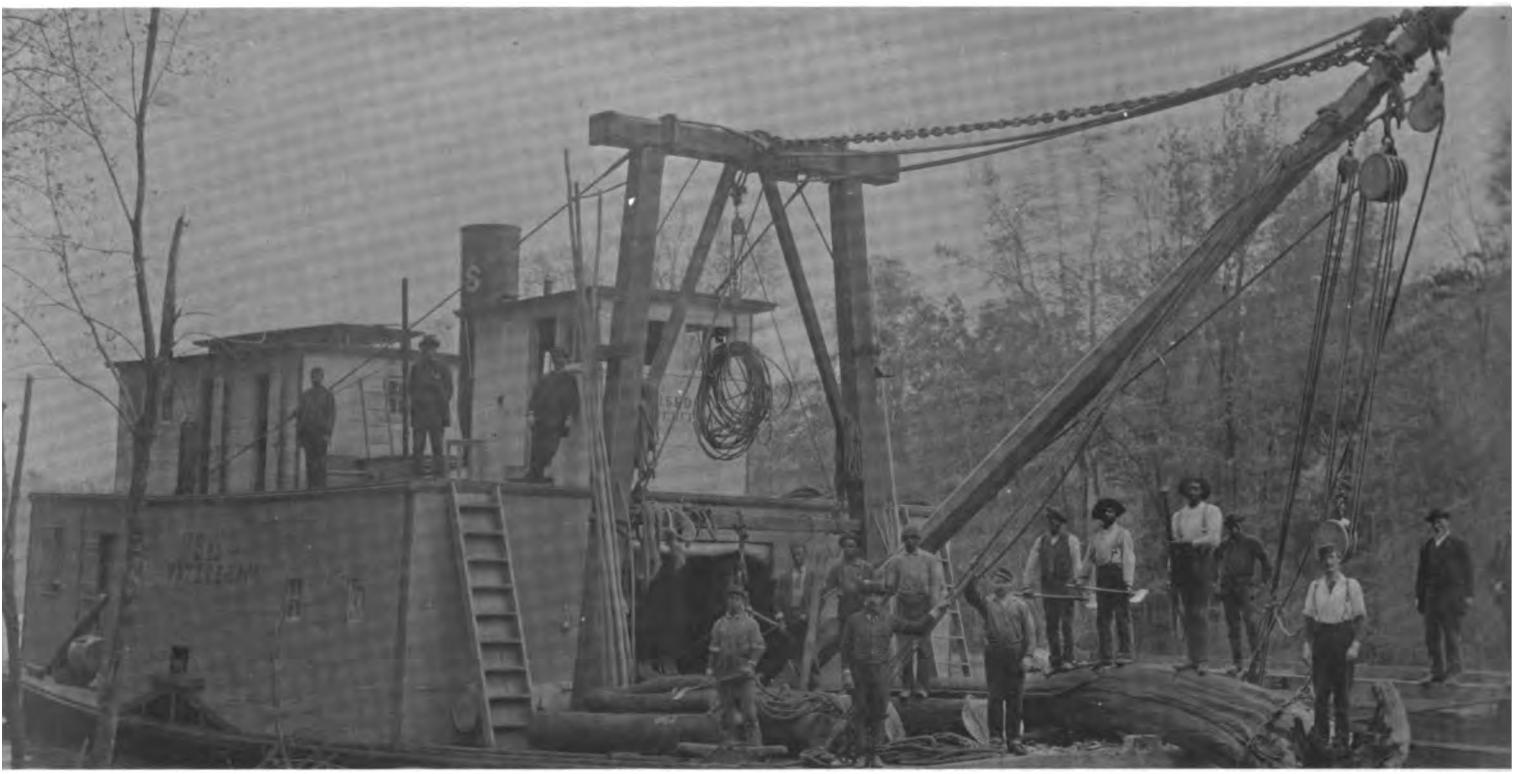
Snagboat **Little Pee Dee No. 1.** *Completed and ready for work at Georgetown, South Carolina, June, 1896.*

north jetty was to be 10,700 feet long, the south jetty 17,500 feet long. Both would be built 6 feet above the mean low water line. The parallel between the jetties at the 18-foot curve would be 4,000 feet.[5] As in Charleston, the jetties were to be constructed of log mattresses with stone dumped on top of them.

Captain Bixby set up a suboffice in Georgetown and construction work got under way in 1890. At first, the method was to drive piles into the water, build a railroad trestle to transport the stone, and lay the mattresses. Unfortunately, the scour at the piles increased so dramatically that instead of the mattresses being laid in water 1¼ to 5½ feet deep, they were soon being put down at a depth of 12 feet. As the trestle went outward the scour increased, and at about 1,430 feet from shore, matresses were being laid in 17 feet of water in places where the original depth was 2.2 feet. At this point the Corps negotiated a new contract which required that the mattresses be kept 500 feet ahead of the trestles, and the scour ceased to be an extraordinary problem. In 1892, construction began on an earthen dike along the shore line of South Island to protect the shore. The dike served as the root of the south jetty, which was built beginning in 1898. A seagoing suction dredge, the *Winyah Bay,* was built and placed in operation in the same year. Construction on the jetties was completed in 1904, and dredging operations continued until the 15-foot channel was secured in 1909. The total cost of the improvement was slightly over $2.5 million.[7]

The lowcountry engineers also became involved in projects designed to improve navigability in the inland waters. The projects were of two sorts: work on the rivers draining into the Atlantic and work along waterways paralleling the coast. They had in common the fact that meager commercial use was being made of the waterways and local hopes that after improvement traffic would pick up. Unfortunately, in the halcyon days of Congressional logrolling, not all projects approved merited the investment. Even where benefits seemed possible, formidable difficulties had to be overcome.

In 1879, $20,000 was appropriated for the improvement of the Yadkin River from Wilkesboro to Salisbury, North Carolina. Rocks, shoals, fish dams, bars, and mill dams obstructed navigation, but with improvements, it appeared possible to secure a navigable depth of 2½ to 3 feet at low water, enough for shallow-draft vessels. With excavation and construction of locks and dams, the river could be made navigable for high-draft steamers. Thus, the object of the $25,000 appropriation for Yadkin River improvement (authorized in the Rivers and Harbors



Act of 1882) was to secure a channel for steamers from the North Carolina Railroad bridge near Salisbury to Bean Shoal, a distance of 21.5 miles.

This part of the river had never been navigable. The character of the stream, the machinery available for carrying on the work, and the nature of needed improvements were such that progress was difficult. Laborers had to work in water varying in depth from 6 inches to 5 feet. In the highwater season, no work could be done. During some years, the low water season lasted only three months. Private owners refused to take out their dams without compensation, and the value they placed on their property tended to rise during discussions with representatives of the Corps. When the federal lawyers ruled that payment to private parties was not allowed under the work authorization, the project ground to a halt. Even if it had been completed, there was no guarantee anyone would actually want to run a steamboat up the Yadkin. By June, 1884, the results were in. Almost $54,000 had been expended to secure "an indifferent channel from 40 to 70 feet wide and from two to two and a half feet deep for eight months of the year." There were "no commercial boats on the river and but little prospect of any."[8]

Better results were obtained when the river crossed the border into South Carolina, to be renamed the Great Pee Dee. An examination in 1873 showed that improvements might afford some navigability from Cheraw, South Carolina, to the Black River, six miles above Georgetown.

The river's course was torturous, however, a continuous series of reverse semicircular curves. Each year, thousands of trees were undermined and fell into the river. During low water seasons, steamers using the river were frequently detained upon or between the obstructions for several weeks at a time until the river rose. Commerce, such as it was, was handled by three steamers with cargo capacities of 200 to 300 tons. At ordinary stages of water, the Great Pee Dee was navigable from the mouth of the Waccamaw River for 41 miles for boats of a 9-foot draft, and for another 88 miles for boats with a 3½ foot draft. Commerce on the river was estimated at $400,000 per year. Work done between 1882 and 1883 added 50 miles of navigability for the larger steamers. By 1885, commerce had increased to over $2 million a year and the usefulness of the project seemed assured.[9]

The relationship between good engineering and economic benefit was not absolute for any given project, although it was commonly assumed by civic bodies that rivers and harbors improvements would be followed by a rapid increase in local prosperity. The spirit is aptly portrayed in the text of a report sent to the United States Senate by the Charleston Chamber

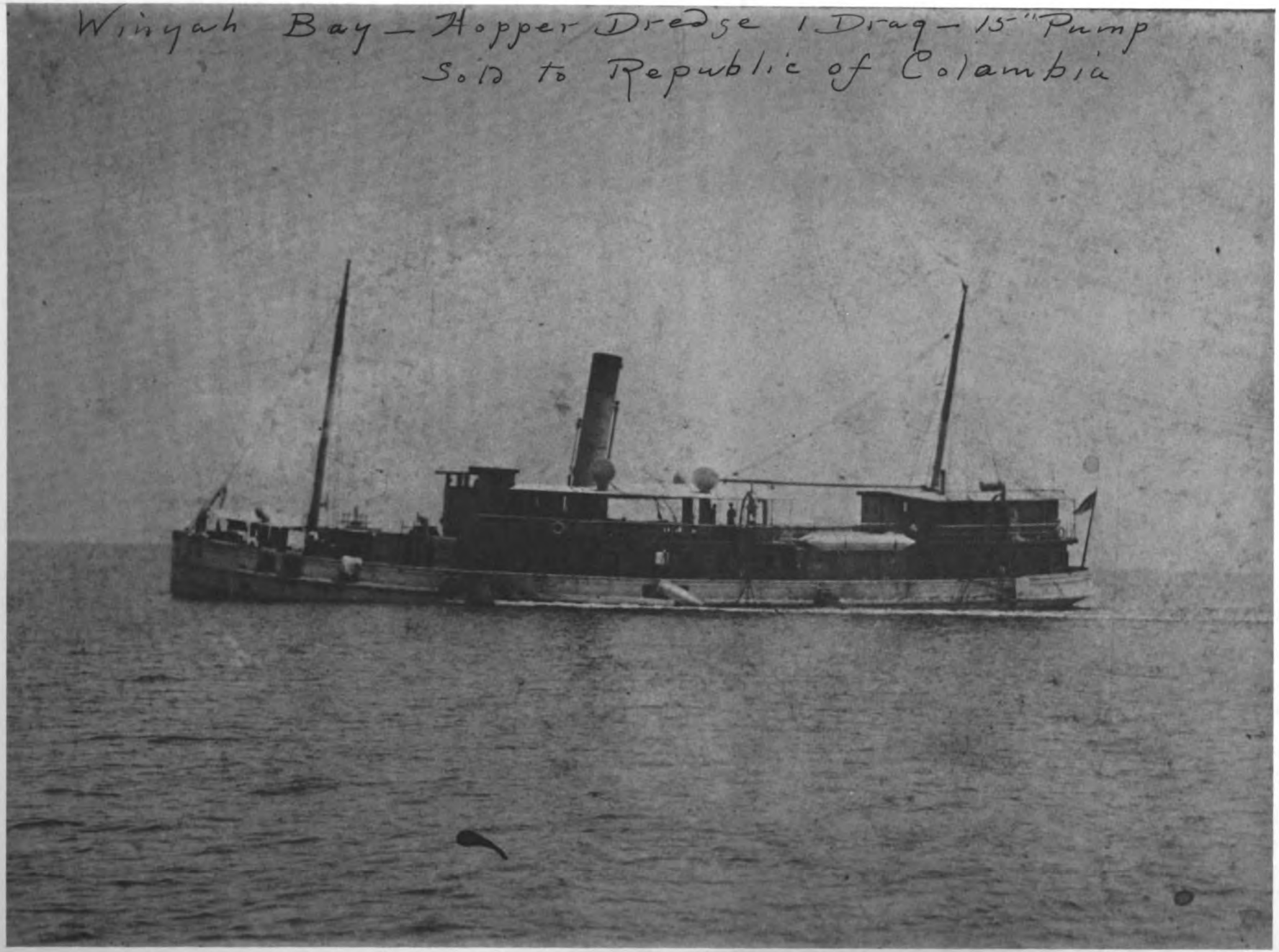
U.S. Snagboat **Wateree.** *The earlier photograph (left) is undated. The reconstructed boat is shown at Georgetown in July, 1896.*

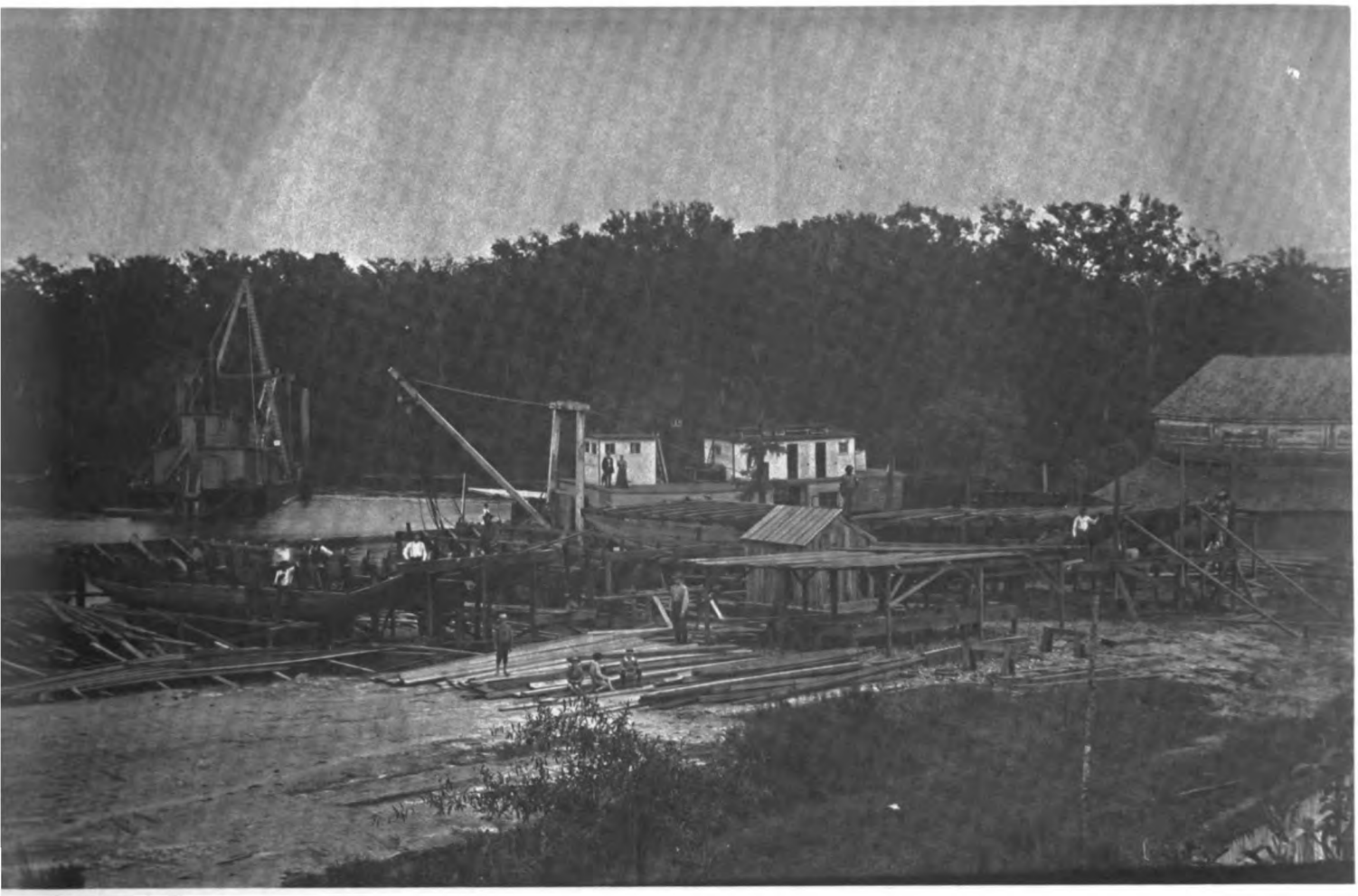
of commerce when the measure appropriating funds for Charleston Harbor was being debated. Said the chamber,

> Soon our system of railroads will . . . be closely connected with that of the West and Northwest, and will offer to the grain growers of that section the shortest, cheapest, and most reliable route by which send their productions to European, South American and West Indian markets . . . . There is a time coming when we of Charleston will rejoice with westerners, when your hearts will be made glad by the sight of long trains of cars daily passing your doors, laden with grain and the teeming products of the West; when your waste lands will be under culture with a farm house upon every acre, and towns and cities will rise up along the line of your road, alive with the busy hum of commerce.[10]

Some of the flowery language can be attributed to political calculation; without expressions of this sort Congress might not feel disposed to commit federal funds. However, the sentiments also represented deep and sincere feelings. There is little doubt that the authors were sure they were close to stating facts.

Within a few years, the optimism would fade. Depression would engulf the nation, and with it, South Carolina and the lowcountry. The envisioned commercial future did not materialize. Yet, the improvement of the harbors did mark a turning point in the history of South Carolina. From them would come, in time, the genesis of real economic growth.

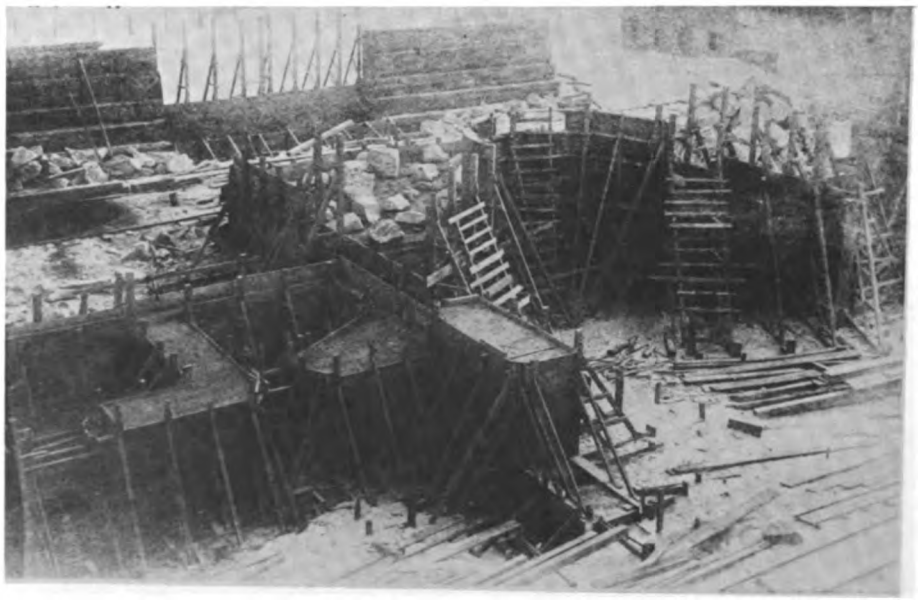




Snag-boats in the process of construction. The dredge **Santee** *is in the distance and the snag-boat* **Wateree** *is at the wharf. September, 1895.*

The hopper dredge **Winyah Bay** *had a 15-inch pump and 1 drag. When newer dredges were constructed, this vessel was sold to the Republic of Columbia.*

Construction scenes. Fort Moultrie and Battery Jasper, 1897-1898.



The wood steamer **Mingo,** *completed and ready for service at Conway, South Carolina, November 27, 1895.*

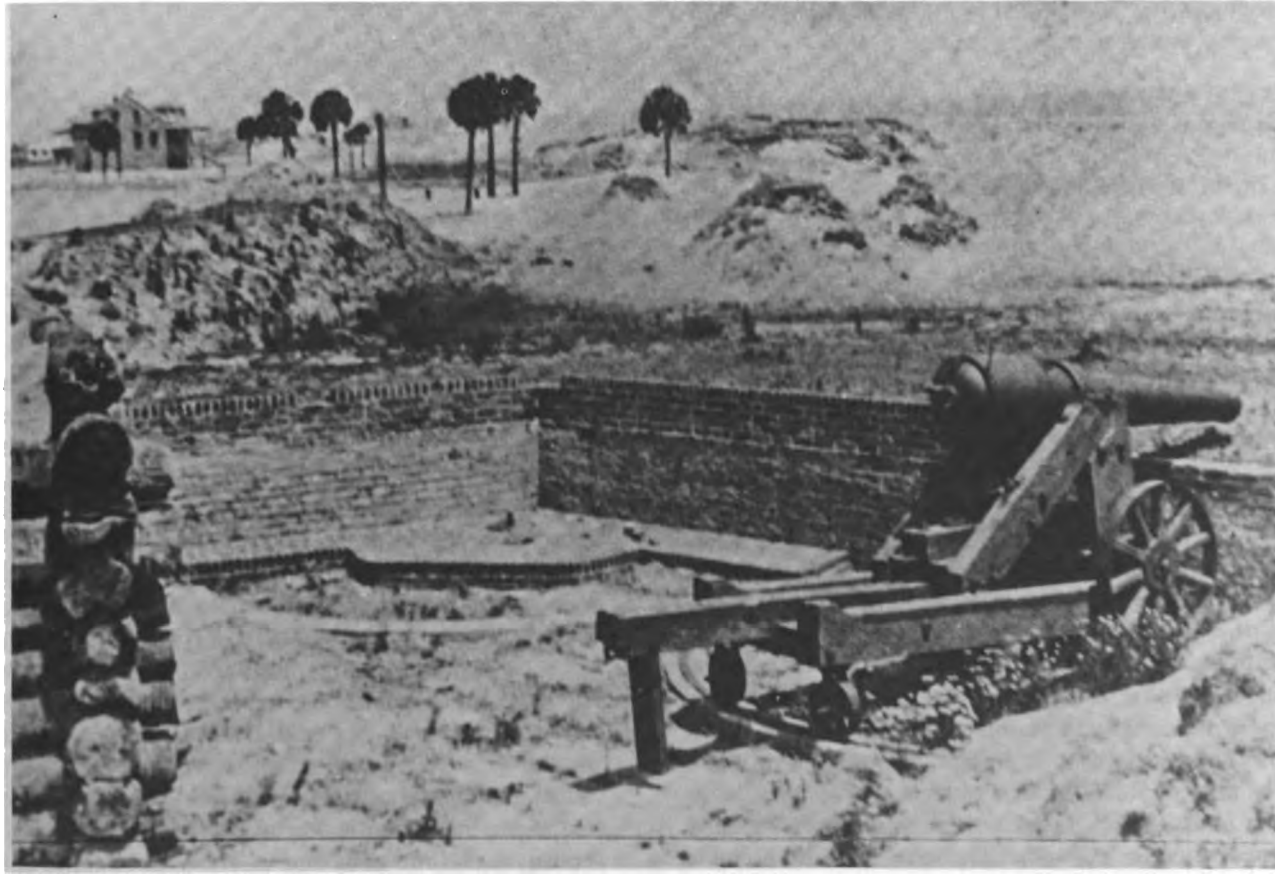
Work on the Santee River in 1895. The dump scow **C,** *built at the Corps of Engineers saw mill, for use on the Estherville and Minim Creek Canal.*

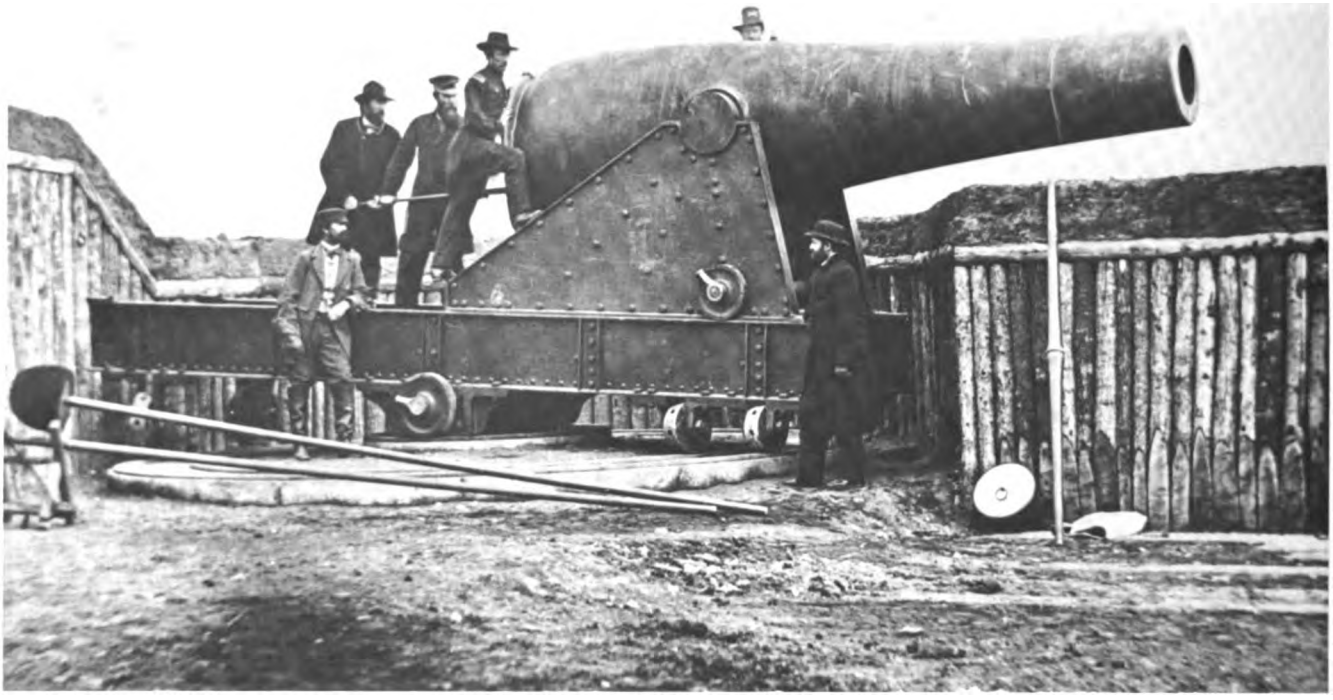
6.

Military Engineering 1865-1914

Post-Civil War thinking about fortifications began with three equally important assumptions. The first derived from the lessons of the war, of which two seemed especially significant. The old masonry forts had not withstood the pounding of rifled guns; earthen works, particularly sandbagged emplacements, gave defending forces better protection. Neither had the presence of forts kept attacking fleets at bay. Only when harbor channels had been fully obstructed and passageways kept under fire from shore batteries had the Union ironclads been turned back.[1] The second assumption was drawn from the fact that weapons technology was evolving so rapidly that it was impossible to design usable forts. The Board of Engineers for Fortifications reported the results of experiments with armor and new methods of construction in 1870 by saying that studies proved the inadequacy of old methods of construction, without indicating the best substitute for them. The board recommended that it would not do to proceed too rapidly; after all, new structures might be "as unfit to resist means of attack of a future year as those works, completed on the highest principles of the art then known in 1859."[2] The third assumption related to the difficulties encountered by the Union armies in conducting siege operations. Stated simply, it was that the theories

Coastal defense in the 1870s. A lone naval cannon looks out from Fort Moultrie.





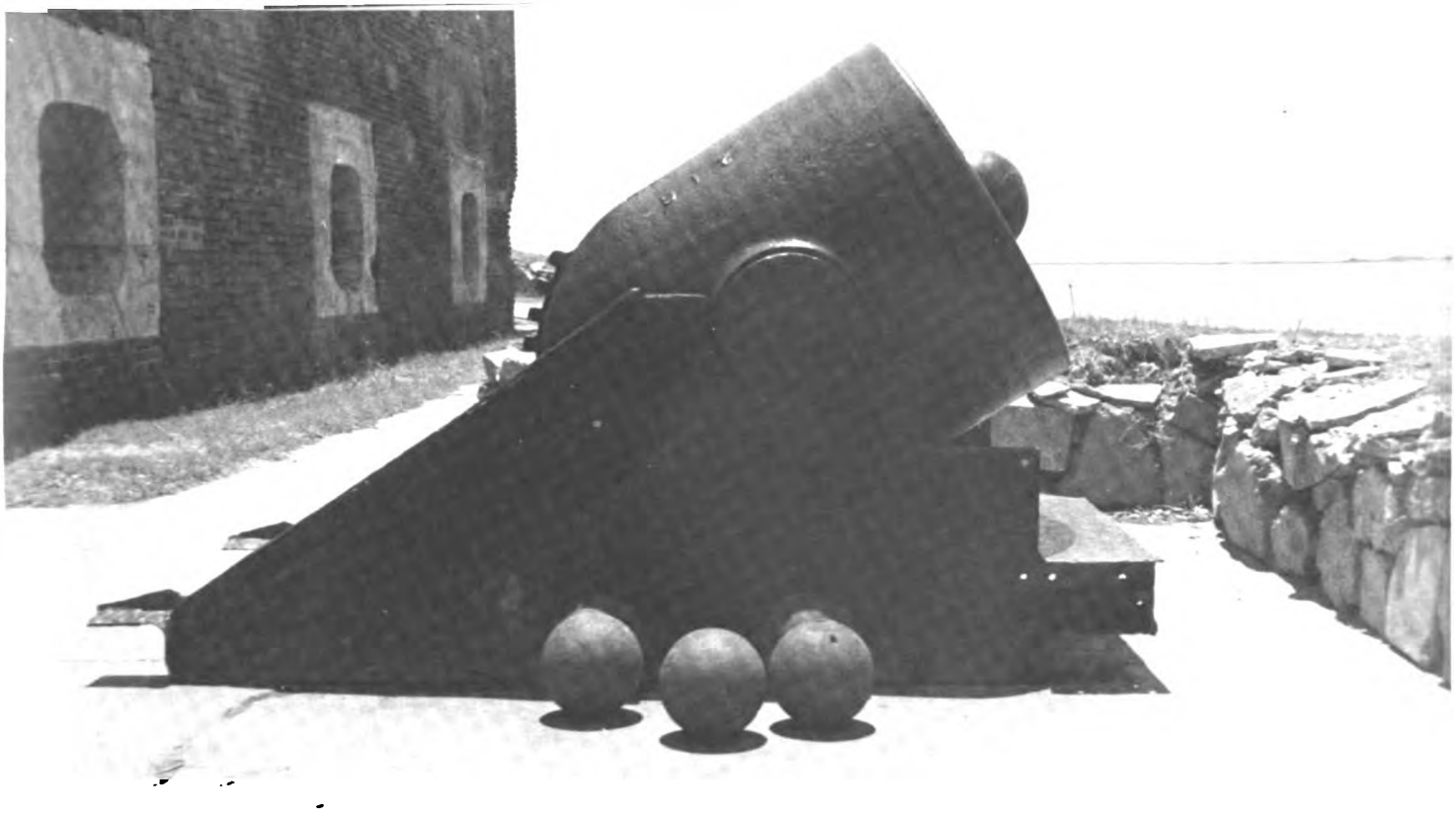
Coastal defense, 1865-1900. The 15-inch Rodman gun, shown here mounted in the defense of Washington, and similar 8-inch and 10-inch weapons were installed in coastal forts ofter 1865. The effective range of this weapon was three to four miles.

advanced by the Fortifications Board since 1816 were sound: a complex of well designed and adequately manned fortifications could hold off an attacking army.[3]

Between 1865 and 1885, the military orientation of the Corps of Engineers was conditioned by these assumptions, as well as a lack of funds for construction, by the need to study mine warfare (the torpedo having been judged the most effective weapon deployed in the protection of harbors), and the old imperative of protecting the seacoast against the future attack of a European seapower. Consequently, during the 1870s, the Army Engineers developed a version of mine warfare technology that could be applied to coastal defense, requested funds to deploy the system they designed, warned of the dangers that would result from neglecting the Army, and, along with other agencies, chiefly the Ordnance Department, worked diligently to persuade Congress to authorize work on a new national fortifications system.[4]

The debate over the advisability of beginning work continued until 1885, when President Grover Cleveland, then in his first months of office, appointed a Board on Fortifications or Other Defenses and instructed it to examine and report where fortifications were required and the character of the defense system which should be adopted. The membership of this board was composed of the Chiefs of the Ordnance and Engineer Branches, experts drawn from each branch and representatives of the Navy Department. The ideas concerning the need for coastal defenses and the types required were essentially those the Corps of Engineers had been advancing. Because Secretary of War William C. Endicott presided over the panel, the study group became known as the Endicott Board.[5] In early 1886, the Endicott Board made a series of sweeping recommendations as to the nature and placement of defenses. For more than three decades, successive administrations hewed to the principles the board proclaimed as they labored to construct a second comprehensive national defense system.

As the Endicott Board envisioned it, the completed defense system would be composed of fortifications (turrets, barbette batteries, and mortar batteries), the capability to deploy mines (submarine mines and the casemates, cable tunnels, and searchlights required to operate the system, and guns for protection), local security (machine guns and earthworks to flank the



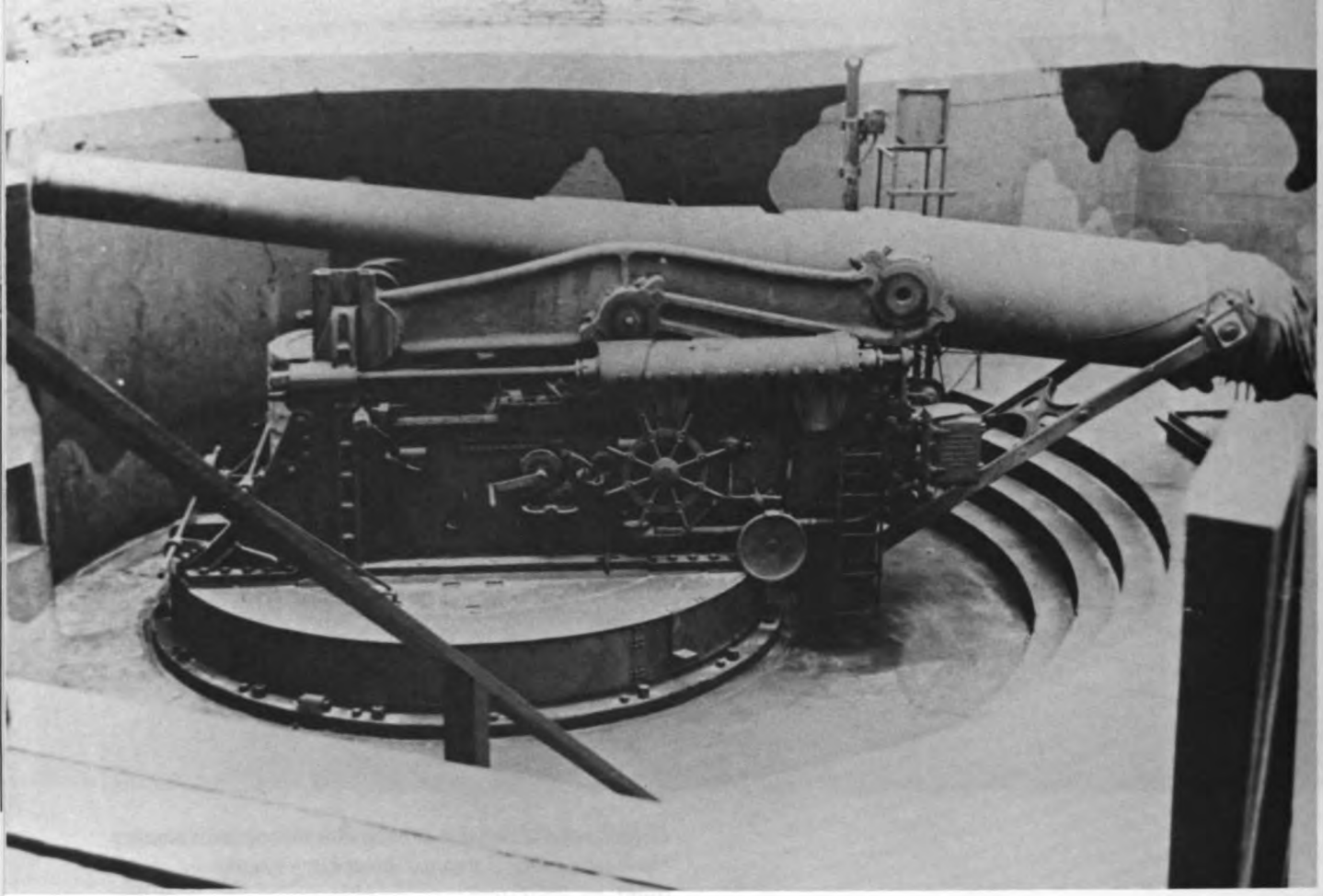
13-inch coastal defense mortar. Hot shot or an exploding shell was lobbed against attacking vessels to strike them at their most vulnerable point, the wooden deck. The appearance of steel warships, as opposed to ironclad vessels, made the weapon obsolete.

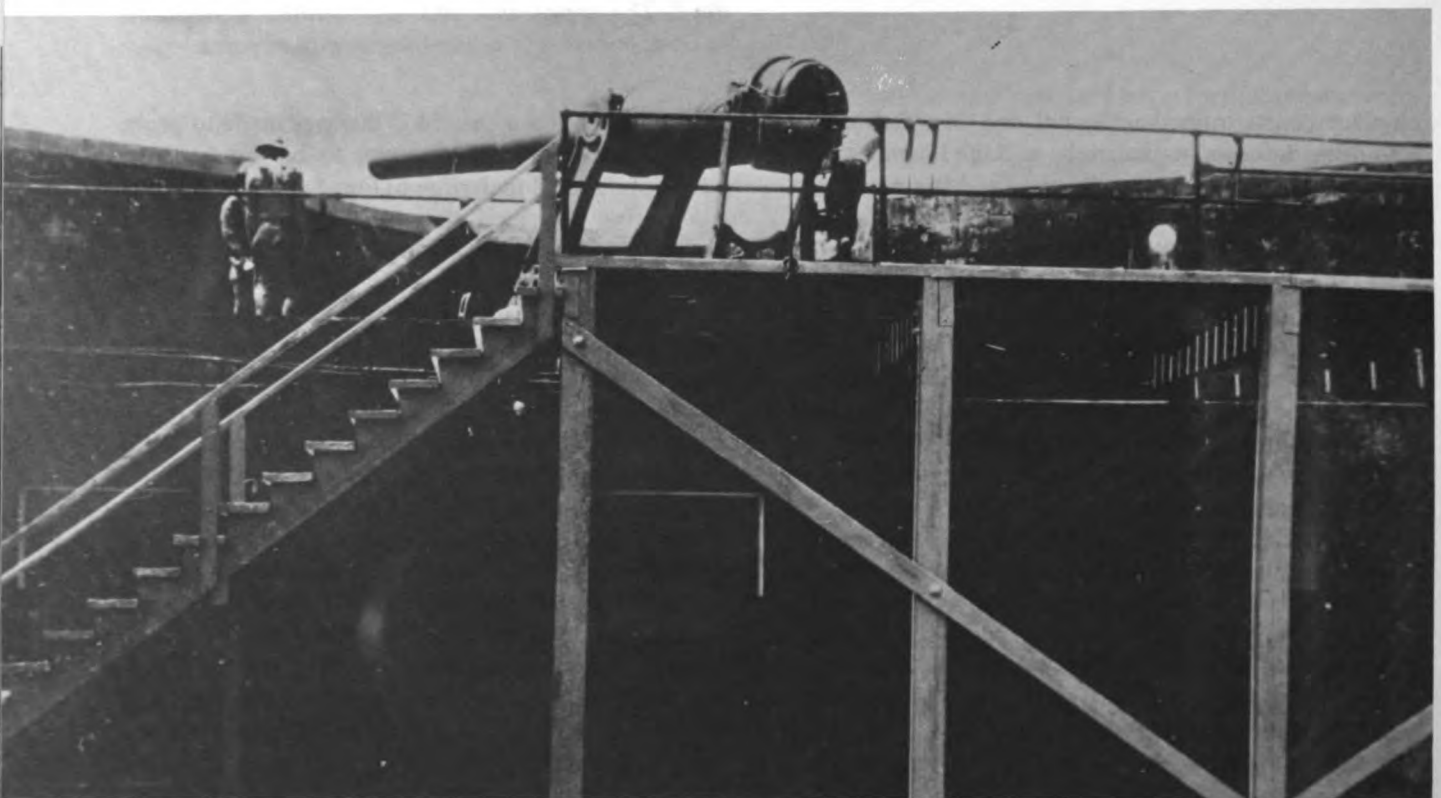
emplacements), trained personnel, and torpedo boats. Requiring defenses immediately, said the board, were New York, San Francisco, Boston, and the ports of the Great Lakes. Charleston ranked 13th in the list of 27 port cities to be provided with fortifications.[6]

In 1891, the Board of Engineers approved Captain Abbott's plan to construct a mine casemate and cable gallery at Fort Sumter. By the time this project was completed in 1893, (at a cost of $13,100), a comprehensive plan for fortifying Charleston Harbor had been prepared. It called for the emplacement of six 12-inch guns mounted on lifts, four 10-inch guns on disappearing carriages, and 16 12-inch mortars. On April 3, 1894, the Secretary of War informed the Governor of South Carolina that the federal government proposed erecting these batteries on Sullivan's Island and requested his aid in the passage of an act by the legislature ceding title and jurisdiction of the batteries to the United States. Title to the sites was secured rapidly, although tentatively, since South Carolina made the grant conditional upon the cooperation of private landowners and provided that disputes between the owners and the government were to be resolved by jury verdict.[7]

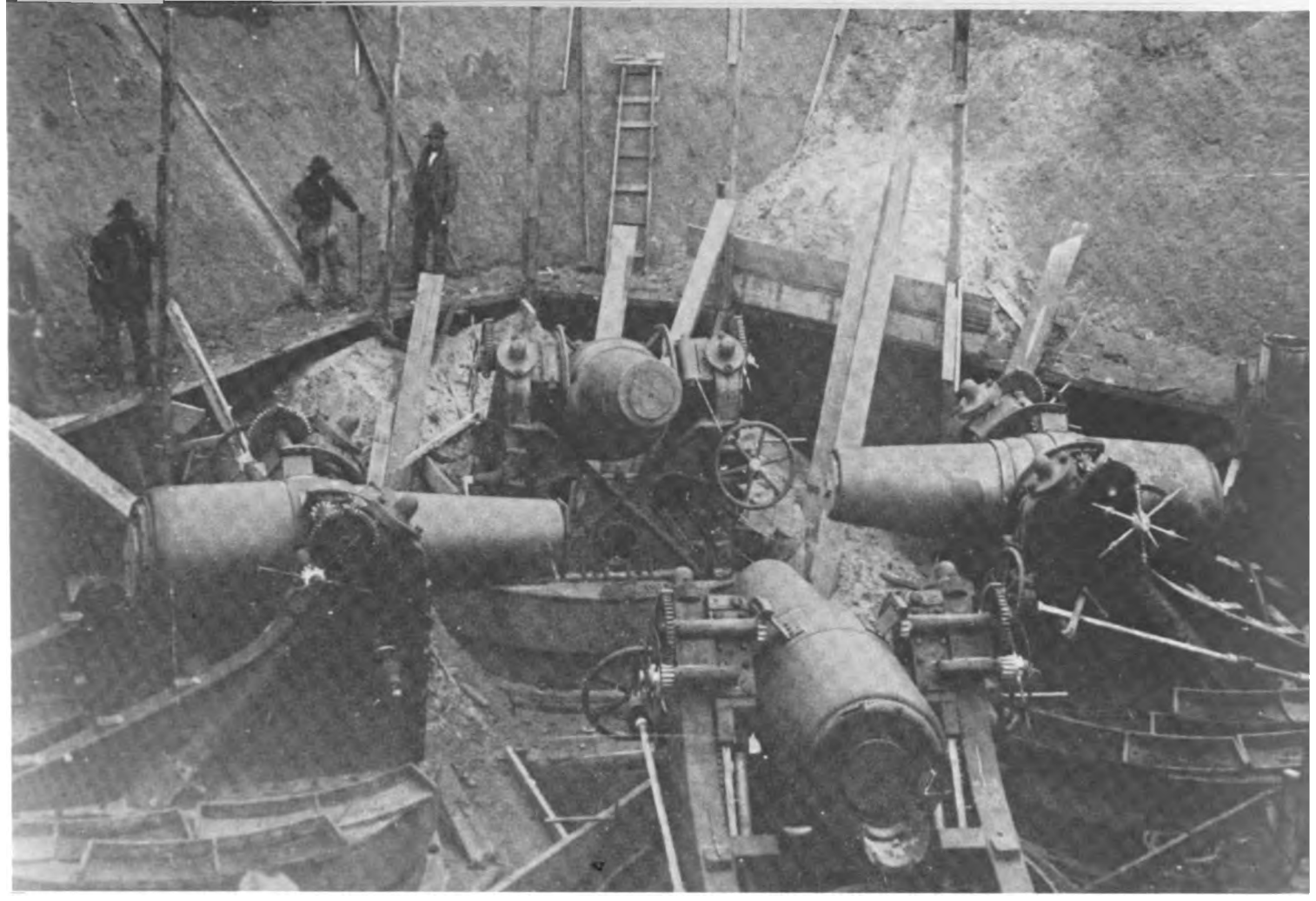
In 1895, an allotment of $75,000 was made to begin construction of the lift battery, to be mounted on piling, of three 12-inch rifles at Fort Sumter; however, test boring indicated the site was not capable of supporting the design. New plans were drafted, the contemplated battery was reduced to two guns, and the emplacement was finally constructed on steel beam grillages floated on the surface soil. Meanwhile, construction funds were transferred to work on the Sullivan's Island mortar battery.[8]

By 1896, Congressional appropriations for the Endicott system had begun to match the magnitude of the nationwide undertaking, and almost $7.4 million was expended in 1897. This sum represented 15 per cent of the War Department's budget and was a considerable increase over the 1889-1896 average construction appropriation of a little over $2.8 million a year. The increase in funding brought with it approval of plans for a battery of 16 mortars and a battery of 10-inch disappearing guns for Charleston. The construction work was a major lowcountry enterprise. Before it could even begin, it was necessary to dredge a canal to handle the 200-ton government lighters at the cove side of Sullivan's Island, build a wharf, construct bins





The 10-inch guns of Battery Jasper were raised only for firing, leaving the gun crews well protected.

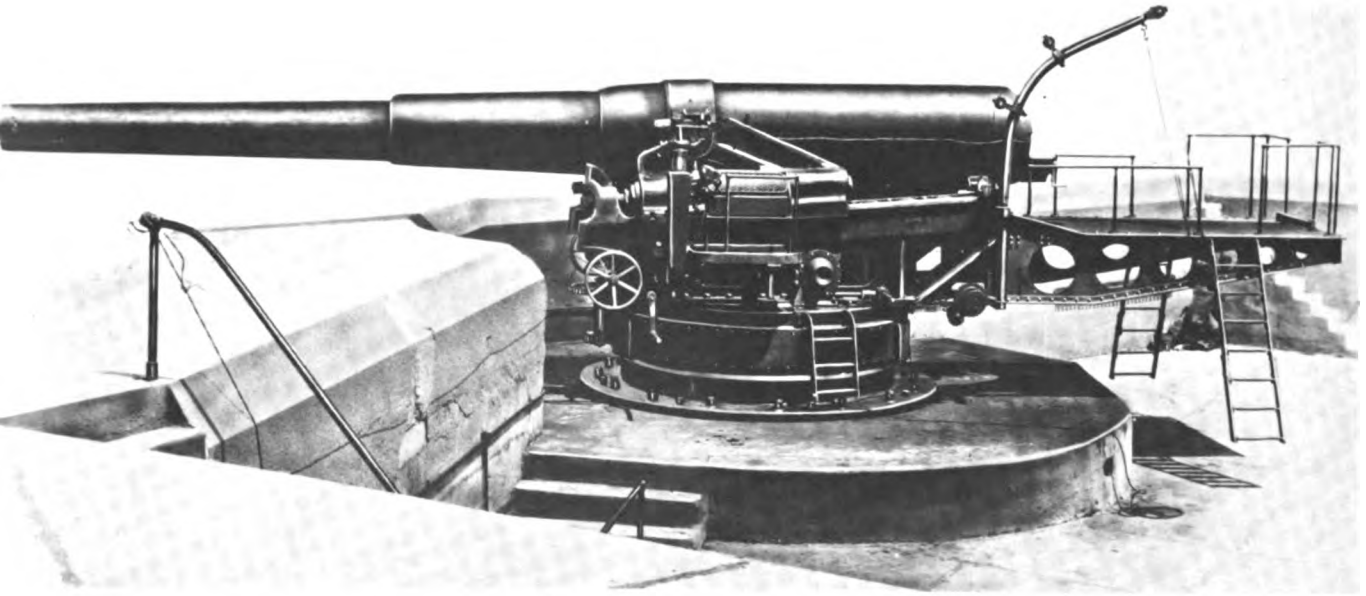


A battery of four 12-inch rifled mortars under construction at Fort Moultrie in 1897. This weapon could hurl a 700-pound projectile up to nine miles. This pit was dug through 13 feet of sand underlaid with 18 feet of soft mud.

capable of holding 1,000 tons of crushed stone, set up a steam derrick near the construction site, secure the right of way for rail lines through Moultrieville and lay the tracks, and attend to hundreds of smaller details. Subcontracts brought concrete from New York, steel I-beams from Pittsburgh, and ironwork from local contractors. The building program involved the use of stone from the quarry at Edgefield and the erection of a cement plant at the building sites.[9]

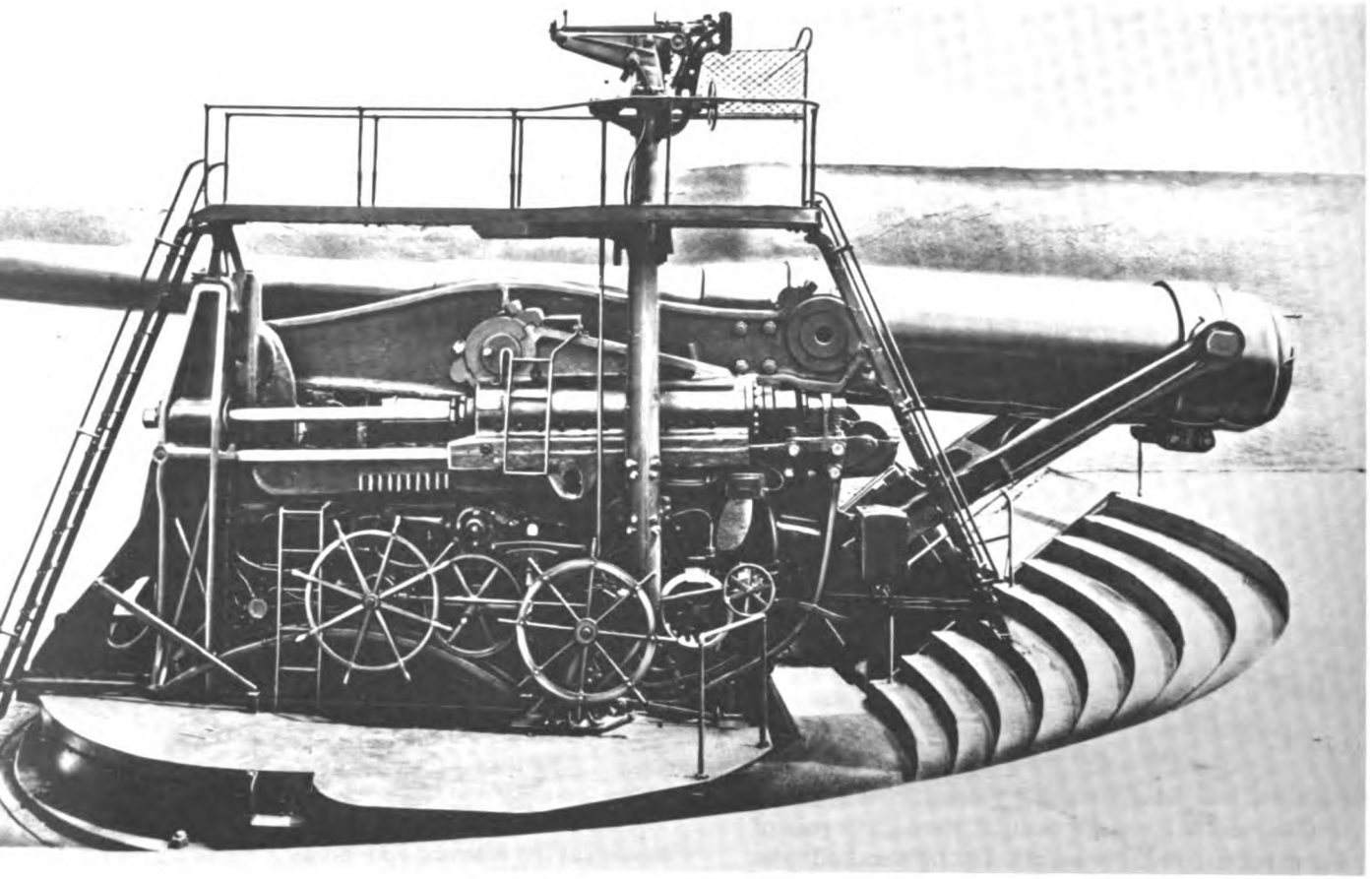
The work brought employment to the depressed Carolina economy. At Edgefield a quarry master ($110 a month), a clerk ($50 a month), 54 mechanics and laborers on the day shift, and a smaller force at night were employed. The wages for workmen ranged from $1.50 per eight-hour day up to $3 a day for a master carpenter. The railroad wharf in Charleston engaged an overseer ($100 a month) and nine laborers. The tugboat which towed the lighters was run by a master ($100 a month) and crew of eight, the highest paid of whom received $35 per month. The lighters had to be poled to the Sullivan's Island Wharf. Four laborers got 50-80 cents a day for this. Large gangs of men were employed at the building sites. An overseer and 40 laborers did concrete work; two skilled white masons and three black assistants were on the plastering gang; an overseer and between 10 and 20 laborers worked on the ordnance gang; a master laborer and seven laborers made up the cleaning crew; a first class master carpenter, three "good" and 40 "poor" carpenters did the carpentry; and a suboverseer and 24 laborers were available for heavy work.

A superintendent was in charge of all this activity. Undoubtedly, he earned the $125-a-month salary he drew, as did the assistant engineer who aided him and who also received $125 a month. Other specialists included a rodman and a receiver of materials ($40 a month), the office force (one clerk, one cement tester, and one laborer), and two night and one day watchmen. The last were required to pump loaded lighters, take hawsers at the wharves, and "do other usual watchman



Drawings of the guns of Battery Huger, Fort Sumter. One gun was mounted on a disappearing carriage, the other **en barbette.**

These 12-inch rifled guns fired a 1,070-pound projectile up to eight miles on a relatively flat trajectory. Gun and carriage cost approximatly $100,000.

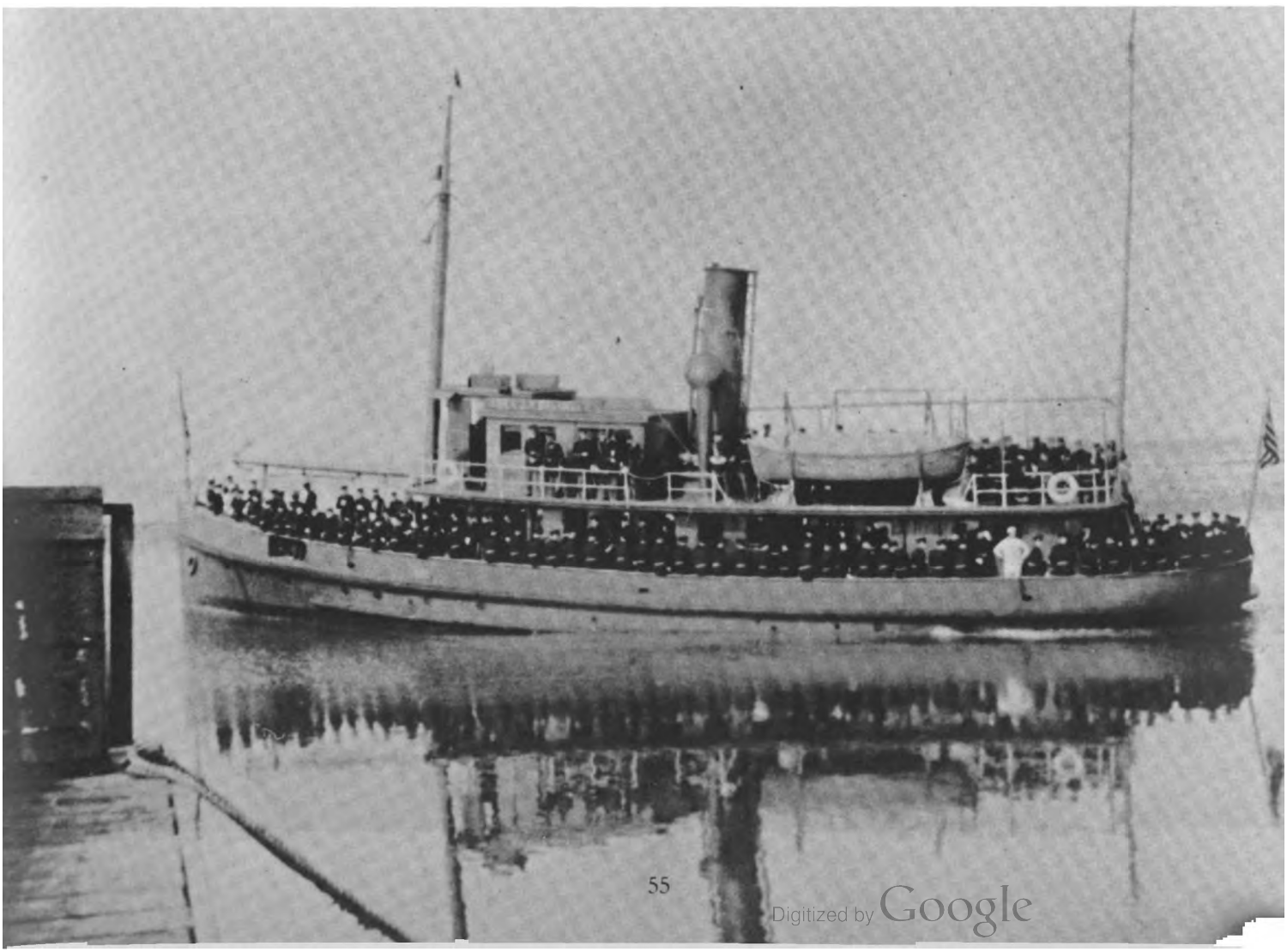


work." The normal workday was eight hours, except for the heavy work crew, which worked longer, and the superintendent and his assistants who put in 12-hour days. Concrete work was done on day and night shifts. The federal authorities were apprehensive about friction between white and black work crews and did not hire black labor. Local contractors knew better and used black workmen. There was no friction. By South Carolina standards of the time, both wages and working conditions were excellent.[10]

Three types of guns were emplaced on Sullivan's Island: long-range rifles to engage capital ships far at sea; shorter-range guns for harbor defense; and mortars. The mortars were designed for the special purpose of hitting an armored vessel in its more vulnerable part, the deck. The rationale for having mortar batteries dated back to the days when hostile fleets had to anchor at sea to steady and aim their guns before bombarding the shore. The turn of the century mortars could drop an exploding shell capable of piercing a steel deck. It was a heavy, short gun, and had to be solidly anchored. Constructing mortar batteries on Sullivan's Island, where there were 13 feet of sand underlaid with 18 feet of soft mud, posed taxing engineering problems, but they were solved, and eight mortars were mounted in 1897, followed by eight more the next year.

The onset of the Spanish-American War hastened work on the coastal fortifications system and rearranged priorities. The Endicott design had taken cognizance only of places important by reason of wealth, population, or stategic location. Fear of hostile attack gave rise to demands from the immediate fortification of a number of points not contemplated in the original national defense scheme. As there were more than 700 towns and villages on the 5,715-mile coast line of the continental United States that could be attacked by ships drawing 10 feet of water or more, it was impossible to defend every point immediately and adequately.

Troops at Fort Moultrie departing for the Mexican border in 1916.

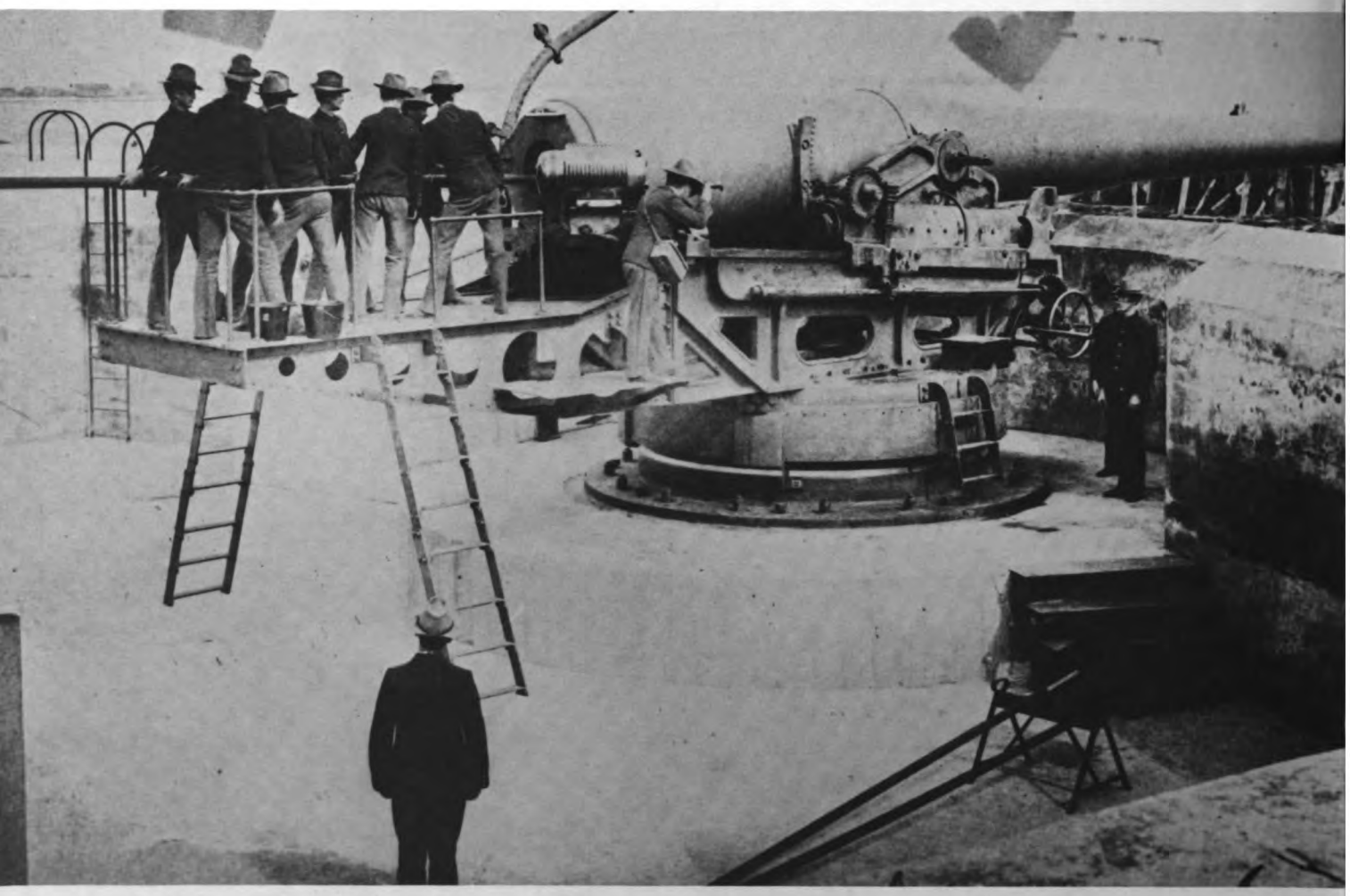


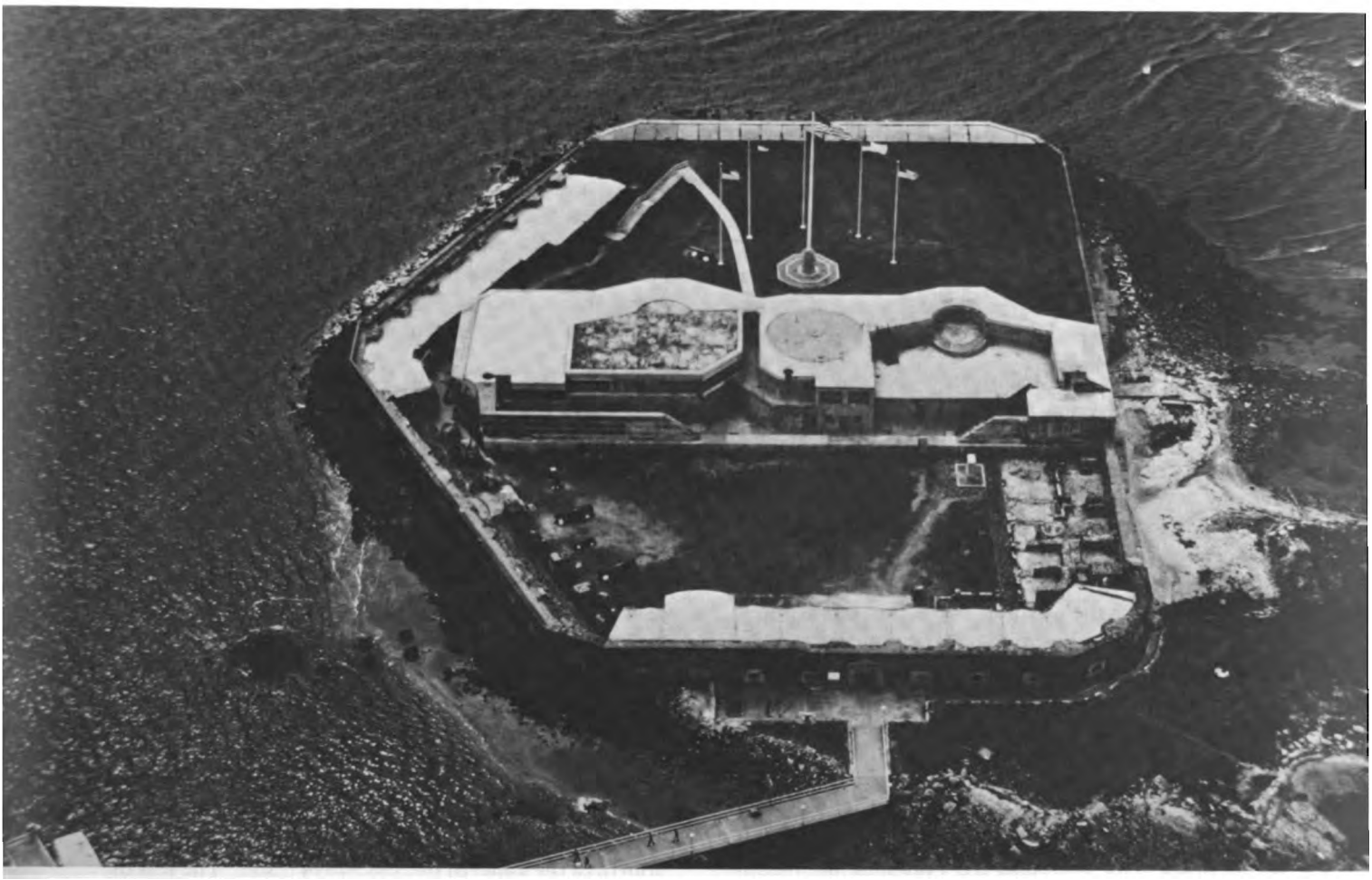
In response to calls for protection, though, the Secretary of War directed the immediate construction of temporary batteries along the shores and, in the absence of any available modern armament, seige guns at a number of exposed localities.[11] Port Royal and Georgetown were included in this program. Two 5-inch guns and two 7-inch siege howitzers were mounted at Georgetown on April 6. The temporary batteries for the howitzers required 6,000 sand bags and the placement of 1,500 cubic yards of sand between the walls. Two more 7-inch howitzers were emplaced later. On May 16, after the sense of emergency passed, this ordnance was shipped to Tampa and four 12-pounder guns were brought in as a replacement. Presumably these were good for morale.[12]

Upon the commencement of fighting, the military engineers placed 36 torpedoes in pattern in Charleston Harbor. The lighthouse schooner *Pharos* was transferred temporarily to the Corps of Engineers, under whose authority it now patrolled the minefield. Arrangements were also made to lay a field at Port Royal Harbor, but no mines were actually planted. The minefield in Charleston Harbor was maintained until the end of the war, when it was removed by exploding the torpedoes or sinking them in deep water.

Charleston Harbor bristled with guns. In March and April, 1898, Corps headquarters directed the mounting of two 4.7-inch rapid-fire guns and one 6-inch rapid-fire gun to protect the minefield. Considerable excavation and blasting were necessary to convert one of the 10-inch gun sites to handle the new ordnance, and the 6-inch gun required a new site. The guns were not mounted until October, but, as a result of modifications in the planned defenses for Charleston Harbor, they were integrated into the permanent harbor defense plan. During the war, work was begun on three structures for 15-pounder rapid-fire guns, and the construction of Battery Jasper with its own 10-inch disappearing guns was accelerated. Three guns were mounted in 1898, and work started on a fourth emplacement. The most powerful ordnance was provided by a battery of two 12-inch rifles laid in at Fort Sumter. The guns, one on a disappearing carriage (the left or northern gun) and one mounted *en barbette*, were in place by 1900.[13]

Gun drill at Battery Huger, about 1901.





Fort Sumter, Charleston Harbor. Now a part of the National Park Service, and a national monument, the fort was rebuilt to hold the 12-inch rifles of the Endicott fortifications system. To save time, the part of the fort in front of the emplacements was filled in with whatever was handy. Many old cannon were buried—and fortunately preserved for later generations. Many of the original pieces can now be seen at the Fort Sumter National Monument reconstruction of Fort Moultrie, which houses a history of coastal fortifications.

The Endicott system was 50 per cent complete at the turn of the century. Twenty-five of the principal harbors of the United States, including Charleston, were now judged to have on hand a sufficient number of heavy guns and mortars to mount an effective defense against attack. In 1905-1906, another fortifications board, presided over by Secretary of War William Howard Taft, extended the Endicott system concept to include defenses for America's recently acquired overseas possessions and recommended modifications in the continental complex, among which was the notation to provide Charleston, "a port of secondary importance," with one more 12-inch gun. That gun was never emplaced.

By 1914, the Chief of Coast Artillery could report to Congress that all of the approved defensive projects for the coasts of the United States and its overseas possessions were completed, except for defenses at Los Angeles and certain batteries in Manila Bay, Hawaii, and the Canal Zone.[14] At an aggregate cost of slightly more than $190 million, the United States had once again secured a complete coastal defense system.[15] Then, as in 1861, the unexpected happended. The Great War broke out in 1914. When America entered in 1917, the military mission was to send overseas an expeditionary force eventually numbering over two million men.

7.

Charleston District and the Lowcountry Economy

The Civil War cost Charleston its position as a major port for the entry and export of foreign goods. In part, the loss was attributable to physical and emotional exhaustion, but other factors were at work.[1] Railway development lagged until 1870, and then was promoted in ways which brought forth an unplanned network of undercapitalized lines controlled by enterpreneurs concerned mostly with quick profits.[2] The small lines in the Carolinas went into bankruptcy in the 1890s, were recognized, and became part of the consolidated rail systems which made their appearance at the turn of the century. Only one of the major railroads, the Atlantic Coast Line, touched Charleston, and its main business consisted in handling the north-south traffic from Richmond to Jacksonville. The Southern Railroad had its overseas terminals, wharves, docks, and warehouse facilities at Norfolk, and directed traffic there. The Seaboard Air Line handled traffic from Richmond to Jacksonville via Cheraw, Camden, and Columbia.[3] The effects of the reorganization of the interior transportation system were devastating to Charleston.

Cotton production dominated the economy, and as cotton went, so went the Carolina lowcountry. Cotton first declined in price, from highs of 36 cents to 38 cents a pound in 1865 and 32 cents a pound in 1869-1870, to lows of 10 cents a pound in 1882, and 6¾ cents in 1892. Charleston factories suffered from overstocked warehouses and reduced opportunities for profit.[4] The flow of cotton to Charleston then slackened as a greater proportion of the crop was worked in the mills springing up in the interior of the state. Upcountry consumption increased from 5.5 percent of the cotton crop in 1874-1875 to 63.4 percent in 1902-1903.[5] Finally, the cloth and yarn produced in the interior began to find its way out of South Carolina by rail rather that the Charleston port. During the year ended June 30, 1910, 59.4 million pounds of cotton piece goods moved from upcountry mills through Charleston and 81.7 million pounds through Pinner's Point, Virginia. The Norfolk area received 57.9 percent of the trade and Charleston 42.1 per cent.[6]

For a time, the postwar economic recovery obscured any potential dangers to Charleston's economy. By 1874, Charleston's export trade reached prewar levels of $17 to $20 million, and the volume held relatively steady for a decade. The revival of commerce inspired confidence.[7] In 1893, though, there was a nationwide financial panic, and a depression followed. The combined impact of depression and economic change burst upon the lowcountry. The dollar volume of traffic through Charleston Harbor plummeted. The value of foreign and domestic commerce declined from $98.5 million in 1890-1891, to $29.5 million in 1901.[8] The value of the exports of domestic merchandise dropped from $19.6 million in 1880, to $661,285 in 1906. From an average of 2¼ per cent of the total U.S. export trade, Charleston's share was reduced to an average of one-half per cent. The export trade from the city for the decade 1900-1909 was less than a fourth of the value of the 1885-1894 trade.[9] The loss of commerce was accompanied by a fall in the actual taxable value of Charleston real estate from $25 million in 1895 to $19 million in 1904. There were numerous attempts to stem the tide of economic disintegration, but nothing seemed to work. New sources of income were needed.[10]

Among the opportunities that presented themselves, three were directly traceable to Corps of Engineers projects. The fortifications program for Charleston Harbor carried out under direction of the lowcountry engineers between 1892 and 1914 pumped approximately $4 million into the lowcountry economy. The harbor improvement project, which achieved a low water depth of 23 feet over the bar in 1895, allowed the admission of larger vessels and quickly resulted in an increase in foreign imports. From an 1878 low of $134,564, approximately .03 per cent of the value of imports into the United States, traffic rose to $5.2 million in 1910, about a third of one percent of all imports.[11] Most importantly, the modified harbor project made Charleston a desirable location for a naval base.

During the War of 1812, a naval station had been established near Charleston Harbor, and after the cessation of hostilities it continued to operate. It was

not a large station, however, and the Navy finally closed it.[12] The first major naval facility arrived in South Carolina during the Civil War when the federal forces established themselves at Port Royal Harbor. The harbor was abandoned after the war, but returned to federal service in the 1890s after a mixed military and naval commission, searching for a site for a naval drydock and station on the Atlantic Coast south of Cape Hatteras in 1889, decided to locate at Parris Island. At the time, the Charleston port was not open to vessels drawing over 17 feet of water, a category which included all the major vessels of the new American navy.

The drydock was constructed at Port Royal Station in 1894-1895 at a cost of $449,437.09. The location did not satisfy the Navy. There were no rail connections from Port Royal to the interior and the roads were poor. During the hurricane of 1893, the entire station was inundated. The battleship *Indiana* grounded in the river in 1896 while swinging at anchor waiting to enter the drydock. As complaints about the difficulty of getting work done properly increased and repair costs mounted, the Navy Department began withholding funds appropriated for the repair and expansion of Port Royal's facilities and indicated clearly that it was awaiting the right moment to abandon the site.

Meanwhile, work on the Charleston jetties was completed and a 23-foot channel was secured. In 1898, $150,000 was appropriated for construction of the new dredge which the Engineer Department felt was necessary to widen and complete the 26-foot channel, but the funds were insufficient to build the proper machine. It appeared that the new project would be delayed. At this juncture, Mayor J. Adger Smyth, concerned over Charleston's declining economy, went to Washington and called upon Senator Benjamin J. Tillman, a member of the Senate Naval Affairs Committee. Smyth delivered a simple message: Charleston had a magnificent harbor. The Navy was getting ready to pull out of Port Royal. When it did, the facility ought to stay in South Carolina. Shortly afterwards, at a meeting including representatives of The House Naval Affairs Committee and Admiral Mordecai T. Endicott, Chief of the Bureau of Yards and Docks, Tillman began pointing out the difficulties he had in getting the Navy Department to spend the monies appropriated by Congress for the development of Port Royal. His listeners said flatly that Port Royal could not be developed further. Endicott asked if Tillman had seen the reports on Charleston Harbor. Before the meeting ended, Tillman had been assured of the support of both the House committee and the Navy Department for shifting the naval yard to Charleston. Instead of fighting for a pittance for Port Royal, Tillman now had the opportunity to try for large appropriations for Charleston. Almost immediately, arrangements were made to insert into a pending appropriations bill a clause allowing the Secretary of the Navy the discretion of using $150,000 earmarked for construction at Port Royal to make a survey to determine the feasibility of moving the facility to Charleston. On May 7, 1900, Endicott sent a letter to the Secretary of the Navy calling his attention to Port Royal's deficiencies and suggesting that the Secretary appoint a board to examine the situation and advise the Navy. A board quickly assembled, made its survey, and on January 10, 1901, presented to the Secretary of the Navy a report recommending the construction of a new navy yard at a site on the west bank of the Cooper River, about six miles above the Charleston Customs House.[13]

The Corps of Engineers began to formulate plans for enlarging the entrance channel to the harbor and completing the dredging authorized in 1899. A 28-foot harbor project was designed and authorized in 1904, and this was followed by the authorization for dredging a 30-foot channel. Charleston Harbor, now improved and modern, was also surveyed as a possible harbor of refuge.[14]

The lowcountry Congressional delegation shepherded the navy yard through several dangerous political situations.[15] Also, Charlestonians lost no chance to promote the new facility. One opportunity was presented in 1905, when the Coast Defense Squadron for the Fleet was temporarily based in Charleston. The assemblage of the battleship *Texas*, three monitors, and nine torpedo boats brought into port 2,000 men who had to be fed. The contracts were all won by Charleston bidders, who supplied 130,000 pounds of meat, 130,000 pounds of fresh vegetables, 4,000 pounds of sauerkraut, 100,000 pounds of bread, 3,000 pounds of cheese, and 12,000 pounds of fresh creamery butter. It was estimated that the squadron added at least $250,000 to the trade of the city during its stay of five months. In a departing speech, Admiral Francis W. Dickins praised Charleston, said he would continue to recommend the improvement of the naval station, and indicated that a shipbuilding plant would come in the future.[16]

By 1906, the federal government had invested $2 million in the Charleston Navy Yard and Tillman managed to have a warship permanently stationed in the port. A drydock costing $7.2 million was finished in March, 1907. That some degree of permanence had been achieved was attested to by William Howard Taft in a speech delivered in Charleston, January, 1907, in which the Secretary of War related the strategic location of the port and Navy Yard to defense of the Panama Canal. By 1910, the Navy Yard was furnishing the city with a payroll of over $500,000 annually.

Despite the building program, it was still more difficult for South Carolina to get the Navy Department

to spend money in Charleston than it was to get authorization through Congress. The triumph of the Democrats in the election of 1912 boosted things along. Tillman was advanced to the chairmanship of the Senate Naval Affairs Committee, and a Southerner, Josephus Daniels, became Secretary of the Navy. One of the first acts of Woodrow Wilson's new administration was to approve $300,000 for construction of a new torpedo basin at the Charleston base. Additionally, in 1918, after years of failure in pushing for new appropriations. Tillman finally secured $1,650,000 for the Charleston Navy Yard.[17]

Eight of the 11 battleships of the Atlantic fleet are visible in this photograph of the visit in November, 1912. The entire city took a general holiday to welcome the Navy.

Part III

1914 - 1978: The Modern Era

8.

Since 1914: Civil Engineering

Town Creek is a short channel often mistaken for part of the Cooper River. In the spring of 1929, it was being deepened. Chief Engineer Henry L. Rivers was in charge of the work. On May 10, a dredge struck a wreck. Investigations led to 81-year-old John Moisson, who remembered seeing Confederate forces blowing up their ironclad gunboats. The wreck was removed with dynamite and a clam shell bucket dredge, and identified as the three-masted schooner *Indian Chief,* a training ship of the Confederate navy. The dredge struck a second wreck on May 24. It was removed and identified as part of the *Palmetto State.* On August 1, a tanker hit a third wreck and was turned completely around. This obstruction was part of the remains of the *Chicora.* Further investigations turned up other remembrances of the Civil War: the receiving ship *Eagle,* sunk at the foot of Charleston's Tradd Street, and the blockade runner *Stonewall Jackson.* All had been dismantled and scuttled as Sherman's army moved up from Savannah. In the Carolina lowcountry, even the most prosaic engineering operations had a rich military flavor and heritage.[1]

The project dredging which led to the discoveries of the Confederate wrecks was typical of the works of the Charleston District engineers between the wars. Through World War I, inland navigation between the Cape Fear River in North Carolina and the St. Johns River in Florida followed natural waterways: the series of creeks, rivers, sounds, and bays that formed a partially sheltered passage behind the chain of islands lying between the mainland and the open sea. The waterways are tidal, and except in the Winyah Bay area are little affected by freshwater flow. Most of the route is made up of waterways flowing through the low marshlands lying between the coastal islands and the mainland.

The section between Charleston and Savannah, where channels originally were obstructed by a number of narrow, crooked passages and shallow reaches, particularly at points where the tides meet, had been straightened by artificial cuts and deepened by dredging in a series of local projects. Distances had been shortened, a more protected route had been made available, and by 1913, a continuous channel at least 6 feet deep at low water had come into existence. Between Charleston and Winyah Bay, a series of local projects had improved navigation and a comprehensive project authorizing construction of a channel 4 feet deep and 60 feet wide had been completed. The part above Georgetown was different. From there to Little River, North Carolina, there are no inlets or marshes. The land rises directly from the sea to a plain with a general elevation between 25 and 50 feet above sea level. The terrain is undulating, the upland is forested with pine, and the territory includes flat areas, numerous depressions, and poorly drained, often thickly wooded swamps. No connecting waterways had been constructed in the stretch from the Cape Fear River to the Waccamaw River. In the Carolina lowcountry in the 1920s, there were only the rudiments of a coherent system of intracoastal waterways.[2]

By 1932, projects for improvement of the intracoastal waterway had been adopted to provide for a channel 8 feet deep and 75 feet wide from Southport, North Carolina, at the mouth of the Cape Fear River, to Georgetown on Winyah Bay, a distance of 95.2 miles; a channel 10 feet deep and 90 feet wide to Charleston Harbor, 63.8 miles away; and from there to Savannah, a channel 7 feet deep and 75 feet wide, a further distance of 120 miles. Under the original conditions of these projects, it was up to local interests, the counties or states, to construct and maintain all bridges over the waterway; furnish, free of cost to the federal government, rights of way of sufficient width for the canal prism; and provide spoil disposal areas.[3]

The first of these projects cast an unfair burden upon Horry County, in northeastern South Carolina, and the state. Here the intracoastal waterway would be of limited benefit as a means of drainage. Adequate highways served the locality and the waterway was no longer as important as a means of local transportation. Prospective commerce on the waterway would be through traffic, of limited benefit to the residents. In addition, Horry County was poor, too poor to be assessed the costs of bridging the new waterway where

Bridges over the intracoastal waterway constructed by the Charleston District and turned over to the state of South Carolina for maintenance. The two swing bridges are electrically operated. The combination railway and highway bridge is a rolling bascule type. Construction took place in 1935-1936.

The dredges **Tampa** *and* **Margate** *dredging in the intracoastal waterway section in back of Myrtle Beach, South Carolina in 1935.*

necessary. Given these conditions, and the fact that federal authority had absorbed the costs of some bridges constructed north of the Cape Fear, the project was modified to adopt the recommendations of Charleston District Engineer Gilbert Van B. Wilkes that the United States construct two highway bridges and a combined highway and railroad bridge and that, afterwards, local interests maintain them.[4] The modification cleared the way for the Charleston District to begin work. The intracoastal waterway projects were again modified in the Rivers and Harbors Act of August 26, 1937, which authorized a channel 12 feet deep and 90 feet wide.

Construction presented some problems. Huge cypress stumps had to be removed by blasting. In some parts of the work, the most efficient dredging technique was to float the dredge into a section, build a small dam to raise the water level, and then pump the spoil material out. When sufficient depth was secured, the dredge was moved forward and the process repeated. The lowcountry engineers literally inched their way along the coast. Two highway bridges of the swing draw type and a combined railway and highway bridge of the bascule type were completed in 1936. The South Carolina portion of the intracoastal waterway, measuring approximately 235 miles, was finished in 1940.

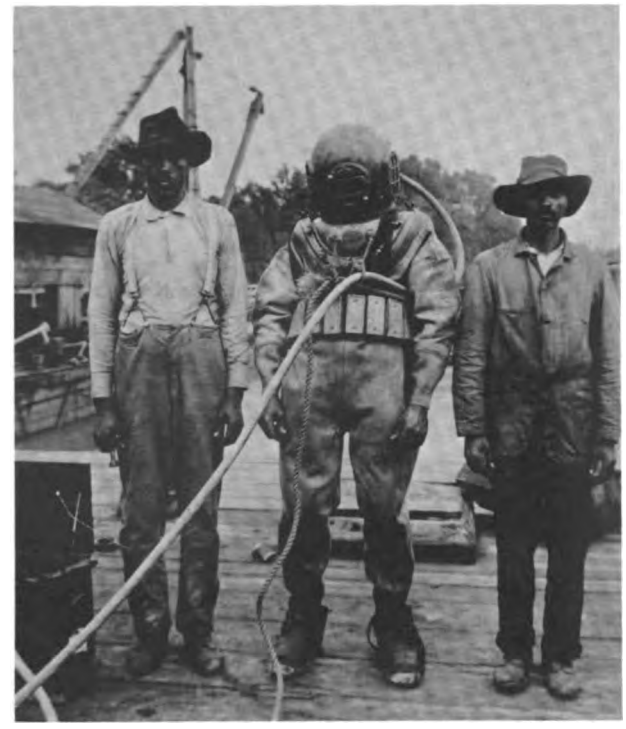
In contrast to the increasing importance of the intracoastal waterway system, river navigation in the state declined. The reasons why this occurred can be seen from a cursory investigation of developments pertaining to commerce on the Congaree River, where conditions typified the problems which had to be faced. The Congaree, one of the rivers which make up the Santee River basin, is formed by the junction of the Saluda and Broad rivers at Columbia and flows sinuously about 51 miles southeast until it joins with the Wateree River to form the Santee. The course of the Congaree is tortuous. The average width of the river is about 350 feet and it is wider in the lower than in the upper section. The banks are composed of sand for about a quarter of the Congaree's length and marl in the remaining portion. Prior to the adoption of federal projects, the stream had a low water depth of 3 to 4 feet to the railroad bridge at Columbia. Navigation was blocked by the bridge, logs, snags, and overhanging trees.[6] An engineer project to clear the river for 4-foot navigation for the lower 49 miles of the river and to clear a channel 100 feet wide through the shoals above that point was adopted in 1888. A lock and dam were constructed at a point two miles below a principal Columbia street. The work was completed in 1904, but the dam was destroyed by flood in 1908 and had to be rebuilt.

Dredging and snagging at last made the river navigable.

The project, paid for entirely by federal funds, was designed to induce competition to force the railroads to lower their freight rates. During the period 1913-1915, commerce on the river averaged about 4,770 tons a year. The average value of produce was slightly more than $600,000, but the main object was not achieved.[7] Commerce on the river fell rather than rose as railroads became more efficient. World War I brought coastal shipping to a halt, forcing many river lines out of business. The appearance of larger trucks and the construction of modern highways led to a further decline in river navigation.[8]

The transportation revolution also changed the composition of waterborne commerce. In the coastal, continguous, general cargo trade, and on the rivers, this commerce was adversely affected by high labor costs and competition from motor carriers and railroads. Consequently, the principal water carriers shifted to hauling bulk commodities, mainly petroleum products. The development of waterborne commerce as a low-cost transportation mode was reflected by an increase in the tonnage of low-valued bulk goods on the rivers and inland waterways in the Charleston District.[9]

Further inhibiting any growth in river commerce was the construction of reservoir projects with large storage capacities. These influenced the flow of all rivers which were no longer deep enough to support navigation. On the Congaree, in 1942, for five days a week there were 5 feet of water below the lock. During the other two days, as the hydroelectric companies reduced their output, the river depth was less than 2 feet.[10]



Diver working on the reconstruction of the Congaree River, a lock and dam project authorized in 1888 to improve navigability of the river.

The major flood control project of the Charleston District was the construction of the W. Kerr Scott Dam and Reservoir.

The Yadkin River rises in the Blue Ridge Mountains of North Carolina and Virginia, flows southeast about 15 miles, turns 90 degrees and flows northeast 85 miles, then turns abruptly southeast again. The length of the river from its source to its confluence with the Uwharrie to form the Pee Dee River is about 200 miles. Between its great bends, the Yadkin parallels the Blue Ridge. Several tributaries arising on the Atlantic-facing slope of the Blue Ridge flow southward and empty into the Yadkin at right angles to form a trellis-like pattern. The channel capacity of the Yadkin is small. The flood plain frequently overflows. Until the 20th century, this natural activity did not interfere with the works of man. After 1900, man and nature began interfering with each other.

Around 1891, the railroad joined Winston-Salem to Wilkesboro. The transportation system was a source of economic development and industry, which had previously been absent from Wilkes County, located in the flood plain of the Yadkin. Residences were constructed. When the the floods came, as they naturally continued to do, devastation was the result. A disastrous flood occurred in 1916.[11]

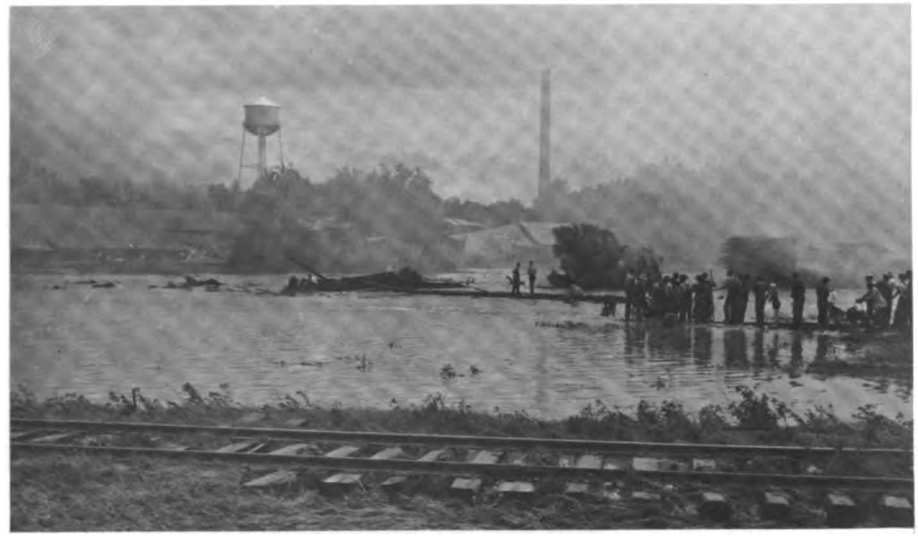
The Yadkin flooding and property loss was one of many similar instances of a problem now receiving national attention. Throughout history, when floods came, men endured them because they had little choice. Twentieth century technological and engineering advances, however, made the concept of flood control feasible. In 1907, President Theodore Roosevelt created the Inland Waterways Commission and directed it to develop comprehensive plans for water resource development. A bureaucratic struggle over the proper manner of going about the business of flood control ensued. The debate was rudely interrupted by the severe flooding in the Ohio River basin in 1913, and the extreme ravages in the valley of the Miami River. The loss of life and property in the "Dayton Flood," as it came to be known, and the pioneering flood control project in the Miami Conservancy District, led, in time, to a recommendation that Congress authorize detailed studies. In 1925, the Corps of

1916 flood in the Charleston District.

Engineers and the Federal Power Commission were directed to submit cost estimates for surveys of practically every major river basin in the United States in order to develop comprehensive plans for navigation improvement, hydroelectric power generation, irrigation, and flood control. The cost estimates were authorized in 1927. The Corps of Engineers then proceeded to make an evaluation of the potential water resources of practically the entire United States.[12]

In the Flood Control Act of June 22, 1936, Congress established as general policies that flood control throughout the United States is a proper activity of the federal government and that in cooperation with state and local communities the federal government should improve or participate in the improvement of navigable waters or their tributaries for flood control purposes if such projects are economically justified or if the lives and well-being of people are adversely affected by the floods. As elaborated in later legislation, the policies came to include specific features. The dam and reservoir projects authorized are constructed at federal expense and maintained by the Corps of Engineers. States or local communities provide access routes and rights-of-way and maintain them thereafter. The federal government is exempt from any liability. State interests and rights in determining the development of the watersheds are recognized. Under laws enacted in 1944 and 1946, the Corps of Engineers is authorized to construct, maintain, and operate public park and recreational facilities in reservoir areas, and otherwise facilitate public use of the reservoirs for recreational purposes.[13]

In 1936, the Charleston District was directed to survey the Yadkin River and report on a project for developing a dam at Wilkesboro, a project recommended as a result of the surveys, initiated in 1929, of the upper reaches of the river.[14] The district complied. On August 13 and 14, 1940, a great flood, resulting largely from sudden and extended hurricane-related cloudbursts along the crest of the Blue Ridge, sent roaring waters down the tributaries and the Yadkin. The entire watershed, with the exception of a narrow valley between the Blue Ridge and Brushy Mountain ranges, is a system of ravine-like slopes which produce a rapid runoff. In the upper reaches of the river, the tributaries flow through steep valleys that have little or no flood plains. In some places, the stream gradients exceed 500 feet to the mile.[15] In many areas, the forest cover which would have retarded the runoff of rainwaters had been cut over, and the headwaters of the streams were no longer protected. When the cloudbursts came, huge landslides started near the tops of ridges and descended into the hollows and valleys below. Dirt, trees, and large boulders went downstream. At least 150 homes were washed away, and seven people died. Fires, resulting from the undermining of electric transformers by flood waters, contributed to property losses conservatively estimated



1940 Yadkin River flood. Scenes from Elkin-Jonesville and the flood plain.

W. Kerr Scott Dam and Reservoir. This sequence of photographs follows the construction from site preparation to completion.

at $5 million. Damage to track trestles and bridges cut off train service. The possibility of further flooding discouraged manufacturers from restoring their damaged property. In the aftermath, local residents requested the assistance of the federal government.[16]

A plan was drawn up, and in 1944 the Chief of Engineers recommended a comprehensive development for the area consisting of an initial project of a dual-purpose dam for flood control and the generation of hydroelectric power. Amid a climate of intense opposition to flooding farm land, Congress, in 1945, requested a review of the report to determine the practicability of a strictly flood control operation in the upper waters of the Yadkin River. In June 1945, the Yadkin flooded again. By the time public hearings were held on the revised concept in October, there was no disagreement on the proposition that a flood control project was needed.[18]

There were substantial disagreements on what the flood control project should be, however. The alternatives, in brief, were to construct a single dam for flood control, achieve flood control by the construction of two dams, construct dams on the tributary streams, build levees to contain flood waters, or expand the project into a comprehensive plan of flood protection. After evaluating five alternatives and surveying over 30 potential dam sites, the lowcountry engineers concluded that the system for flood control which best balanced costs and benefits involved building dams at two sites on the Yadkin River and two sites on the Reddies River. Costs for the project were estimated at $7.2 million with $308,600 in annual charges. The ratio of benefits to costs made the project attractive, and since the modified plan reduced the overall costs estimated for the previously recommended dual-purpose dam from $102.2 million to $98.2 million (a result of eliminating power-generating facilities), it seemed the most feasible to the district.[19]

Residents of the areas to be flooded or otherwise affected by the construction of the large reservoirs saw the problem differently. Their preferred alternative was to control the flow of the Yadkin by means of detention dams on the tributaries and the Yadkin to prevent permanent inundation of populated areas. The concept was expressed in a resolution read at a public hearing by speakers for the Yadkin Valley Citizens' Association, and was unanimously supported by the audience of approximately 150-175 people.[20] The citizens group drew upon the widespread antipathy toward the flooding of valuable crop land which already had resulted in the scuttling of the dual-purpose project. The issue could be compromised only so far; either one built large storage reservoirs or one did not. A course had to be selected, and the lowcountry engineers wanted to former. The Corps of Engineers evaluation was based on a consideration of costs and benefits, as these categories were defined and interpreted in 1945, that showed the plan for an expanded project promised a favorable cost ratio for the construction of the first large reservoir. A quarter of a century later, when discussions of the ratio of costs to benefits were modified to include calculations reflecting intangible environmental values, different decisions regarding the buildng of a second dam would be reached.

The Flood Control Act of July 24, 1946, provided for the construction of four detention reservoirs as recommended by the Charleston District.[21] North Carolina Senator W. Kerr Scott succeeded in getting Senate approval for the project, but the House of Representatives refused to concur. On June 14, 1947, the Yadkin flooded, causing $500,000 in damage. Still, the controversy over building the dam continued. The project was modified. On April 5, 1957, the Yadkin flooded again, adding impetus to the movement for flood control. A delegation of Wilkes County citizens appeared before a congressional committee on May 7, 1957, and urged construction.[22]

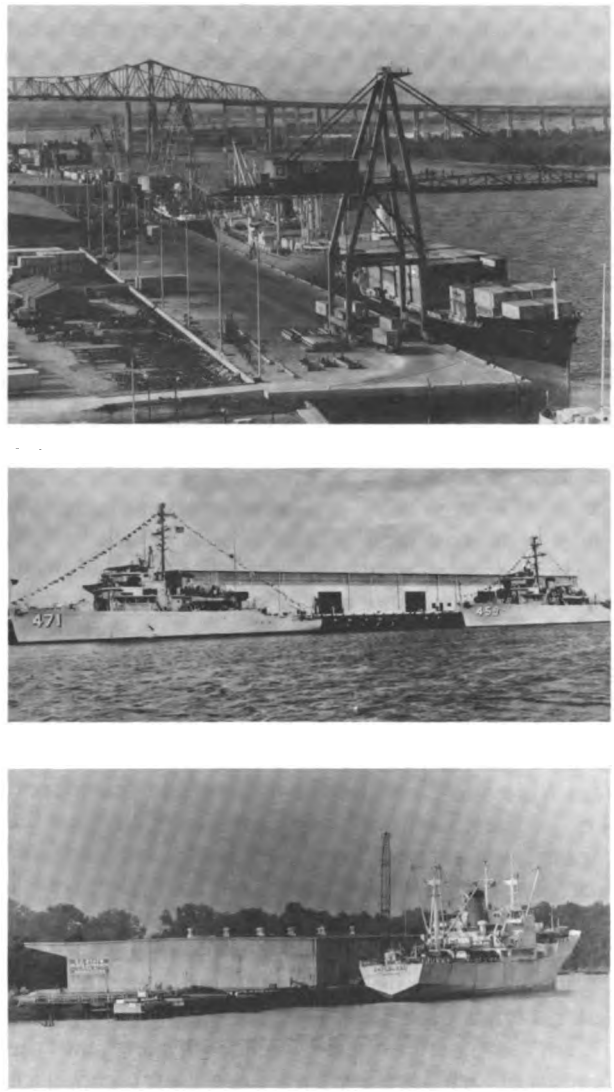
By 1958, much of the local opposition to the project had died away. The North Carolina congressional delegation made a determined effort to get funds for the project, now modified to substitute one reservoir for the two authorized for the Wilkesboro site and one for the two authorized on the Reddies River. The final design also incorporated a plan to provide storage capacity in excess of flood control requirements; some 33,000 acre-feet were allocated to the purpose of water supply for Wilkes County and the city of Winston-Salem. Initial funds were appropriated in October, 1959. Land acquisitions began immediately. Highway relocation began in August, 1960, and construction of the dam and outlet works the following month. By August, 1962, the project was completed for water storage and flood control operations. The finished structure, a rolled earthfill dam 1,740 feet long with a crest 148 feet above the streambed, had a gross capacity of 153,000 acre-feet of water. A 12-foot-3-inch concrete conduit extended through the base of the dam from a gated intake structure upstream to a concrete stilling basin downstream. The gate structure contained two service gates and one emergency gate. The total cost of the project was $9.2 million, of which local interests were obligated to pay $945,000 as the non-federal cost for water supply.[23]

During the planning stage, the Charleston District engineers made an evaluation of the recreational resources of the proposed reservoir in coordination with the National Park Service and the North Carolina Division of State Parks. Since the study showed that considerable recreational benefit could be derived

from the Yadkin River project, a plan for public use and access was formulated, approved and incorporated in the design. Eventually, five public-use and four public-access areas totaling 1,256 acres were provided for recreation. A system of surfaced roads was built to serve 10 boat-launching ramps, tent and trailer camping areas, and other sites. Two of the camping areas were provided with showers and facilities.[24]

The Wilkesboro dam, officially renamed in 1963 the W. Kerr Scott Dam and Reservoir in honor of the former North Carolina governor and senator, proved its intended economic value in August, 1970, and June 1972, when heavy rains caused rapidly rising water levels upstream. Potential flood waters were contained in the reservoir and prevented an estimated $7.5 million in damages within the first 10 years of operation.[25] To date, the project, which was built at a cost of about $10 million, has prevented an estimated $40 million worth of damages.

Harbor improvement continued to be a field of major activity for the lowcountry engineers. When the Charleston jetties project was adopted in 1878, the goals, judged by later standards, were modest: a narrow channel with a depth of 25 feet over the bar at low water was desired. The naval station required more. Under the Rivers and Harbors Act of June 25, 1919, a project for increasing the depth over the bar to 28 feet at low water and widening the channel to 500 feet between the jetties and 1,000 feet to the seaward side of them was approved.[26] As a result of dredging done by the Navy Department under the Naval Appropriations Act of August 29, 1916, a channel 30 feet deep at all stages, 600 feet wide in straight reaches, increasing to 1,000 feet at bends, and extending from deep water in the Cooper River to the United States Navy Yard, was completed. Dredging done in connection with the construction of the Army Ordnance Depot at North Charleston resulted in a channel with a depth of 30 feet at mean low water, with a width varying from 400-800 feet from the Navy Yard to the depot, a distance of 3½ miles. The Rivers and Harbors Act of August 8, 1917 authorized the Corps to increase channel depths to 30 feet and widths to 500 feet between the jetties and 1,000 feet seaward. The Rivers and Harbors Act of July 18, 1918, provided for a 40-foot channel from the 40-foot curve at sea to the Navy Yard. There was a stipulation, however, that the work would not be undertaken until construction of a new dry dock at the Navy Yard carrying a depth of 40 feet of water over the blocks was authorized. The dock was authorized in the Naval Appropriations Act approved July 1, 1918, but funds were not provided for its construction.[27]



State Ports Authority facilities at Charleston, Port Royal, and Georgetown.

The jetty design had been based on three principles, each the product of observations of conditions in the Charleston harbor. The first was that the jetties should not impede the inflow to such a degree that the tidal basin would not be filled, the second that the outflow of the tide would be controlled in a manner which would allow a channel to be maintained through the bar, and the third that the ebb tide flow would not build up a new bar beyond the heads of the jetties. Surveys made in the 1930s showed the design was working. The jetties had deteriorated only slightly; with one possible exception, no stone had moved, and the foundations and jetty caps were secure. By 1939, the only noticeable change had occurred in a submerged portion of the south jetty where there had been a widening of the gap and some scouring where the jetty crossed what was originally the deepest part of the Charleston south entrance channel.[28] Slightly more

harbor maintenance was required as the deeper channel now cut through pluff mud, and soil from the slopes often slid to fill the bottom. The amount of dredging required was not a great financial burden, however.

For reasons which are explored in detail below, the rivers and harbors improvements stimulated economic activity only to a limited extent during the interwar years. At the port of Charleston, commerce fluctuated around one million short tons during the prewar years 1914-1916. A wartime slump reduced the figure to less than half that in 1918. With the return of peace, traffic revived, and during the 1920s commerce averaged slightly under 2.5 million tons. During the 1930s, the tonnage figure sank to an average of 2.1 million tons as Charleston port activity followed national trends (declining during the first years of the Depression and increasing after 1935.)

The absence of industry, which had prevented Beaufort's development as a port of importance earlier, continued to inhibit development there. The Port Royal bar was surveyed five times by the United States Coast and Geodetic Survey between 1855 and 1900.[29] In 1903, the harbor was viewed as the possible site of an engineer project for dredging a channel 500 feet wide and 25 feet deep to promote commerce. The request, which had originated with local interests, was turned down. Given the fact that the Port Royal entrance was the best natural entrance along the South Atlantic Coast—vessels drawing 27 feet of water could enter at high tide—and the declining commerce of the port, an expenditure of federal funds did not seem advisable.[30]

Forty years later conditions had changed, and the request of local interests for a deep-draft channel for oceangoing vessels from the ocean to Port Royal, 21 miles from the deep water, met a more favorable response. In the interim, population had increased, truck farming had revived local agriculture, and the establishment of canneries in and around Beaufort attracted large quantities of seafood to be processed for shipment. Rail connections to the interior had improved, although the tributary territory served exclusively by the port was limited, and the freight-rate situation had become favorable to commercial development. Prospects for industrial development had been enhanced by a supply of electric power from the hydroplants in Georgia and South Carolina while construction by the Corps of Engineers of the Clarks Hill multi-purpose flood-control and power dam on the Savannah River above Augusta promised an abundance of power. The federal government had become a prime investor in the area. The old Port Royal naval station was now the Parris Island Marine Corps facility, the main recruit training station on the East Coast.

The natural advantages at Beaufort, coupled with the prospective economic benefits, made a compelling case for development. The potential for growth and favorable cost-to-benefit ratio produced approval for a project to provide a channel 27 feet deep and 500 feet wide across the ocean bar, a channel 24 feet deep and 300 feet wide in Beaufort River and Battery Creek, and a turning basin 27 feet deep and 600 feet wide.[31]

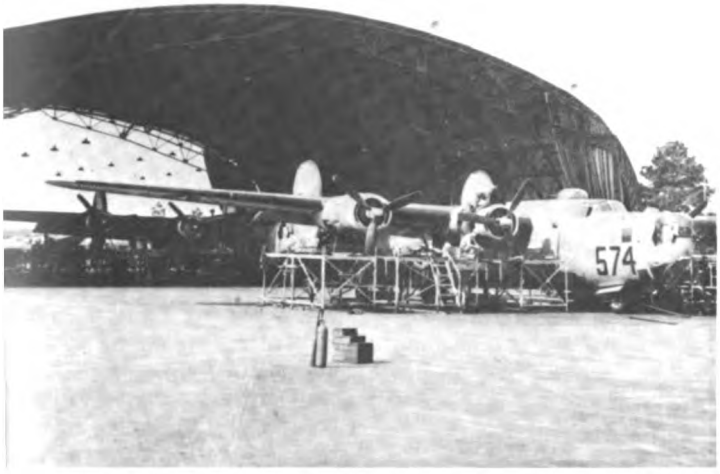
After years of uncertainty, commerce in Georgetown had begun to grow. From 1900 to 1912, commercial traffic increased gradually, averaging 323,266 tons valued at $7.9 million and consisting chiefly of lumber, naval stores, and cotton. Commerce declined between 1913 and 1921, except for the 1916-1917 surge in exports before America entered the World War. A revival began in 1922, and continued until 1931, when the nationwide stagnation of business affected activity at the port. Tonnage increased again in 1937, in the face of a nationwide recession, when a large paper mill located in the Georgetown area.[32] Buoyed by the plant's output, commerce gradually increased form 302,767 tons in 1937 to 507,867 tons in 1941. The war brought an end to foreign commerce in late 1941, and coastal commerce disappeared in 1942.[33]

By 1937, business and political leaders in the northern coastal portion of South Carolina could claim with justification that the lack of adequate ports was restricting development. Area industries included cotton mills with 1.29 million spindles, 22.2 per cent of the total in the state; 14 cottonseed-oil mills, 42.4 per cent of the state's total; and sales of leaf tobacco amounting secured for a project for a 27-foot channel from the ocean and dredging of a turning basin. The work was Georgetown. There were requests for further development of the harbor, but these did not receive favorable consideration until 1937, when Corps approval was secured for a project for a 27-foot channel from the ocean and dredging of a turning basin. The work was finally authorized by the Rivers and Harbors Act of March 2, 1945.

After 1945, factors similar to those affecting the development of the ports at Beaufort and Georgetown promoted the development of projects for the improvement of Charleston Harbor. The projects included deepening the existing channel to 35 feet and dredging a second 35-foot channel to relieve congestion and offer a more practical route for naval vessels using the Charleston base and yard.[36]

The problem at Charleston, Georgetown, and Beaufort had been the lack of diversity in waterborne commerce and the absence of industrialization in the interior of the state, the presence of which would have required harbor improvements. By the end of World War II, conditions had begun to change,

and in an effort to improve port facilities, the state of South Carolina established the State Ports Authority. A part of a statewide program for the active promotion of economic growth through industrialization and commercial expansion, the South Carolina State Ports Authority aimed at developing a triport system. Charleston was to be developed as a major port and Beaufort and Georgetown were to be developed to take full advantage of their locations with respect to the territory each served. The lowcountry engineers participated in the regeneration of the commercial ports. The Georgetown Harbor project of channel improvement was completed in 1952, the Port Royal Harbor project in June, 1959, and improvements at Charleston Harbor, except for dredging an authorized 35-foot channel, in 1963. At all three ports, facilities established by the State Ports Authority sparked a rise in commercial traffic.



Charleston airport construction, World War II and enlargement during the Korean War.

9.

Since 1914: Military Engineering

The great wars of 1914-1918 and 1939-1945 were fundamental departures from the past. In the United States, vast quantities of manpower were mobilized; finance, industry, labor, agriculture, and transportation were organized for war; and federal agencies, the districts and divisions of the Corps of Engineers among them, were called upon to administer a multitude of new programs. The major effects were two: Americans prosecuted their wars efficiently and made the Allied victories possible, and from 1914 on, the federal authority played a greater role in American life.

The immediate effect of World War I in the South was to bring dynamic change to an essentially static society. Over a million Southerners entered the armed services. Six of the 15 U.S. Army camps and 13 of the 16 National Guard cantonments were located in Southern states, four in the Charleston Engineer District. Southern ports became important naval bases and jumping-off places to Europe.[1] Charleston became the headquarters of the Southeastern Military District, a new administrative division, created in March, 1917, by the War Department, when the peacetime arrangement of four military districts was enlarged to embrace two new commands. Formed on May 1, the Southeastern District included the states of the old South (North Carolina, South Carolina, Tennessee, Georgia, Florida, Alabama, and Louisiana). Major General Leonard Wood was named the first Southeastern District commander.[2]

The Charleston Engineer District supported the Southeastern Military District. The first of the World War I military missions of the lowcountry engineers was to make sure that coastal defenses were ready.[3] The two 12-inch rifles at Fort Sumter, the 10 gun batteries of the Fort Moultrie complex, the searchlights located at the eastern end of Sullivan's Island and in the town of Old Fort Moultrie, the mine defenses, and the command and control elements of the coastal defense system were inspected and made ready.[4] Other tasks included some fortifications work outside the Charleston Engineer District and special studies. Some missions were new, like dealing with the need to recommend an air defense system for Charleston, which left everyone slightly baffled, but most of the work of fashioning a modern defense called for skills developed in peacetime.[5]

The main military work in the Southeastern District was locating, planning, and building the wartime camps. This nationwide construction task was given to the Quartermaster Corps, despite the fact that by the turn of the century the Corps of Engineers was the largest, best trained, and most experienced construction agency in the country. The quartermasters organized a new bureau, the Cantonment Division, an autonomous branch that quickly developed systems for administration, supervision, and contracting.[6] The nationwide building program involved 541 construction projects undertaken at a cost of more than $811 million, double the cost of the Panama Canal. Overseas military construction ran twice the domestic figure. This work was the responsibility of the Corps of Engineers, and to handle it, 1,966 new engineer officers were commissioned.[7]

The typical World War cantonment was designed to house 60,000 men and provide a remount station for 8,000 horses and mules. Cantonments were constructed under contracts under an established fee system.[8] All camps built in the Charleston Engineer District were intended originally to be temporary training sites for guard members, with most troops housed under canvas. Only certain divisional storehouses and quarters for special use were constructed of wood. The nature of construction and the weather had been factors in the decision to locate the training camps in the South.

The fact that three of the camps were erected in South Carolina was due to the efforts of Governor Richard I. Manning, who had taken office in 1914. Probably the first South Carolina leader to recognize the seriousness of the new social and economic problems caused by industrialization, Manning pushed reform programs and industrial development. When the onset of war required him to lay aside his domestic program, he began devoting his time, energy, and organizational ability to mobilizing South Carolina's resources. Anticipating American involvement in the fighting, Manning appointed the Commission on Civic Preparedness, and began conferring with Secretary of War Newton D. Baker regarding the possibility of locating Army camps in South Carolina.

Construction at Charleston Air Force Base during the Korean War, barracks and the chapel.

Columbia, the state capital, offered a definite location for a camp, guaranteed the installation of light, power, and other utilities, and subscribed $50,000. Manning conveyed this information to Baker during a conversation on March 5, 1917, and spoke of Columbia's advantages. Baker subsequently instructed General Leonard Wood to inspect the 2,000-acre site near the city. After the engineering surveys had been completed, Wood recommended that the cantonment be constructed. Manning was criticized for his efforts by competing municipalities and did not recommend any particular location after that, but he did continue to promote South Carolina. Camp Sevier later was located at Greenville and Camp Wadsworth at Spartanburg. The Charleston District engineers lent assistance in the construction work at these campsites and at Camp Green, built near Charlotte, North Carolina.[9]

In addition to the cantonment program and maintenance of the coastal defense system, the military mission of the Charleston District included support for projects of the Ordnance and Quartermaster Corps. The largest construction was the overseas depot for the quartermasters for the embarkation of troops, animals, supplies, and equipment. Originally budgeted at $4.5 million, the ordnance depot and port terminals complex was expanded several times as the Army acquired a port of embarkation at Charleston. Between

1917 and 1919, the federal govenment built six covered warehouses, each 1,200 feet by 160 feet, and other structures, eventually providing some 32½ acres of warehouse space. An animal embarkation corral for 10,000 horses and mules was erected at a cost of half a million dollars. As construction approached its peak, 8,700 men were employed. More laborers, up to 15,000 were needed later. To meet the demand for labor, hundreds of Bahamian Negroes were imported for construction work. Many died during the 1918-1919 influenza epidemic.[10]

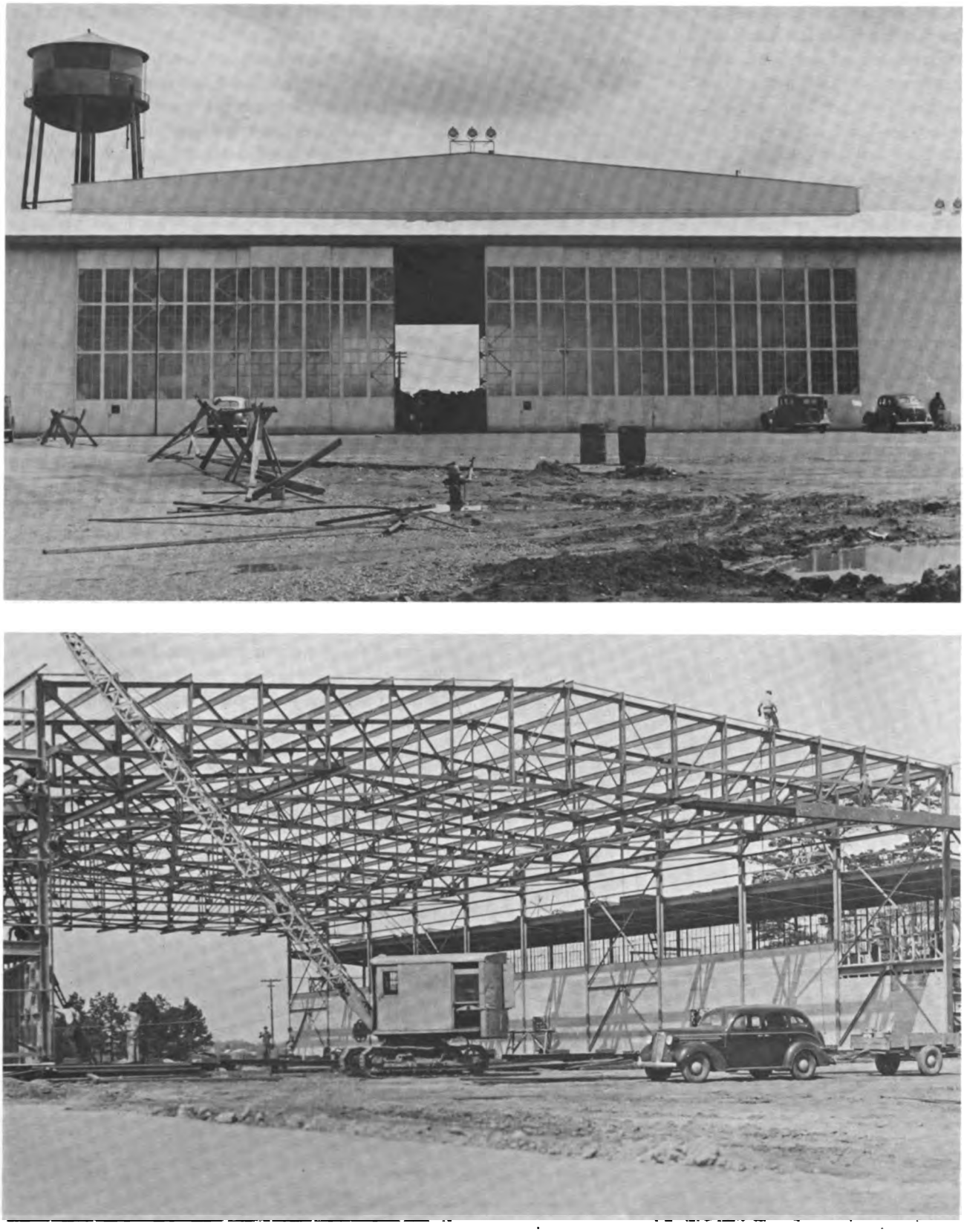
After World War I, the Corps of Engineers was involved in a bureaucratic struggle. At issue was the question of whether domestic military construction would be assigned to an independent branch of the Army, to the Corps of Engineers, to the Quartermaster General, or to a new department of public works. Each plan had vociferous and powerful advocates. In the end, Congress returned construction functions to the Construction Service of the Quartermaster Corps, and for the next 18 years, the Corps of Engineers did not have non-combat construction duties. The years were lean ones for the Army. Maintenance, rather than new construction, constituted the principal work of the Quartermaster Corps during the early 1920s. In the mid-1920s, Congress loosened the pursestrings slightly. When the Depression caused the volume of construction to fall in the United States from $13.9 billion in 1929 to $5.7 billion in 1932, Congress voted modest increases in Army building funds. Higher levels of funding came in 1933, with the passage of legislation authorizing the Civilian Conservation Corps, and other laws appropriating funds for construction to be financed through the Public Works Administration (PWA). The emergency measures required a rapid expansion of construction programs administered by the Army. This era, in turn, was followed by a drying-up of appropriations for military building, a condition which persisted until the mid-1930s. In 1936, an almost imperceptible buildup of America's armed forces began as efforts were made to resume suspended military programs and undertake new ones utilizing Public Works Administration and Works Progress Administration (WPA) monies. The early programs had important omissions, though.

The most critical of the missing components was the failure to plan for a massive military construction effort. To be sure, the 1920 Defense Act had defined responsibility for emergency planning, and under provisions of the law the War Department was required to develop plans for industrial mobilization and oversee procurement, while the Chief of Staff was required to prepare plans for national defense and mobilization of manpower. For a variety of reasons, however, mobilization planning failed to produce a coherent blueprint for emergency action. A 1924 Army mobilization plan incorporated the old principle of local mobilization: the Army would be mustered in company, battalion, and regimental units, given a brief period of training, and then shipped overseas. The plan did not contemplate much new construction; the philosophy of the General Staff was that local facilities could be used for the sheltering of troops and the great cantonments, like those constructed during World War I, would not be needed. The construction capabilities of the Quartermaster Corps suffered under these guidelines. In 1936, the plan was modified, and a sophisticated scheme for mobilization was drawn up. However, the plan still reflected the assumption that no large-scale construction program would be needed.

The emergency construction program which accompanied the first steps toward national preparedness was touched off by the 1938 Munich crisis, The confrontation in Europe clearly demonstrated the possibility of a new general war breaking out, and President Franklin D. Roosevelt wanted to acquire a large air corps quickly. Establishing a larger Air Corps required a wide assortment of new facilities. Airfield and training site construction became an urgent necessity.

Since World War I, the Corps of Engineers had been accumulating more construction experience. A $2.5 billion program of navigation, flood control, and fortification projects, undertaken during the years of peace, gave the military and civilian components practical experience in directing large-scale projects. The engineers themselves felt they were capable of handling the contemplated work better than any other agency, but assuming that the responsibility of the vast Air Corps program would spread the military engineers too thin (there were, in early 1939, approximately 775 active duty engineer officers, about three-fourths of whom were on military assignment), the live issue for the Corps of Engineers was how to maintain its military capability in a time of increasing personnel demands.[11]

Events shaped decisions. The outbreak of war in Europe on September 1, 1939 was followed by an American proclamation of neutrality and a speedup in defense preparations. Requests for building projects rained in upon the Quartermaster Corps, which performed ably considering the circumstances. Appropriations did not match military and construction needs until the spring of 1940, when, in lightning succession, Denmark, Norway, Belgium, the Netherlands, and, shockingly, France, fell to the German invader. The British were driven back to their isles, their leaders frankly proclaiming a willingness to fight to the death if need be. The ring of democracies on



Construction at the Basic Flying School, Sumter, South Carolina, photographed in June, 1941.

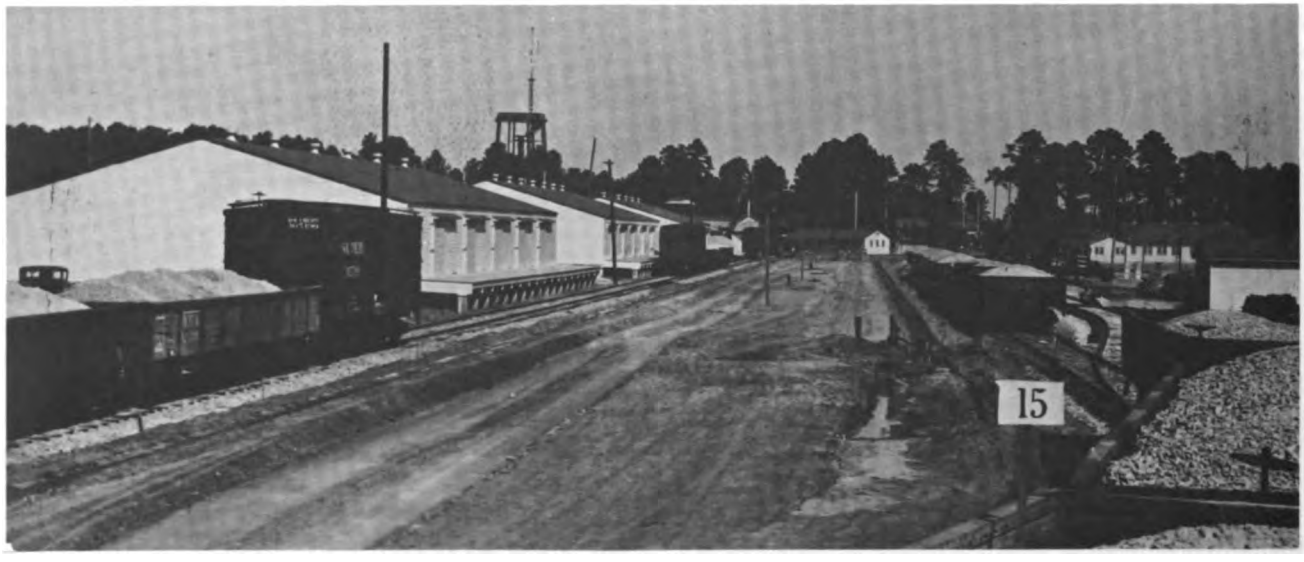
the far shores of the Atlantic Ocean was broken. The American reaction was swift and unmistakable. Congress passed a national defense tax bill designed to generate slightly under $1 billion a year. On July 20, 1940, President Roosevelt signed a bill to provide a two-ocean navy. Units of the National Guard were called to active duty. These were the first of the many measures which would create a modern defense force.

The winds of war blew through the lowcountry. The demand for war news required a Charleston radio station to add special evening news programs. The Navy Department requested that when construction was completed, the Santee-Cooper hydroelectric project prepare to provide standby electric service for the Charleston Navy Yard. The project authority agreed to do so as soon as power production began.

Construction at Sumter Basic Flying School. Photos were taken in October 1941.

Speaking in Charleston after a Caribbean cruise, President Roosevelt talked about the future expansion of the Navy Yard and the construction of new Army training sites. North Carolinians requested the War Department to reactivate Fort Caswell, near Southport, as a coastal defense strong point, and criticized the administration when it did not respond. An enemy, it was alleged, could land and slip behind Wilmington. President Roosevelt journeyed to Fort Jackson to observe training in progress. The U.S. Marines conducted a landing exercise at Sullivan's Island without giving any advance notice, and the Fort Moultrie defense force turned out, ready to repel an invader. Governor Burnett Rhett Maybank declared that it was vital for South Carolina to become the first state prepared for defense, and he urged citizens to volunteer to become spotters for an air raid warning system. The goal was to have one resident spotter for every square mile in the state.[12]

During the last six months of 1940, the Carolina lowcountry was on a quasi-war footing. Among the signs of the time were a proliferation of identification badges worn by workmen, the prevalence of uniforms, the closing of sightseeing spots and terminals, the presence of armed guards at key installations and bridges, a shortage of hospital beds and nurses, and a decline in domestic port activity as the federal government took over more installations. A recreation camp for soldiers sprang up at a site on the Charleston peninsula near the Ashley River. Ranking officers of the Coast Artillery Command gathered to observe the performance of the troops during Fort Moultrie's "war conditions week." The 12-inch guns at Fort Sumter fired at moving targets being towed eight miles out in the Atlantic and scored 87.2 points out of



a possible 100. The Navy took preliminary measures to deploy antisubmarine nets to protect Atlantic coast ports. Division-size war games were held in the Carolinas. Battalions of a South Carolina Defense Force were mustered by the state and sworn in for home defense. From retirement, General Johnson C. Hagood warned that the nation's coastal defenses were almost nonexistent. He noted that guns which he had helped install at Fort Moultrie in 1897, when he was a second lieutenant, were still in place.[13]

To meet defense needs, Congress began in 1939 to make available funds to enlarge the Army Air Corps and provide it with new facilities. In January, 1939, a survey conducted by the Civil Aeronautics Administration reported that while only a small fraction of the nation's airfields could be considered fully suited for military aviation, existing airports did provide a nucleus from which could be developed a system to meet the needs of the service.

From 1929 onward, the Army Air Corps had worked with the Civil Aeronautics Administration and the Works Progress Administration to build up civilian airports of value to the national defense. Now the WPA and CAA were asked to improve all the civil airports lying within 100 miles of the coast from Maine to Mobile, Alabama, in a first-priority effort. As a second priority, the agencies were asked to upgrade the large inland airports. While there were some problems in getting the program organized, the project was mainly successful in designating work sites which the Air Corps considered immediately important and enlisting the required local cooperation.

Few of the municipal airports in the United States were suited for use by combat groups. To obtain the needed improvements, the Air Corps sponsored legislation which would appropriate funds to the CAA for the development of a national system of airfields suitable for defense purposes. In October, 1940, Congress gave the CAA $40 million and directed the agency to improve not more than 250 airports designated by the War and Navy departments as important to the national defense. By December, a list of these airports had been prepared; by June, 1941, all the CAA funds had been allotted. Congress then appropriated almost $95 million more and raised the number of airports to be improved to 399. In expending the funds, the Air Corps sought to get the CAA to build up the airports at which combat groups were to based, develop other fields in each of the four defense areas, improve fields needed for ferrying, and construct new airports to accommodate civilian flying displaced from airports leased for military use.[14]

The selection of sites began in June, 1940, when a tentative list of municipal fields was drawn up and procedures were adopted, but early efforts proved cumbersome and inefficient. The Army Ordnance Bureau's construction corps was overburdened. The unhappy condition was apparent to everyone. To remedy it, General George C. Marshall took the major step of transferring the Air Corps construction program to the Corps of Engineers.

The Army Engineers had impressive qualifications as a national construction agency, but they had little acquaintance with the type of work which had been supervised by the Quartermaster General and no special competence in building housing and airfields.

Construction at the Lexington County Airport, West Columbia, South Carolina, June, 1941 showing the cantonment area.

What the Corps of Engineers did have was a working organization with considerable experience in project management; a system, possibly the best in the government, of estimating project costs; and a long standing practice of decentralization and delegation of authority. Since the Air Corps base program was suffering from precisely too much centralization, with work being undertaken which was ill-adapted to local conditions, the last element was of critical importance.

In December, 1940, Chief of Engineers Major General Julian L. Schley extended to the newly acquired airfield projects the freedom to award advertised contracts and approve plans and specifications for civil works and fortifications. Across the nation, division engineers were given authority to approve negotiated contracts in amounts up to $500,000, and district engineers in amounts up to $100,000. Where contracts exceeded these amounts, decisions were made in Washington, but only upon the basis of alternatives recommended by the lower echelons. In short order, district purchasing departments, familiar with local markets and materials, were assisting contractors in procuring scarce supplies. District labor relations officers continued the long standing practice of settling disputes locally. District disbursing offices took over work previously handled by regional finance offices. The districts set a rapid pace in placing construction under contract.[15]

As was the case in other districts, the Army Air Corps construction program was the first military effort which engaged the Charleston District directly. In the summer of 1940, when the lowcountry engineers assumed the responsibility for siting and designing several airports for the Civil Aeronautics Administration, about 100 people were employed. By December, when the district acquired responsibility for the Air Corps construction program, manpower was running thin. To fill the ranks, available civil works personnel were assigned key positions and recruitment programs were initiated. The addition of qualified personnel was slow, but the nucleus of civil works employees was able to keep work on schedule by employing and supervising architect-engineer firms. As non-defense agencies curtailed their operations, more people were shifted to war work. Eventually, over 1,000 people were engaged in the Charleston District in the design and supervision of construction, inspection, surveying, and administration.

Between December, 1940 and June, 1944, when the district was first relieved of military construction, the lowcountry engineers carried out work involving an aggregate cost of approximately $250 million. Among the projects completed were the siting and construction of complete air bases, camps, depots, sea coast fortifications, hospitals and other facilities, and the expansion of Army and Air Corps installations through the district.[16]

The CAA airfield program in Charleston District included the building of several pilot training centers, construction of an Army bombing center near Myrtle Beach, where 1,000 pilots were to be trained, and the upgrading of designated airports at Charleston, Florence, Columbia, Myrtle Beach, Spartanburg, and Anderson, all in South Carolina, and Charlotte, North Carolina. The work was begun under a $40 million CAA program to fit wartime emergency work into the agency's aviation development program. The most notable project in South Carolina was the Charleston Army Air Field.

South Carolina's strategic location brought proportionately more military pilot training to the state than was obtained by any other state in the union. Air fields were needed and the lowcountry engineers built them. Because there were only three or four airfields in South Carolina with paved runways in 1939, and no airport was up to the standards of the highest CAA classification, it is fair to say that the Charleston District provided the facilities which made possible the postwar air passenger and freight transportation connections in the Carolinas.[17]

Under the CAA program, municipalities estimated what was needed, made requests, and indicated what they were willing to provide. What the municipalities received varied in degree depending upon the needs of the CAA program. Charleston was allocated $177,000 for improvements to upgrade the municipal airport to CAA Class 4, the highest possible ranking. Plans included extending three runways to 5,000 feet each, clearing and draining landing strips, reconstructing the existing lighting system and adding a new one. In addition to the CAA monies, these construction programs in Charleston involved an allocation of $25,134 of WPA funds.[18]

Almost $1.25 million was allotted in 1940 for the construction of a new military airfield near Charlotte. Required immediately were housing for officers and men, hangars, shops, mess halls, barracks, supply rooms, warehouses, a hospital, a fire station, and a recreation building to serve the 147 officers and 1,333 enlisted men of three flying squadrons and a command squadron. The initial contract for the Charlotte air base was awarded December 26, 1940. Work started on January 4, When the first contingent of troops arrived on April 5, 1941, the base was essentially complete. In three months, a small city had been built and occupied. At the peak of work, 2,500 men were employed on the project, which finally cost $2.5 million.[19]

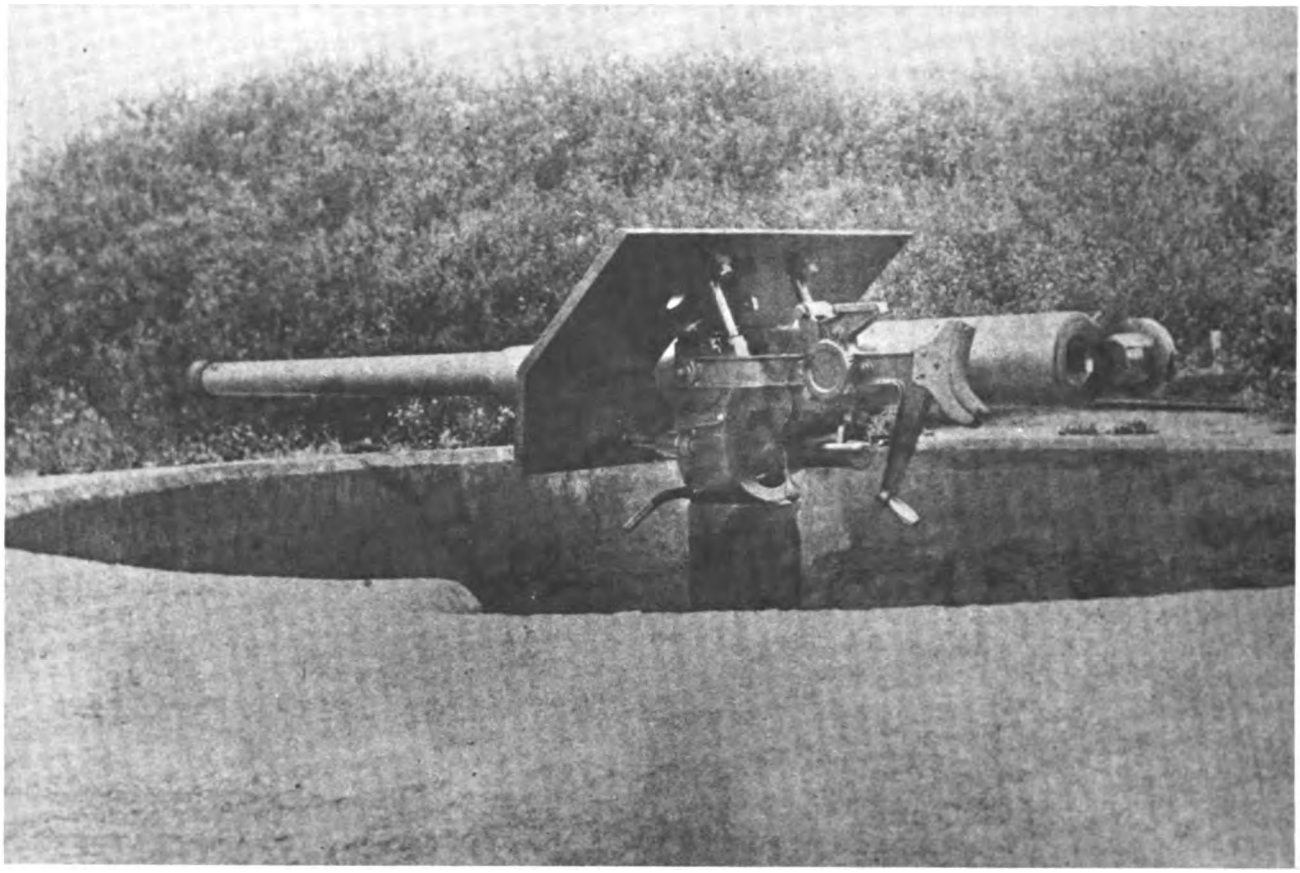
Like Charlotte, Columbia was furnished with a new airport. The CAA allotment was for $319,000 and

provided for a major expansion program. This construction merged with programs already under way to upgrade the airport to house the 14 officers and 90 enlisted men of the 82nd Observations Squadron. Construction involved runway expansion, installation of utilities and facilities for gasoline, diesel fuels and lubricants, new lighting, and construction of hangars, maintenance buildings, base housing and other support facilities. The first thing the lowcountry engineers did was to build (at a cost of $259,000) a tent city to house a squadron of 38 officers and 159 enlisted men. That work required the erection of tent frames, mess halls, and bathing and storage facilities, in addition to the construction of a 75-bed hospital, hangars, a taxi ramp, and parking areas.[20]

The Myrtle Beach airfield, originally designed for the CAA, was built from scratch. The field, with its two 4,500-by-100-foot paved runways, occupied a site of 140 acres in the midst of a tract of 2,800 acres. The initial money allotment was for $111,000, but as was true with most defense building at the time, projects were started with insufficient funds in the expectation that before long additional appropriations would be forthcoming from Congress. By April, 1941, another $35,023 had been made available for the field at Myrtle Beach. Also appropriated then were $24,466 for Florence and another $32,480 for the project at Charleston. A new project calling for the expenditure of $300,382 was authorized for Spartanburg. The works were all part of the new $150 million airport construction program, now upgraded to include 305 designated defense sites. By fall, 1941, the Charleston District responsibilities included construction of eight airports, three Army Air Corps bases (located at Charlotte, Sumter, and Columbia) and five Civil Aeronautics Authority airports for Charleston, Florence, Myrtle Beach, Aiken, and Walterboro.[21]

A flying school was erected at Sumter, South Carolina. The first plans called for the expenditure of $3.3 million for a facility for 1,000 flying cadets. The lowcountry engineers handled all phases of the project. Captain H.G. Gerdes, who had supervised the construction of the Charlotte airport, established a District Engineer Office at Sumter, taking with him a nucleus of officers and administrative staff from the Charleston

Fort Moultrie. Permanent parts barracks and facilities and cantonment area.



office. The air base design, standard for construction of similar installations across the country, called for 54 barracks; 12 administration buildings; 10 dayrooms; five mess halls; 10 supply rooms; four officers' quarters; four warehouses; two recreational buildings; seven operations buildings; three link trainer buildings; three hangar shop buildings; an officers' mess; a fire station; a chapel; a hospital unit; a motor repair shop; a telephone building; a theater; a paint and dope building; a control tower; a post exchange; a guard house; petroleum, oil and lubrication facilities; a utility shop; a commissary; a parachute building; a school building; a station building; utilities; a railroad spur; a night lighting system; and the paving of runways and aprons. In all, construction involved 140 buildings, cost $5 million, and provided living and working facilities for 3,800 people. Some 3,000 construction workers were employed in building a main airfield and five auxiliary fields.[22]

Sumter was a basic flying school. Pilots were fed into it from three privately run primary schools located at Orangeburg, Camden, and Bennettsville, all in South Carolina. Each was a cooperative project. The War Department funded the program and made the arrangements with municipal authorities, the city furnished the facilities it had on hand, and the local flying schools supplied the management and technical skills. The lowcountry engineers supervised the required upgrading and installed the new facilities. In the summer of 1941, British cadets trained at the Camden school.[23]

The foregoing does not exhaust the record of the district engineers' involvement with the CAA and Army Air Corps programs. Other accomplishments included the construction of a large air base at Greenville, South Carolina, at a cost of $7.5 million, and a smaller facility at Dovesville. Both sites were selected by the engineers, and both bases were built from the ground up. At Walterboro and Florence, both in South Carolina, airbases were constructed on sites where only dirt runways had existed previously. An air base was built at John's Island, South Carolina, with three 5,000-foot runways formed in a triangle. Work was done at municipal airports at Spartanburg, Greenville, Florence, Charleston, Columbia, Walterboro, and Myrtle Beach, all in South Carolina, and at the Asheville-Henderson and Charlotte municipal airports in North Carolina. In North Carolina, the Maxton-Laurinburg and Morris Field air bases, the Asheville Headquarters of the Army Forces Weather Wing, an Army Air Forces Rest Center at Lake Lure, several bombing and gunnery ranges, and a number of Filter Centers for the processing of air defense information, were built. For good measure, during maneuvers at Hoffman, North Carolina, Army Aviation Engineers first put to use the technique of installing a portable runway.[24]

World War II defenses of Fort Moultrie. A three inch gun looks over the harbor chanel. Troops drill on the 12-inch rifled mortar. Note the two rear mortars in the battery have been removed to ease crowding.

Because the lowcountry engineers supervised a multitude of other projects, their workload had expanded greatly. The Secretary of War had given the Air Corps construction to the engineers because the Quartermaster Department was overburdened with building cantonments. To keep from being similarly inundated, the engineers expanded their operations and made them more sophisticated. The Department of the Army began, in 1940, to recall retired officers, assign them as district engineers, and release younger men for duty with the troops. Colonel Frank C. Boggs of Evanston, Illinois, was called back to head the Charleston District Office.

The tempo of work was accelerated in 1941. On June 6, the Charleston District awarded $1 million worth of contracts. When things had to get done in a hurry, all sorts of improvisations were made. Shortly after the attack on Peal Harbor, engineer Walter M. Bell found himself needing designs for an electrical system and a waterworks facility for the air base at Columbia. He obtained the plans by calling friends. The South Carolina Gas and Electric Company provided the electrical plans, and the Commissioner of Public Works in Charleston furnished the waterworks design. Neither company charged the government for the services.[25]

The Air Corps and CAA programs were but one facet of the lowcountry engineer responsibilities. Important and demanding work was also done in the specific areas of fortifications construction and maintenance, arsenal and depot construction, cantonment construction, general hospital programs, auxiliary support systems of all kinds, unique installations, and local defense facilities.[26]

In 1940, the Coast Artillery command at Fort Moultrie had in its complement of weapons 3-inch antiaircraft guns, 10-inch rifles, and 12-inch rifles at Fort Sumter. The possibility of an attack from the sea or air or both, or, more accurately, the need to take precautions, no matter how remote the possibility of an attack actually occurring, led to the emplacement of more defense systems. Two new coastal defense batteries, one with two 12-inch rifled cannon and one with two 6-inch rifles, were sited on Sullivan's Island by the engineers. Existing weapons systems, which included an anti-aircraft complex with an 80-million candlepower searchlight, were brought to an advanced state of operational readiness. Defense posture was upgraded

to full alert status when America entered the war, and was maintained at only slightly reduced level until it was clear all the fighting would take place overseas.[27]

Fort Moultrie had been intended originally as a coastal defense post. During the First World War, the fort had served as a command center for several Army activities which had to be located quickly, but, other than coastal defense, the garrison commander had limited responsibilities in the area. During World War I, New York and Norfolk had served as the chief ports of embarkation to the war theatre. After the war, the War Department curtailed operations at Norfolk and maintained embarkation posts only at New York and San Francisco. By 1937, it was obvious that more troops would be trained in the South in the event of a national emergency, and it seemed likely that many would be sent to the Caribbean area. As it made little sense to send troops by rail from the South to the Northeast and then ship them back to the Caribbean, sub-ports of embarkation were established, Charleston among them. Fort Moultrie acquired a casual detachment, and Army transports began to stop in Charleston on a regular basis. In 1940, a new depot was constructed on the eastern end of Sullivan's Island to handle the overflow of casual troops at Fort Moultrie. With the acquisition of Caribbean bases in the destroyers-for-bases exchange with Great Britain, the need for larger facilities presented itself. Plans were made and construction quickly started on a new overseas discharge and replacement depot north of Charleston on the peninsula.[28]

Work on the overseas depot technically was carried out under the authority of Quartermaster Corps until transfer of the program to the Corps of Engineers in December, 1941. As a practical matter, however, the enigneers were involved in the renovation and new work from the beginning, and they had control of many phases of the project from its inception. The renovation project involved the reconstruction of the facilities of the Army Ordnance Depot.

Following the end of World War I, the Ordnance Depot had been turned over to Charleston Port Terminals, Inc., a quasi-public agency. Beginning in March, 1924, the Charleston Port Utilities Commission, a semi-official arm of the city government, operated the depot under a lease from the United States Shipping Board. In 1936, at the behest of Senator James F. Byrnes, Congress passed a bill giving the depot to the city of Charleston with a revocation provision in case the facilities were needed for national defense.[29] The federal government exercised its option in 1940. In 1941, the War Department determined that Charleston, used only to ship personnel overseas since 1937, would be a site for the movement of supplies and material. The repossessed port terminals, which had been leased to a pulp and paper company for years, were to be rebuilt. The lowcountry engineers planned the work and oversaw the contracting. A depot dock was built to replace the creosoted timber dock that had stood since 1919. The new structure was a reinforced concrete loading dock 46 feet wide and about 1,000 feet long. It supported two railroad tracks along its entire length on more than 1,200 reinforced concrete piles. Nearby, new warehouses were erected and a connecting railroad was constructed.

The scope of the new work in Charleston District was impressive. In one 11-day period, May 20-May 31, 1941, the lowcountry engineers opened bids for $1.5 million worth of construction. Simultaneously, the Construction Quartermasters rushed work on the new facility to house the casual detachment. This effort, which the Charleston District engineers supported, included construction of 43 buildings at a cost of half a million dollars to serve 1,500 troups and 180 permanent cadre. When the project began, about 200 people were employed. The work force peaked at 500 men and women.[30] The Construction Quartermasters also erected a new 1,000-bed hospital comprising 80 buildings connected with covered walks. It cost nearly $5 million, employed 200 people, and when completed, was considered a model institution in the South.[31]

Dredging a 35-foot harbor channel was an essential component of the Ordnance Depot renovation and port projects. The work involved the dredging of approximately 2.44 million cubic yards of material from the main shipping channel and was preceded by an intricate sequence of events.

In 1940, the city of Charleston recommended a $6 million project for the removal of 50 million cubic yards of material from the harbor area. The plan was disapproved by the South Atlantic Rivers and Harbors Board. City officials then scaled down their requests to $2 million and appealed the decision on the grounds that the improvement was necessary to make the port adequate for national defense needs. The Navy, meanwhile, decided Charleston was not to be the site of a major improvement. That decision was quickly reversed by events in Europe, the intervention of Senator Byrnes, and the concerted efforts of city officials and Representative-elect Mendel L. Rivers, who, in early December 1940, announced that his specific goals were to support President Franklin D. Roosevelt's defense program and to work toward recognition of Charleston as the chief naval port in the South Atlantic in the contemplated defense scheme. When naval activity increased in Charleston, which it soon did, the harbor improvements were required. In June, 1941, the Office of Production Management declared that the dredging of a 30-foot channel in Shipyard River to serve private docks was necessary to national defense.[32]

Harbor Entrance Control Post and Harbor Defense Command Post installation at Fort Moultrie during World War II. Note sandbagged gun emplacements, camouflage netting, and troop confidence course.

As in World War I, South Carolina became the site of large Army training camps. A completely new facility, Camp Croft, near Spartanburg, was built. Fort Jackson was expanded and became South Carolina's third largest community; only Charleston and Columbia had larger populations. By mid-1941, there were 121,800 troops encamped in the Charleston Engineer District.[33]

A mobilization plan had been prepared in early 1940 for the rapid expansion of Camp Jackson in case of war or national emergency, and the government began purchasing land. In June, the 8th Infantry Division was ordered to the camp permanently. The South Carolina Congressional Delegation urged the enlargement of the facility, which was already crowded with 8,200 new arrivals. When the expansion plan was approved, the Corps of Engineers began a $250,000 project for the construction of a huge new tent city. Similar projects were carried out at other campsites. With troops in such large numbers quartered in the area, it was necessary to construct recreational facilities. The Construction Quartermasters and the Corps of Engineers built what were then called "Soldiers Holiday Camps," to be referred to in later years as "R & R Centers."

For the lowcountry engineers, the mobilization and war efforts mixed together old missions and new projects. An old project was the work on the 12-foot deep intracoastal waterway, completed in late 1940 and the subject of a *Life* magazine photo essay.[34] Other projects. An old project was the work on the 12-foot-deep intracoastal waterway, completed in late 1940 and the subject of a *Life* magazine photo essay.[34] Other Womens Army Corps facility. Bombing and gunnery ranges were constructed in the swamps of the lower Pee Dee River near Myrtle Beach. Farther down the coast, an amphibious landing school was built at the Isle of Palms. A mock-up of a submarine under water was constructed south of Seabrook Island to train pilots for coastal patrol. An ammunition dump for

Reconstruction of the warehouse and wharf at the Ordnance Depot on the Cooper River, Charleston, in 1941. Scenes show the old dock and dock shed and the reinforced concret piles in the replacement structure.

use of the Ordnance Department was built north of the Charleston Navy Base. Loading docks, warehouses, railroad tracks, a mess hall, and other facilities to serve the transportation system linking the Charleston port with the interior were put in at the town of Moncks Corner. When the United States entered the war, the workload increased. Following the invasion of North Africa, prisoner-of-war camps were built.

The District Engineers were engaged in so many activities that they ran out of office space in the Customs House. Forty carpenters and 40 laborers were put to work, and from 50,000 feet of lumber and 15 kegs of nails they built a complete office building, a nonfabricated structure measuring 30 feet by 90 feet. Construction took two weeks.[35]

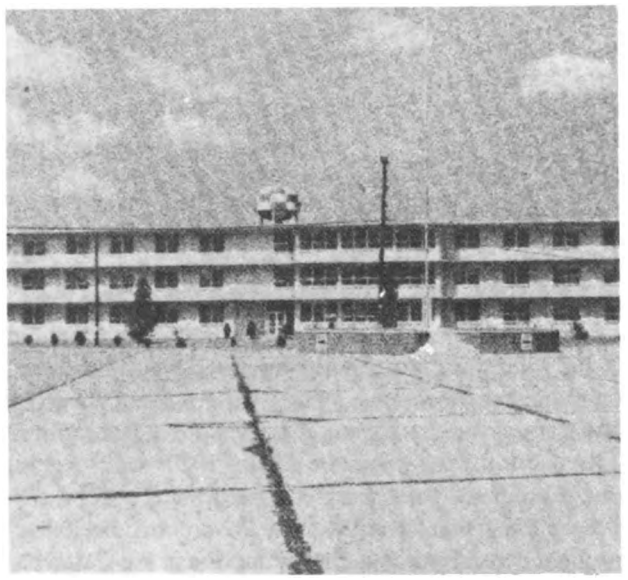
In 1935, an Army-Navy agreement specifying the establishment (as the need arose) of Defensive Sea Areas to guard the approaches and harbors of selected important ports had been reached. In 1940, the commandants of the Naval District were advised to plan for action against enemy air, submarine, and surface vessels which might be directed against American harbors. On September 19, 1941, a combined Harbor Entrance Control Post (HECP) and Harbor Defense Command Post (HDCP) was established at Fort Moultrie. The need to provide for combined operations by Army and Navy personnel utilizing existing facilities, the possible need to defend against attacks by air or sea, and the requirements of modernization meant substantial planning and new construction. Army estimates were made by the Charleston District engineers and a modern, sophisticated monitoring system was installed.[36]

The Charleston District engineers also were directly involved in the Fort Moultrie HECP-HDCP mission when they were required to dismantle armament. By the time the Harbor Entrance Control Post and Harbor Defense Command Post was fully operational in March 1944, harbor defense required only 12 guns: the two 3-inch rifles of Battery Lord, the two 6-inch rifles of Battery 230, the two 12-inch rifles of Battery 520, which had been emplaced by the lowcountry engineers, and four 90 mm anti-aircraft guns. Eight of the batteries protecting Charleston Harbor (armed with obsolete weapons) were disarmed. Further dismantling took place when the war ended. In 1946, the 3-inch rifles of Battery Lord were removed. Fort Moultrie lost the last of its guns. For the first time in 136 years, the Reconstruction period excepted, the old masonry fort was without weaponry. One generation of lowcountry engineers removed the defenses emplaced by the engineers of an earlier age.[37]

In the fall of 1946, the Charleston Engineer District was assigned the mission of designing two Veterans Administration hospitals. This was the last of the

World War II military missions, and the district reverted to concentration on civil works. Personnel at the district office were reduced to less than 75 people, but the Korean War then broke out. The military construction mission for the state of South Carolina was once more assigned to the district and the experience of the Second World War was repeated. Over 300 civil works employees again assumed key positions in the expansion. Because many of these people had mobilization experience during World War II, the buildup was accomplished expeditiously. The military workload was decreased from 1957 to 1961.

During the Korean War, the work of the Charleston District was a combination of old and new missions. With the reassignment of military construction to the district came the now familiar air base and cantonment expansion construction. Work was carried on at Charleston, Donaldson, Shaw, and Myrtle Beach Air Force bases; Congaree Air National Guard Base; Aiken Air Force Station; and several bombing and gunnery ranges. Cantonment construction was undertaken at Fort Jackson. Eleven Army Reserve training centers were built. New work involved areas of nuclear installation and civil defense. In January 1951, the Charleston District entered into an agreement with the Atomic Energy Commission to perform subsurface investigations and provide technical assistance for the design of the foundations of the Savannah River Plant. The Charleston District accomplished this task by drawing upon drilling equipment and personnel from other districts of the South Atlantic Division and the Waterways Experiment Station. In 1961, the district was assigned the responsibility for making fallout shelter surveys in seven counties, and, thereafter, district personnel were involved in updating old Civil Defense programs and assisting in new ones. In June, 1961, after admirable performance in times of national need, the Charleston District again was relieved of its military mission.[38]



Construction at Charleston Air Force Base during the Korean War, barracks and the chapel.

10.

Modern Engineering

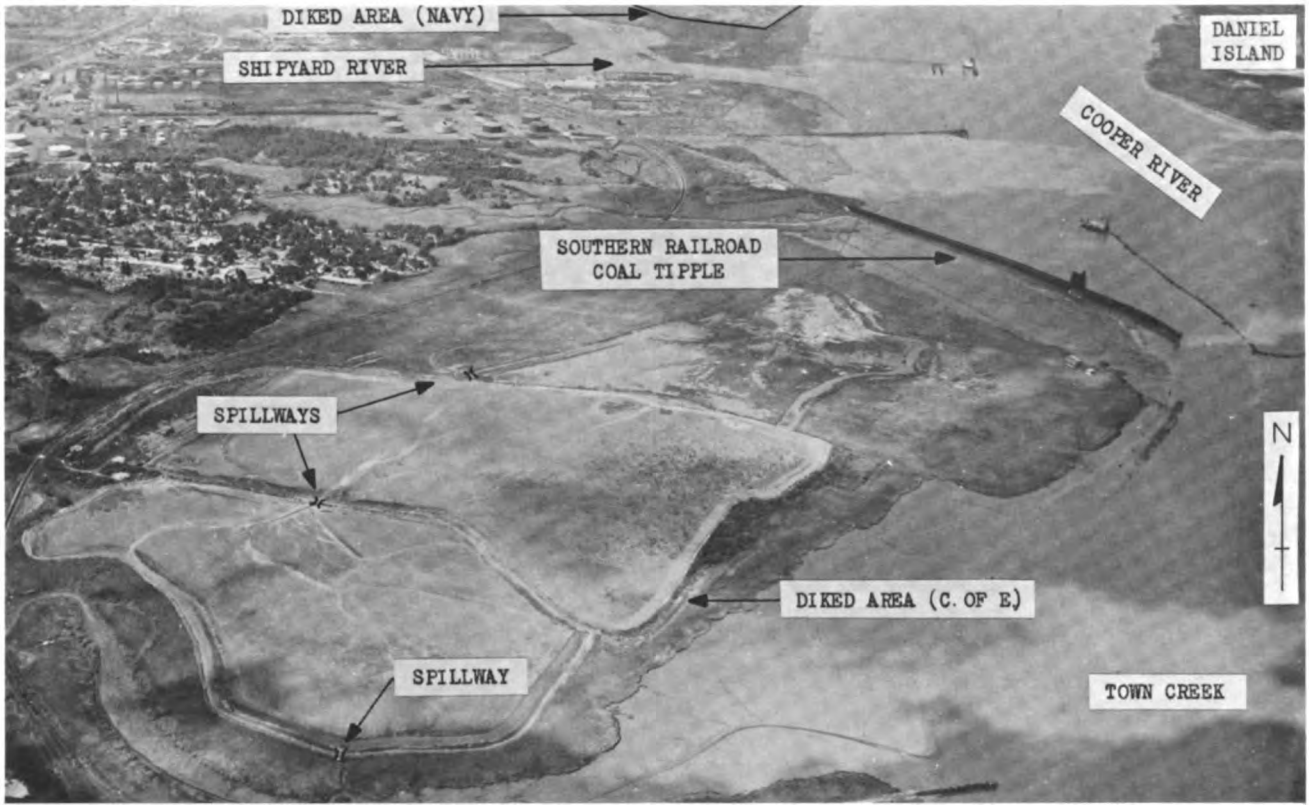
Out of the Industrial Revolution came the technology which could tame the hostilities of roaring rivers, end the ravages of floods, open the waterways as arteries of commerce, and harness the power of falling water to create electricity. Adopting this technology required the reshaping of the land, and to the completion of this task Americans set their hands. The environment was altered. Then society was confronted with unanticipated problems.

Before the Civil War, all mills in South Carolina were run by the power of falling water. Mill owners later converted to steam which continued to be used as the main power source until approximately 1900, when hydroelectric technology began to spread rapidly in the Piedmont, dotting the upcountry streams with dams and powerhouses. The availability of electric power made industrialization in the Southeast feasible. The economic renaissance of the 1920s was largely due to progress in electrical technology, but hydropower was an uncertain variable. In 1925, a record-breaking drought caused a drastic flow reduction in the Catawba River. To meet consumer power demands, water levels in the chain of reservoirs were allowed to drop lower and lower with the result that thousands of acres of mud and stumps surrounded the diminished reservoirs. To prevent a reccurence, when a river did not act "normally," auxiliary generating plants were constructed to complement the hydroelectric dams. In time, great power generating systems arose.[1]

Engineering accompanied the rush to electrification. In 1913, devastating floods swept the northern sector of the Ohio Basin. Loss of life was high and damages were extreme. As a result of the experience, the Chief of Engineers requested each engineer district to report confidentially on comprehensive project planning for streams in its jurisdiction. The Secretary of War directed the Chief of Engineers to appoint a special board to inquire into conditions in the flood-damaged areas of the Ohio Basin and report upon the most practicable and effective measures to prevent damage by floods. Congress, in 1925, directed the Corps of Engineers and the Federal Power Commission to submit cost estimates for surveys of major river basins in the United States. The goal was to develop comprehensive plans for navigation improvement in conjunction with hydroelectric power generation. The focus of interest was on hydropower.[2]

Hydropower technology affected the operations of the Corps of Engineers. Complaints that the ponding of water by power dams was interfering with navigation and disastrously affecting local interests put engineers of the Charleston District in the business of devising regulations to determine procedures for accommodating the rights of both the power and navigation parties.[3] The authority to regulate was derived from the Refuse Act of 1890 and the Rivers and Harbors Act of 1899, which originated with the desire to strengthen the hand of the federal government in keeping waterways open to shipping. The most important provisions of these acts forbade changes in the course, location, condition, or capacity of waterways by any obstruction not "affirmatively authorized" by Congress. The concept of affirmative authorization became the core of the new permit system set up by the Corps of Engineers in 1905. In essence, anyone who wished to build, dredge, dike, or otherwise change a waterway was required to obtain a permit from the local Corps district or be prosecuted for violating the law.[4]

After the suspension of activities of the old Santee Canal Company, there was, at various times, agitation for the reopening of navigation on the Santee River. Studies were conducted, but aside from interested parties in central South Carolina, it was not thought that a navigation project would pay dividends, and no real plans were formulated. With the development of electrical technology, however, new possibilities presented themselves. The most attractive and ambitious of the plans called for the diversion of the waters of the Santee River into the Cooper River and the construction of dams for the generation of power and navigation. Various private interests devoted their time to the idea, and by 1921 the notion had ripened into a license issued to the Columbia Railway and Navigation Company to build dams on the Santee and Cooper rivers. But the Santee-Cooper project was



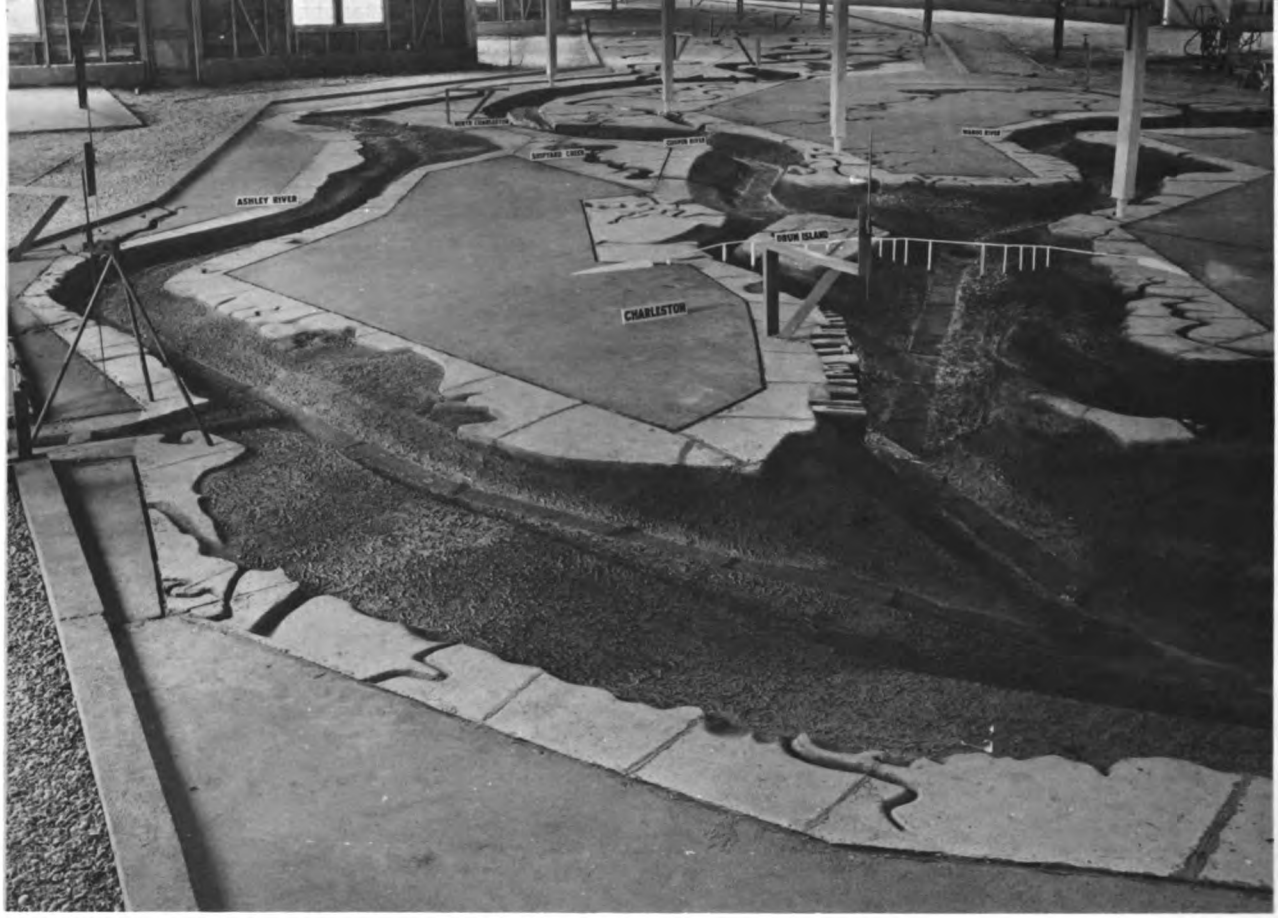
Corps of Engineers diked area on the west bank of Town Creek and Cooper River for the disposal of spoil dredged from Shipyard River. Photo taken in 1952.

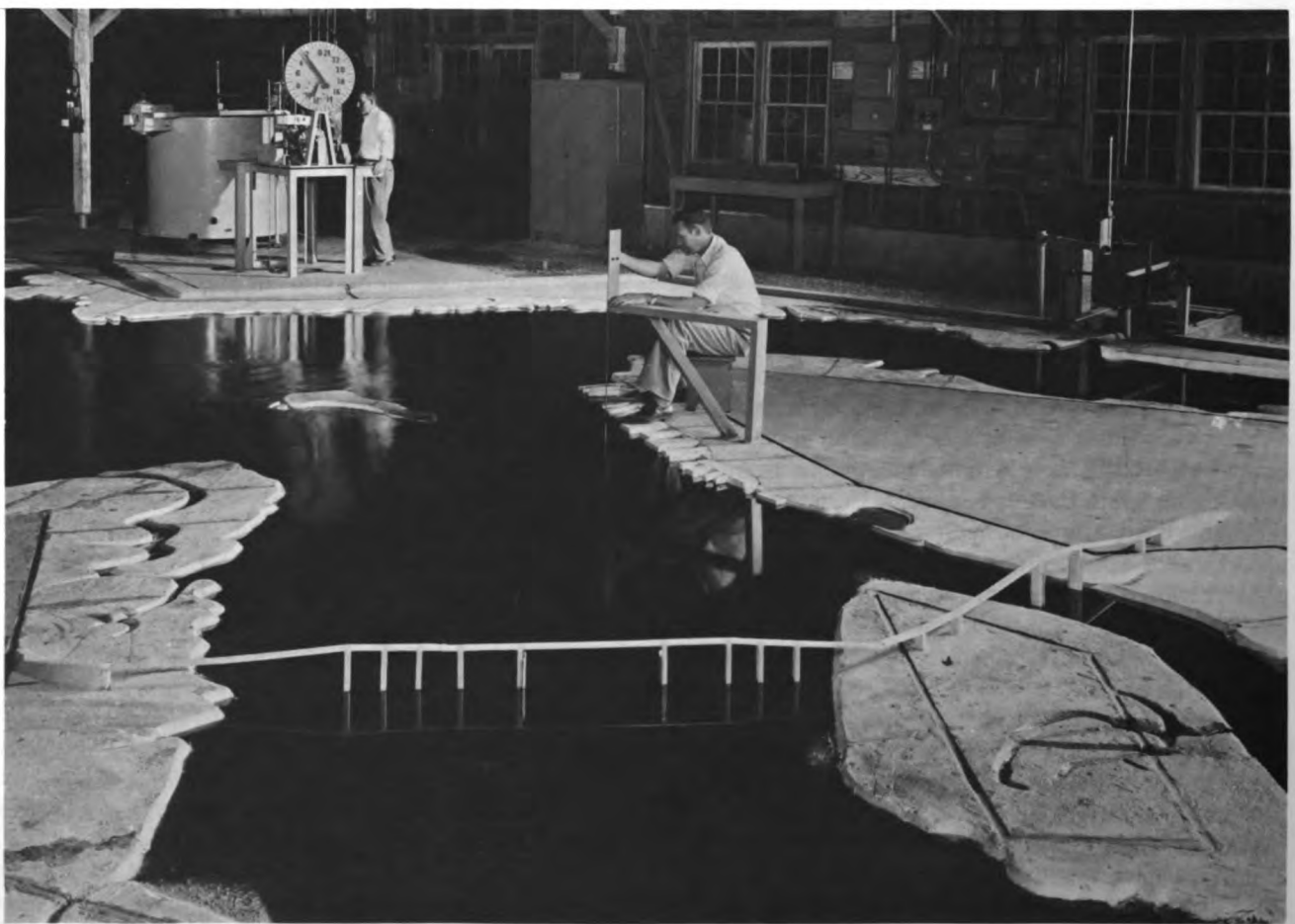
postponed while a development of the Saluda River was completed.

The financial crash of 1929 and the resulting Depression made it apparent that private interests would not be able to complete the Santee-Cooper project. At the 1932 Democratic Convention, Santee-Cooper was among a number of projects suggested for federal development. An intense period of legislative activity followed, and it was determined that the federal government would not build the project but would provide financing on a loan-and-grant basis through the Public Works Administration. Enabling legislation cleared the South Carolina Legislature in 1934. A board of directors was appointed and planning began. In 1935, the South Carolina Supreme Court approved the right of the State Public Service Authority to go ahead with the project, and work began in 1938 on the construction of a huge dam and reservoir complex of two lakes. To provide sufficient water reserves, the flow of the Santee River had to be diverted into the Cooper River.

Santee-Cooper took shape during the national defense buildup and became an essential component of the lowcountry war effort. Without the power the project's generators promised to provide, much of the defense construction in lowcountry South Carolina could not have taken place. Before Santee-Cooper was finished, power was in short supply. On November 2, 1941, the Office of Production Management had to issue an order curtailing consumption of all electrical power in southeastern South Carolina. The use of electrical signs; show windows; ornamental, decorative, or advertising lighting; and flood lighting for sports events was prohibited.[5]

With the completion of the Santee-Cooper project, the drainage of the "new" Cooper River increased from 1,200 square miles to over 15,000 square miles. The average flow from the Cooper River into Charleston Harbor increased from about 72 cubic feet per second to about 15,600 cubic feet per second. Everyday this additional freshwater flowed on top of saltwater, carrying tons of fine, inorganic silt into the tidal estuary. The Cooper River estuary changed from a vertically-mixed river to a salt-wedge stratified type, creating an ideal environment for the deposition and entrapment of sediments in the harbor. The tons of deposited silt altered the internal structure of Charleston Harbor. Instead of being a wide natural harbor, it now resembled a river port with narrow channels dredged through shallow mud flats.





Beginning in 1942, the phenomenal increase in the rate of shoaling made it more difficult for the lowcountry engineers to maintain Charleston Harbor. As the deposits of black muck material settled in the harbor, large shoals began to form in the channels. When the shoals were removed by dredging, they reformed quickly at the same locations. Frequent redredging was necessary to maintain the channel depths required in the project, and at some locations, slips which had been dredged to full depth would refill in a little over a year. The rate of silting, coupled with the expense of keeping the channels open and the increase in cost related to spoil disposal, threatened to bring an end to the useful economic life of the port. As the port of Charleston was inextricably interwoven into the fabric of the South Carolina economy—by 1960 in the manufacturing sector the port supported 30 per cent of the state's total personal income—and since the naval facilities were an "industry" larger than any private facility, it was obvious that a solution to the silting problem would have to be found.

It was not obvious what that solution had to be. Conditions had changed, and problems had become more complex. New industries and larger cities dumped more untreated sewage into the faster flowing Cooper River. Slowing the flow of the river would have health, environmental, and economic consequences. The power produced by the Santee-Cooper authority was critical for the operation of lowcountry and midlands industries and residences. Distribution lines provided power to 12 large industrial customers; three military installations; 17 rural cooperatives; two municipalities; and over 18,000 residential, commercial, and retail customers in a three-county area; and interconnected with two other major electric power facilities. Before the water flows through the Pinopolis hydroplant could be reduced, the problem of replacing the power lost through giving up a hydroelectric facility had to be mastered. Moreover, the recreational benefits of the Santee-Cooper project, only dimly understood when the project was contemplated, had proven to be enormous. No plan for solving Charleston's harbor problem, which would adversely

The model of Charleston Harbor constructed by the U.S. Waterways Experimental Station, Vicksburg, Mississippi. Before any plans for reducing the shoaling in Charleston Harbor were made carefully controlled experiments tested alternative solutions.

affect the area's recreational industrial complex, would be feasible.

Another important change had taken place. All over America people had become concerned with the quality of the natural environment. The desire manifest in many quarters was to protect the environment from further harm, which was often equated with change. The term "environment" was loose and covered many things, but it usually referred to the ecological system existing at the time the popular concern arose. In the lowcountry, the flow of Santee River waters into the Cooper River, the faster moving Cooper River, and the reduced flow of the Santee were now the norm, the "natural" environment.

For the lowcountry engineers, two items were becoming more critical each year. The first was the cost required for channel and harbor maintenance. The annual volume of maintenance dredging increased from less than 200,000 cubic yards prior to 1941 to over 10 million cubic yards by 1977. Estimated costs for added maintenance dredging amounted to $17 million for the Corps of Engineers and totaled $24 million for the Corps, Navy, and commercial users by 1966.[6] The second problem was dredged material disposal. Before the advent of heavy shoaling, spoil from maintenance dredging was placed in the deep water areas of the harbor convenient to the site of the dredging. The practice continued after the shoaling became heavy. It then became evident that much of the dredged material remained in suspension for a short period, then drifted back. A policy of diking land for containment of the dredged material was established to reduce shoaling and save money. In time, the capacity of the spoil areas was severely depleted.

Equally important, the disposal areas provide an excellent habitat for the breeding of salt marsh mosquitoes. These mosquitoes characteristically lay their eggs in moist soil just above the water line where the eggs remain until hatching. Hatching occurs after sufficient rain permits the ponding of water for the duration required for completion of larval development and metamorphosis. The time interval required to produce an adult salt marsh mosquito may be only a week in warm weather. Dredged material forms deep fissures upon drying, and these cracks are ideal sites for egg-laying and larval development of the mosquito. The spoil disposal areas lack the natural predators which limit mosquito production in the marshes. Since the most common type of salt marsh mosquito has the ability to fly relatively long distances, the spoil disposal areas in the coastal zone came to pose a major problem. A considerable portion of the county mosquito abatement effort has to be expended in an attempt to control them.

Model and prototype studies were undertaken to deal with the shoaling problem. A program begun in 1955, consisting of stopgap measures of channel realignment and dike construction, succeeded in changing the sediment distribution and circumnavigating the most notorious shoal areas. What the projects could not correct however, were the basic causes of the heavy rate of sediment deposit. The silt-laden freshwater had to be diverted away from the harbor area, or, alternatively, the Charleston Harbor project had to be modified to maintain a 30-foot-deep channel The latter choice would inhibit commercial activity and naval use of the Charleston port.

A general plan for improvement was needed, and it had to take one of two forms: either unrestricted release of water at the Pinopolis Dam would be permitted and diverted downstream, or the release of water at Pinopolis would be restricted. Those plans for restricting the release of water at Pinopolis included three hydro-rediversion schemes, construction of a new hydroplant (at Wilson Dam), purchase of energy as replacement of the energy generated by the Pinopolis facility, purchase of the Pinopolis facility as compensation to the state, or no action. Each of the other plans had merits, but they were discarded for reasons of cost, adverse environmental effects, or the requirements for maintaining the supply of energy.

The 1970s energy crisis intruded into the planning for the Charleston Harbor project. The idea of taking an existing system based on waterpower out of operation at a time when oil supplies were critical and the construction of nuclear power plants at best a controversial topic did not seem to make sense. None of the hydropower replacement plans seemed practical or economical. Nor did the plan to settle with the state of South Carolina on a lump sum basis work out.[7] Negotiations between the State Ports Authority and the South Carolina Public Service Authority concerning plans for the Ports Authority to purchase outright the hydroelectric plant and eliminate the need for diversion collapsed over disagreements as to what constituted a just price.[8] The narrowing options indicated that rediversion was the only answer.

There were many rediversion plans. Three schemes involved a simple redirection of flows below the Pinopolis Dam to the Santee River or the ocean; three involved rediversion with a hydroelectric generation facility from Lake Moultrie to the Santee River; and one involved diverting the Pinopolis flow from the upper part of Charleston harbor and discharging it on an ebb tide about midway in the harbor. One plan required reduced river flows. Another contemplated a sediment trap located midway in the estuary. Still another involved deepening, widening, and straightening the Cooper River from the head of navigation to the Pinopolis Dam. Two designs were

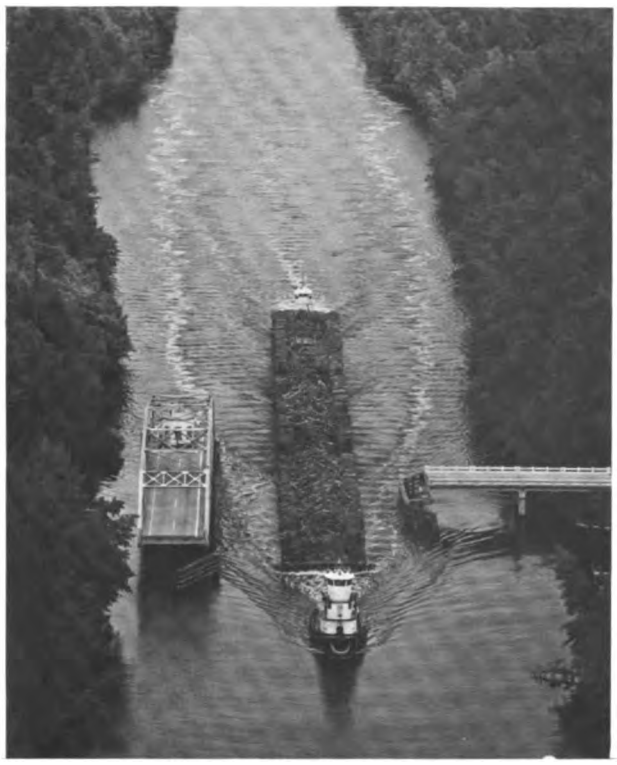
finally considered. The hydropower features incorporated in one demonstrated its superiority.[9]

Under the preferred solution, the St. Stephens project, a diversion canal connecting Lake Moultrie and the Santee River is being constructed. A hydroelectric power plant is being built about midway on the canal where the water elevation will drop from the lake level to the river level. The hydroplant is to be operated and maintained at federal cost, excluding betterments to the South Carolina Public Service Authority, which will be reimbursable. The Public Service Authority is to be compensated for the value of energy lost. A new fish hatchery will be located below the new hydroelectric facility and operated by the South Carolina Wildlife and Marine Resources Department. A fish lift will pass blueback herring into the Santee-Cooper reservoir system during annual spawning runs. A distillation of discussions and studies stretching over 25 years by a number of federal and state agencies, the Santee-Cooper project was authorized by Congress in 1968. Construction began in April 1977.[10] The ground breaking ceremony, hosted by District Engineer Harry S. Wilson, Jr., was attended by such notables as State Senator Rembert C. Dennis, Governor James B. Edwards, and Senators J. Strom Thurmond and Ernest F. Hollings.

The St. Stephens project is but one of many current projects of the Charleston District engineers. Navigation continues to be a major responsibility. The district maintains the harbors at Georgetown, Charleston, and Beaufort, the intracoastal waterway, and several small channels. The high shoaling rate in Georgetown Harbor and the ever-present requirement for disposal areas for dredged materials led to an experiment for the possible construction of artificial marsh land in the relatively shallow eastern side of Winyah Bay. Dredged material was pumped directly from a pipeline dredge working in the Winyah Bay channel and was held within the selected area by weighted polyester material curtains. Since construction of productive marsh land has occurred accidently during dredging operations in both Charleston and Georgetown harbors, the hope is that the experiment will prove that marsh land can be created deliberately.[11]

Industrial and urban development depended upon the availability of water resources. To insure ready supplies, a number of dams were built. The impounding of water made the flood plain available for development. The danger lay in the possibility that the reservoir systems would become overloaded and dams would give way, resulting in disaster. On Friday, May 4, 1928, the 700-foot-long earthern Table Rock Dam (not a Corps-built dam) on the Saluda River opened a fissure around a drain pipe at the base of the outer side of the dike. Tons of water poured through. Many residents fled. Charleston District engineers conducted an inspection, diagnosed the cause as a break in a drain pipe within the dam, and recommended a method of repair.[12]

Artificial marsh land construction in Winyah Bay.



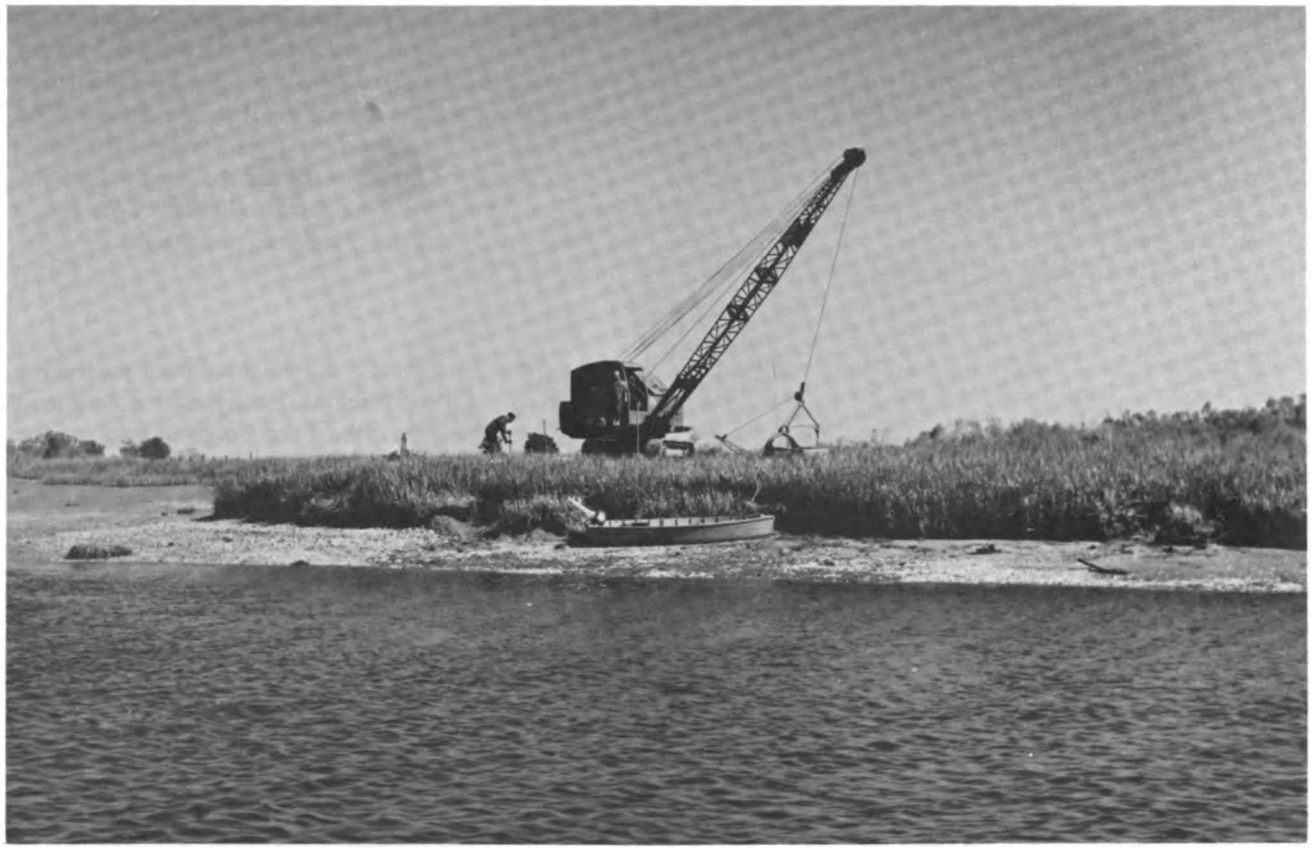
The Atlantic Intracoastal Waterway. Three and four barge tows of pulpwood are typical of the commercial traffic. Maintenance work and improvement are continuous. Shown are construction of a dike in connection with dredging in 1948 and dredging operations near Myrtle Beach.

The incident pointed up the fact that use of the flood plain entails certain risks. Today, in recognition of the increasing use and development of flood-plain areas and the need for flood hazard information to guide development in ways that will minimize future flood damage but permit the best use of flood-prone lands, the Corps of Engineers has been authorized to carry out a flood-plain management services program. Under the program, the Corps of Engineers prepares information reports, provides technical assistance, and warns of specific dangers. Over three dozen flood control and flood plain information studies have been prepared by the engineers of the Charleston District.[13]

Much of the future work of the Charleston District will be concerned with environmental protection. Now a national priority, protection of the wetlands became a Corps project because the engineers were already intimately concerned with the nation's waterways.

The Corps of Engineers' waterways authority derived from the power of the federal government granted under Article 1, Section 8, clause 3 of the federal Constitution which established the power "to regulate Commerce with foreign Nations, and among the several states, and with the Indian Tribes." Court decisions affirmed that control of navigation, an essential part of commerce, was within the powers of Congress. Federal regulatory jurisdiction was usually defined in terms of "navigable waters." Originally, the phrase referred to a water body's physical capacity to carry waterborne commerce.[14] As federal authority expanded, so too did the authority of the Corps of Engineers over navigable streams. Following the Civil War, increasing appropriations for river and harbor works transformed the Corps into a national public works organization. Engineer districts were established, developed from a nucleus of one or more military engineers and a clerk or two into more elaborate bureaucracies, and reported fully on conditions affecting navigability of the waterways. Many of the reports complained of a problem new to the government and brought about by the process of industrialization—the obstruction of waterways by bridges, wharves, dredging, and dumping.

It took a long time for any effective forms of regulation to be devised. The search for legal means to regulate waterways usage began in the 1850s, but not until 1890 was a federal statute, the Refuse Act, enacted. It proved enforceable, but was poorly worded and contained no policing powers. The Rivers and Harbors Act of 1899, an omnibus bill into which had been inserted the complete package of legislation affecting navigation desired by the Corps of Engineers,



removed these shortcomings. The Refuse Act of 1890, as modified in 1899, was a broad new law. It forbade dumping without a permit. Permits were required for building wharves, piers, bridges, and bulkheads; and it was illegal to change the course or condition of a navigable waterway without authorization. The act became the core of the permit system set up by the Corps of Engineers in 1905.

The law functioned only to protect navigation. Everyone in authority seemed to agree that regardless of its language the Refuse Act was designed to strengthen the hand of Congress in keeping the waterways open to shipping. The same view shaped the Corps of Engineers enforcement policies.

The pressure of events pushed environmental concerns to the forefront. Political issues and new court decisions moved the interpretation and enforcement of the Refuse Act of 1899 out of the navigation context. In 1951, the Corps sought to force a steel company to dredge shoals on a waterway on the grounds that the mill was drawing clear water from a river and returning water filled with particles in suspension. The Court of Appeals dismissed an injunction on the grounds that matter in suspension was not refuse. The government appealed to the Supreme Court which ruled, in 1960, by a 5-4 vote, in favor of the Corps' position. The language of the majority decision was far reaching. Subsequent

decisions expanded this statement, and by 1969, the federal courts were deciding consistently that almost any substance was refuse and that any discharge of substance constituted the depositing of refuse.

Simultaneously, the Corps of Engineers came under pressure to involve the powers granted under Section 10 of the Refuse Act of 1899 to prevent damage to wildlife. The clearly stated authority of the Secretary of War to prohibit dumping or discharge of pollutants was spotlighted as an effective available weapon in the federal arsenal. The Corps was urged to harness the Refuse Act to the aims of the 1969 Environmental Policy Act, and on December 23, 1970, a presidential order instructed the Corps to implement a permit program.[15]

Because of its original navigational obligations, the presence of its working bureaucracy, and its experience in executing permit powers, the Corps of Engineers was ideally positioned to become the federal agency empowered to enforce the provisions of laws designed to restore and maintain the chemical, physical, and biological integrity of the nation's waters and wetlands. That the Corps might not be ideally suited to the task was suggested by a variety of environmentalists and their allies. They sought to exclude the Corps from any permitting role on the grounds that to grant the engineers this power would amount to a sellout to the development interests.[16]

On December 18, 1968, the Department of the Army published a regulation declaring:

> The decision as to whether a permit will be issued must rest on an evaluation of all relevant factors, including the effect of the proposed work on navigation, fish, and wildlife, conservation, pollution, aesthetics, ecology, and the general public interest. . .[17]

The public interest review quickly became a requirement of law for any Corps permit program. As the Congress, the courts, and the executive branch of government all made emphatically clear, this, rather than navigation, was now the guiding policy for Corps' decisions.

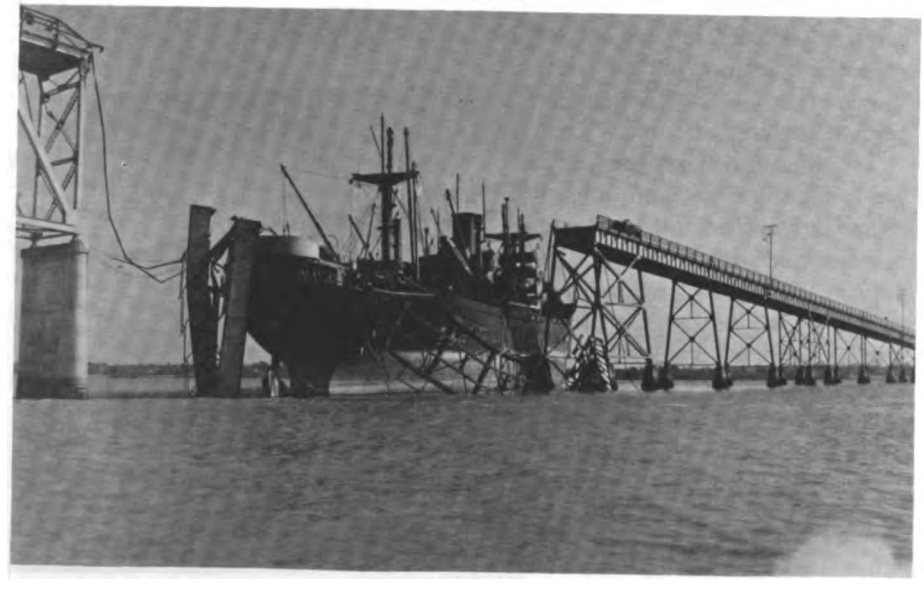
In 1969, the National Environmental Policy Act became law. The act of issuing a permit being a federal action, the requirements of this act are brought into play whenever a permit is issued by a federal agency. Before giving its decision, that agency is required to prepare a detailed environmental impact statement for permit actions that affect significantly the quality of the human environment and to take into consideration not only the ecological but also many of the social and economic impacts of the agency's action.

By 1972 two important trends, the Corps of Engineers regulatory program and the general public interest review, had intersected. A new mission of protecting waters from environmental damage was now joined up with the historic task of the Corps to oversee the navigable waters of the United States through a permit program. The mission was spotlighted by the enactment of the Federal Water Pollution Control Act Amendments of 1972. Also during 1972, the Corps adopted an administrative definition of "navigable waters of the United States" to include those waters subject to the ebb and flow of the tide up to their mean high water mark. This definition includes waters that are currently navigable, historically used for commerce, and capable of being made navigable at a reasonable cost. The adoption of the public interest review and the "ebb and flow test" was followed by the formal promulgation of a Federal Wetlands Policy (1974) to be used by the Corps in the evaluation of all coastal zone activities involving wetlands, and to prevent development of wetlands where the public interest indicated otherwise. These events greatly expanded the duties of the district's regulatory program.

The effects of the Federal Water Pollution Control Act Amendments of 1972 were far reaching, especially in the South Carolina lowcountry. The amendments state that the "Chief of Engineers may issue permits. . . .for the discharge of dredged or fill materials into the navigable waters." During this time, new industries were moving south into the state, attracted by an abundant water supply, easy access to ports, an ideal climate, a work force, and large undeveloped areas that were relatively inexpensive and close to shipping and population centers. The goal of the water pollution legislation was to eliminate the discharge of pollutants into the nation's waters by 1985.

In the Charleston District, as elsewhere, the "navigable waters" as used in the 1972 amendments meant many things to many people. From the actual wording of the law, the Corps concluded that Congress was merely reaffirming its jurisdiction in navigable waters of the United States (i.e., tidal waters and other waters administratively determined to be navigable up to their mean high water mark or normal river stage elevation). However, the Natural Resources Defense Council and the National Wildlife Federation

On February 24, 1946 a sudden squall with winds up to 60 miles per hour caused the **Nicaragua Victory** *to crash into the Cooper River Bridge. Five lives were lost as an auto was knocked from the bridge. The breech in the bridge was spanned temporarily by a Bailey Bridge procured for the South Carolina highway department by the Charleston District. This was a unique use of a Bailey Bridge in peacetime.*



challenged this limitation of jurisdiction as being inconsistent with the intent of Congress to regulate "all waters of the United States" as expressed in the Federal Water Pollution Control Act Amendments of 1972's definition of navigable waters.

On March 27, 1975, the U.S. District Court for the District of Columbia ordered that the applicable U.S. Army regulations be revised and expanded to include "waters of the United States." The Corps acquired new permitting power extending over the nation's navigable waters. Navigable waters (now referred to as "waters of the United States") were defined by the court in the broadest possible way. As the goal of federal policy was to restore and maintain the chemical, physical, and biological integrity of the nation's waters, and since waters of the United States included inland and coastal waters and their adjacent wetlands, the responsibilities thrust upon the Corps were immense. In South Carolina, the Charleston District became responsible for 500,000 acres of unforested wetlands and three million acres of forested wetlands in both North and South Carolina. The entry of the Corps into the vast area of land-use regulation for navigable waters of the United States and wetland areas posed formidable administrative problems. It now took nine people to staff the district's Regulatory Functions Branch.

In response to the challenge facing it, the Corps, after offering four alternative regulations for public review and comment, published Interim Final Regulations on July 25, 1975. To make people aware of the ramifications of the new regulations, a series of public meetings was scheduled throughout the district during the week of Oct. 6-10, 1975, in Charleston, Greenville, Myrtle Beach and Columbia, all in South Carolina, and in Charlotte, North Carolina. Over 5,000 notices of these meetings were mailed to contractors, engineers, land surveyors, governmental officials, and other interested parties throughout the area, but response was unexpectedly low. More interest was shown in the lowcountry than in the Piedmont, though both areas were affected.

To allow for experience to be gained and to get ready for the new operations, the Corps decided to phase in its jurisdictional expansion. The first phase commenced with publication of these regulations on July 25, 1975. During Phase I, permits were only required for the discharge of dredged or fill material into traditionally navigable waters of the United States and their adjacent wetlands, including those above the mean high-water mark or normal river stage. After July 1, 1976, additional waters were phased into jurisdiction, inlcuding the waters and adjacent wetlands of primary tributaries of those waters covered under Phase I and all lakes five acres and over. Later regulations

The Ashley River Bridge at Charleston after it was struck by the **Fort Fetterman** *October 5, 1955; the Ben Sawyer Memorial Bridge over the Atlantic Intracoastal Waterway connecting the mainland and Sullivans Island; and the Wappoo Cut drawbridge of the stretch of the waterway connecting the Ashley and Stono rivers.*

changed jurisdiction to lakes 10 acres in size. During the Phase I period, the district learned that it must deal with two volatile issues. On one side was an environmental imperative, the protection of our nation's valuable diminishing wetlands. On the other side, opponents, notably businessmen and developers, voiced concern with the act's economic impacts, in particular the expansion of the federal bureaucracy into an area of traditional state responsibility. They saw the Corps as forcing land use control. The time required to process an application compounded the problem. The usual interval at Charleston is two to three months; however, in some cases, processing has taken three to four years. Many persons concerned with these issues wrote to their elected representatives. The implementation of Phase II was delayed for 90 days by Executive Order of President Gerald Ford to allow Congressional action on revisions to the Federal Water Pollution Control Act Amendments of 1972, but such action did not take place.

The third and final phase (Phase III) of jurisdictional expansion went into effect on schedule on July 1, 1977, taking in all "waters of the United States." This included all waters with an average annual flow of 5 cubic feet per second or greater. As a result of experience gained during this period, the Corps issued final regulations on July 19, 1977, somewhat clarified and simplified. Congressional action resulted in the passage of the Clean Water Act of 1977 (Public Law 95-217) on December 27, 1977, as an amendment to the Federal Water Pollution Control Act. The new final regulations in response to this act were published in 1979.

During this period of transition, the Charleston District has been involved in many major permit actions, two of which are especially noteworthy. In April, 1973, the Charleston District received an application for the Chicago Bridge and Iron Company to construct a pier and to dredge in the Colleton River. Beaufort County, South Carolina. The company intended to build a metal fabrication plant at the site to construct liquified natural gas tanks to be installed on ocean-going vessels. The state of South Carolina issued the required State Permit and Water Quality Certificate. The Charleston District conducted three public hearings during which it was brought out that the company had other manufacturing interests in

Flood control. Flooding in the tributary to Briar Creek in 1964; Small Flood Control project under construction near Summerville, South Carolina.

mind. Chicago Bridge and Iron's capabilities and the plant that was contemplated were suitable for supporting off-shore oil exploration. An environmental impact statement was prepared. The Charleston District issued a permit on February 16, 1977. A coalition of interests opposed to Chicago Bridge and Iron Company then filed suit to halt the permitted construction. At issue was whether or not the action of the Charleston District satisfied the requirements of the National Environmental Policy Act of 1969. After a hearing on the merits of the case, the Federal District Court for the District of Columbia handed down a ruling favoring the Charleston District's decision. The ruling was then appealed to the 4th Circuit Court of Appeals in Richmond, Virginia, which affirmed, on September 19, 1977, the action of the Charleston District in issuing the permit. During the controversy, however, the company gave up its project.

Perhaps the most involved permit action undertaken by the Charleston District has been the request by the South Carolina State Ports Authority for terminal facilities on the Wando River in Charleston County. On September 30, 1974, the Ports Authority requested authorization to construct a 135-foot-by-5,000-foot concrete wharf, a steel-sheet bulkhead, a 12-foot-by-350-foot railroad trestle, a barge slip with two concrete docks, and authority to dredge approximately 4.7 million cubic yards to provide a channel and turning basin at the proposed facility. The proposal was divisive. Arrayed against the project were some organized private groups, as well as individuals, many of whom lived near the site of the projected terminal. On the other side of the issue were organized labor, businessmen, the governor, and congressional and legislative delegations. Opponents of the project did not object to the expansion of the port facilities at Charleston *per se,* but contended that there was an alternative site (known as the "Coal Tipple") on the Cooper River which was a better location. In May, 1977, the

Charleston District contracted with an engineering firm for an independent study. It revealed that construction at the Coal Tipple site was feasible but prohibitive because of high site preparation costs. An environmental impact statement was prepared, and the matter was forwarded to division level. On December 28, 1977, a permit for the terminal portion of the project was issued when the Environmental Protection Agency dropped its objections to the project. A permit for dredging was issued on September 18, 1978, and construction began the next month. Completion of Phase I of the project is scheduled for 1982.

Beach nourishment. Condition of the beach prior to artificial nourishment at Hunting Island, South Carolina, and protective timber groin. Erosion resisting revetment on the Isle of Palms.

Aquatic plant control. Alligatorweed on the Edisto River, South Carolina.

The Regulatory Functions Branch of the Charleston District has taken an active role in interpreting and implementing the federal wetlands policy. The Charleston District was among the first to hold regular meetings of concerned state and federal agency representatives to discuss specific issues and matters of common concern. Begun in April, 1975, these regulatory enforcement conferences are held on a quarterly basis and have proved beneficial in providing a forum for an interchange of views and increased understanding.

To eliminate delays in the processing of individual permits, the district began to issue "general permits" for certain categories of work in specified areas where the projects involved are substantially similar in nature and have only minimal adverse environmental impact. Examples of the general permits issued by the Charleston District are: South Carolina Public Service Authority (June 23, 1976)—for construction, repair and maintenance of private piers and floats in Lakes Marion and Moultrie; city of North Myrtle Beach (October 1, 1976)—for construction, repair and maintenance of bulkheads in artificial canals at Cherry Grove Beach, Horry County, S.C.; South Carolina Wildlife and Marine Resources Department (January 20, 1977)—for construction, repair, and maintenance of aids to navigation in the Charleston District: International Paper Company (February 8, 1978)—for access

roads and drainage ditches for agricultural activities in the coastal plain of South Carolina, north of Charleston (This permit was pre-empted by the issuance of a nationwide permit in the July 19, 1977 regulations covering this type of activity.); General Public (April 3, 1978)—for construction, repair and maintenance of private piers and floats in coastal waters, except those waterways with federal channels. The last general permit listed is of particular importance as it reflects the close working relationship the district has with the South Carolina Coastal Council, established in September, 1977, as a result of the South Carolina Coastal Management Act passed by the General Assembly in May, 1977. The council oversees general permits for piers and floating docks in the coastal zone in a cooperative program with the district's Regulatory Functions Branch. The general permit system has been an effective way to respond to public needs.

Because geographical conditions and ecological considerations exist separately from the nation's political divisions, federal authority will remain important in the water regulation program. Because the focus of water quality legislation is upon wetland preservation, the Corps, as the responsible federal agency, will be intimately concerned with land use regulation. That policy provides, in essence, that except in unusual circumstances, no development in wetlands is to occur. The policy raises deep philosophical issues (balancing the need for economic growth against wetlands preservation is an example) and will undergo further refinement.

Environmental preservation was already among the operations of the Charleston District engineers. About three-fourths of the ocean shoreline of South Carolina shows the effects of erosion. Approximately 30 percent of the shore, 57 miles, is eroding critically. At Hunting Island Beach, just south of St. Helena Sound in Beaufort County, a project for periodically nourishing the beach with sand and trapping sands with a prestressed concrete sheet pile terminal groin has been undertaken. Beach erosion control studies have been made along the coast.

A special water-oriented program in South Carolina is combating aligatorweed and other obnoxious aquatic plants in the state's streams and waterways. In 1963, approximately 30,000 acres of waterways were covered. The dense mats formed by the plants are detrimental to water travel and to fish and wildlife. They retard drainage, prolong flooding, and increase mosquito breeding. The control program, undertaken in cooperation with state agencies, consists of one to two applications of herbicide annually.

In November, 1972, the National Program for the Inspection of Dams began with a survey of maps and other file data necessary to develop an inventory of dams. The survey, authorized by Congress in August, 1972, produced a computerized listing, as of 1974, of all known dams in South Carolina—a total of 1,076. In cooperation with the South Carolina Land Resources Conservation Commission, identification numbers were assigned to each dam in the inventory and each dam was classified according to its "hazard potential," defined as the threat to life and property in the event of dam failure. Prompted by failures of the Teton Dam in Idaho and the Kelly Barnes Dam in Georgia, the President directed, in November, 1977, that the Corps of Engineers assist the states in a prospective four-year program of inspecting all dams with a high hazard potential. The Chief of Engineers committed the Corps to inspecting 1,800 dams by December, 1978. The Charleston District's quota was 14. On November 21, 1977, Governor James B. Edwards formally requested that the Charleston District provide financial and technical assistance to carry out the inspection of privately owned dams with a high hazard potential.

The Charleston District responded by establishing an inspection organization which included an inspection team and inspection report review board. At the same time, the district contracted with the state to initiate a three-year county-by-county investigation to update the 1974 Federal Inventory of Dams and to develop a confirmed priority list for inspection of all high hazard potential dams within the state. Inspections were initiated by Corps personnel on the North Saluda, Table Rock, and Broadway Lake dams on December 14-16, 1977.

To complete the inspections as expeditiously as possible, the district used a consulting firm. By September, 1978, 14 dams had been inspected, 12 of which were reported unsafe to the governor, with appropriate corrective recommendations. The deficient dams all had spillways which were inadequate to pass the probable maximum flood and would be overtopped if one occurred. In the case of North Saluda Dam near Greenville, where the initial inspection had revealed seepage from the approximate mid-elevation on the back slope, more detailed studies were conducted. Test borings showed the problem not to be serious, and revealed the cause to be an impervious layer within the dam structure that created a perched water table. By the end of 1978, the Charleston District had completed plans to study the 40 remaining high hazard dams and inspect six dams located at Fort Jackson.

On January 20, 1978, the Corps of Engineers and the Environmental Protection Agency entered into a

national agreement which provided for Corps support of the EPA's construction grants program for waste water treatment facilities. As the character of Corps involvement would vary among different states and EPA regions, regional agreements were written to supplement the national agreement. The South Atlantic Division of the Corps and Region IV, EPA, located in Atlanta, Georgia, executed their regional agreement on April 28, 1978, outlining the specific functions to be carried out by the individual districts. As these functions are assigned by state boundaries rather than Corps drainage basins, the Charleston District was assigned South Carolina.

Basically, the Corps assists the Environmental Protection Agency in the task of managing EPA grants for the construction and rehabilitation of sewage treatment plants, sewer lines and collection systems, and appurtenant works. The district is involved mainly in construction management, and Corps personnel work closely with resident engineers and grantee representatives to assure that applicable federal procurement requirements and good contract administration procedures are employed. District personnel participate in the contracting process from certification of the bidding through final inspection. Typical duties include presentations at preconstruction conferences, certification of payment estimates, review of change orders, and regular site inspections. In addition to contract management, certain grant management activities are included in the Corps assignment. These include review of a grantee's real estate procedures,

Applying liquid spray herbicide to alligatorweed on the North Fork of the Edisto River. Compare the river in this second spray season with the condition before spraying.

and monitoring preparation of user-charge and industrial-cost recovery plans, sewer use ordinances, operations and maintenance manuals, and plant personnel staffing.

The Charleston District organized an Environmental Protection Agency Support Branch within its Operations Division to carry out the assignment. By 1978, eight of nine new positions had been filled. The district's initial assignment included 25 projects at various stages of construction and totaled approximately $130 million. The largest of these is the sewage disposal plant located between Aiken, S.C., and Augusta, Ga. As determined by the State of South Carolina, new construction projects totalling $60-$100 million each year are projected through fiscal 1983.

The Corps of Engineers has been tapped by present-day needs and its historic role to be an agency of the federal government intimately concerned with land and water use planning. One mission mandated by changing times is protecting our national resources. What the resolution of individual problems will be, only time can tell. In any case, the Charleston District engineers will play an important role in the process of finding solutions.[18]

11

The Lowcountry Engineers and Economic Development

There is a relationship between public works projects and subsequent development in the region affected by them. When harbors are improved or dams constructed to control flooding, it is natural to expect beneficial changes. This was the case at Georgetown where businessmen, searching in the 1880s for alternatives to the culture of rice, redeveloped the lumbering business. About the time the Georgetown jetties were completed, the largest lumber concern was expanded and began a capital improvements program. By 1914, a new lumber plant covering 56 acres in a bend of the Sampit River was operating.[1]

Benefits also accompanied the completion of the W. Kerr Scott Dam and Reservoir. In 1940, 50 per cent of the employed men in Wilkes County were in agriculture. By 1960, the proportion had dropped to under 15 per cent. In the intervening 20 years, the number of subsistance farms decreased, cash-crop farms were consolidated, and the amount of land under cultivation was reduced. Between 1940 and 1950, the job losses in agricultural employment were overcome by gains in furniture, retail, wholesale operations, and manufacture, but between 1950 and 1960, local industry could not absorb the population being pushed off the farms. The number of males employed in the county fell (more women went to work), and people began migrating from the area. When the dam and reservoir were completed in 1962, a local economic boom was inspired. New factories, an airport, and a water plant quickly located nearby. Jobs became more plentiful, wages went up, local spending increased, tax revenues soared, and the tide of emigration was reversed.[2]

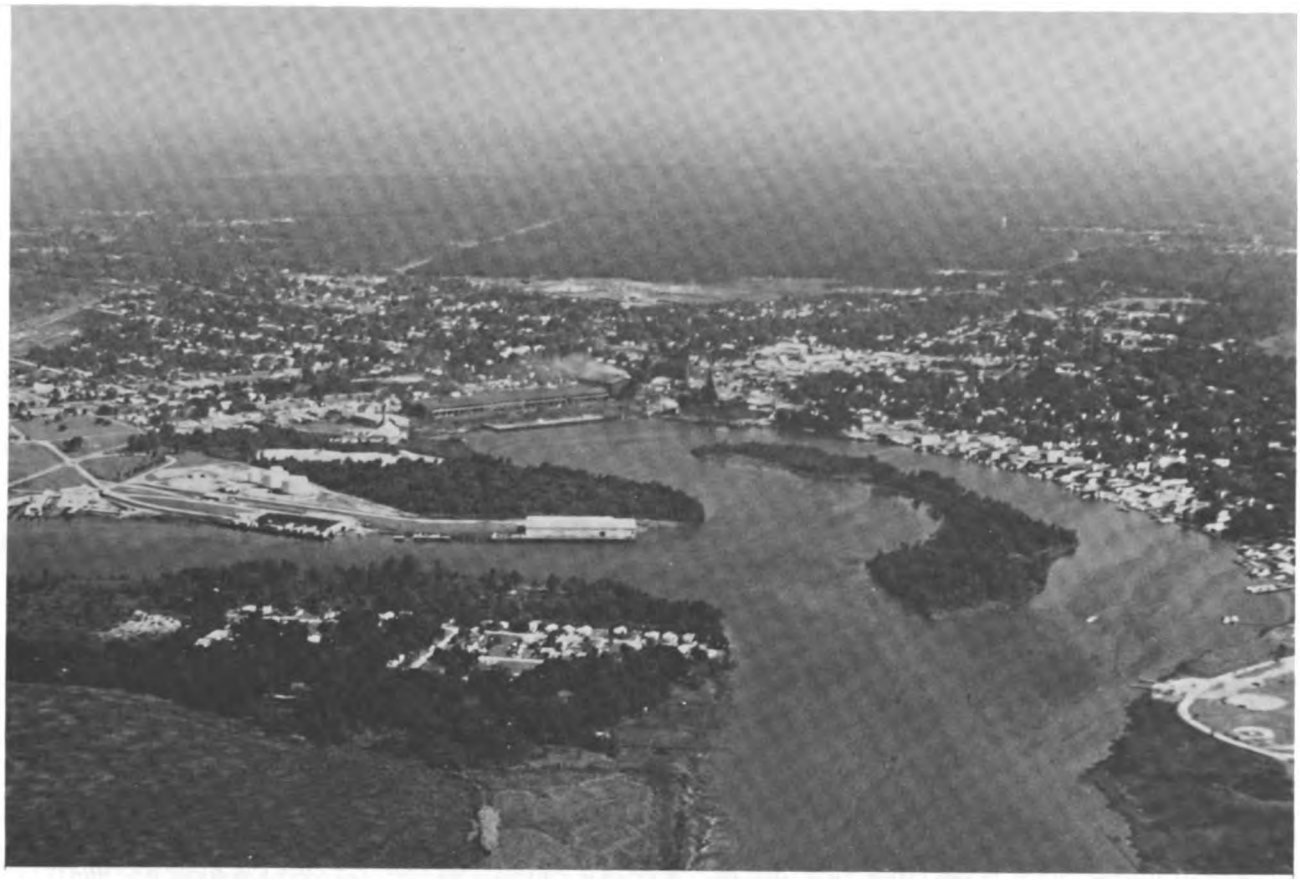
In some special cases, the opening of a river or harbor sets in motion a complex train of events that creates something entirely new. This occurred in Charleston County and the surrounding lowcountry as a result of the completion of the Charleston Harbor jetties.

Before the days of railroad domination, Charleston was the metropolis of the Southeast. On the sea, accessible to the largest ships, linked to the interior by the Charleston and Hamburg rail line (for a time, the longest in the world), Charleston attracted the cotton trade. The economic life of the city had always depended upon trade and the produce of local agriculture, and the commerce promoted regional development. But as we have seen, the Civil War used up the area's capital, while after the war, the pattern of railroad development diverted traffic away from the Charleston port.

Upcountry, textile manufacturing came to dominate the economy. Between 1870 and 1903, the number of textile mills rose from 12 to 136, the number of spindles from 34,940 to 2,479,521. By 1939, 1,311 manufacturing establishments in the state employed 126,983 wage earners, 77 per cent of whom were in the textile mills. The mills were also a focal point for investment by South Carolina financial institutions.[3] The combination of capital investment, income returned to the region from the scale of cotton goods, and employment provided by the textile manufacturing plants were the basis for economic growth in the Greenville and Spartanburg metropolitan areas. In 1900, the population of the Greenville standard metropolitan areas was 53,490. By 1940, population had risen to 136,580. The rate of population growth was 27 percent between 1900 and 1910, 29 per cent between 1910 and 1920, 32 per cent between 1920 and 1930, and 16.7 per cent between 1930 and 1940.[4] The increase in population in the upcountry represented an economic change of major proportions.

In the lowcountry, the "cotton culture," comprised of the institutions and arrangements in society that arose to facilitate the production of cotton, militated against industrial development. After the Civil War no manufacturing center appeared. The principal industry in Charleston in 1919 was fertilizer production, followed by baking, printing, soft drink manufacture, confections, ice, automobile repairing, and forest-related industries.[5] Even as late as 1972, no dominant industry had emerged. Chemicals and allied products ranked first in value of manufactured product,

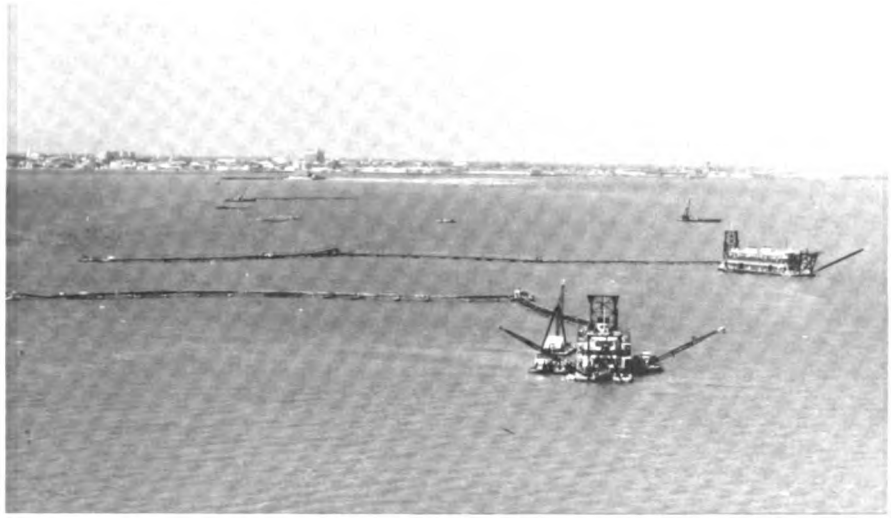
An aerial view of the inner harbor at Georgetown and the International Paper Company plant.



A modified Chinese junk on the intracoastal waterway. Pleasure craft of all types use the waterway along the South Carolina coast.

followed by stone, clay and glass production, transportation equipment, food processing, printing and publishing, textiles, dairy manufactures, and forest products.[6] In contrast to the Greenville area, where 41 per cent of all personal income came from manufacturing in 1969, manufacturing in Charleston contributed only 16 per cent of the personal income. Commerce did not induce growth in the lowcountry the first half of the 20th century. Between the world wars, Charleston was a bulk port, frequented by tramp steamers and sailing vessels. The city depended upon the port, but primarily because there was not much else. When the Depression hit and no ships came in for about six months, recalled one resident, "this town died. I mean really died . . ."[7] When the trade slowly revived it was chiefly in bulk cargoes, mostly local in origin. The territory served by the port was limited, and the industrial development continued to lag.[8]

Economic development in the Greenville area (and the absence of similar development around Charleston) can be explained by a growth model. In the model, growth depends upon the activities of key industries which respond to an increase in demand arising outside the region by exporting goods or services. The income which is returned stimulates local activities. Every increase in economic activity brings in its train a series of related economic effects. An intricate set of relationships is involved, but, depending upon the industry, the effects upon regional growth can be measured by economic multipliers and the pull or attraction the key industry has upon other manufacturing. Growth, then, is the result of a region's export base. The process may be visualized as a field of force flowing from the center of a plain, like a pole sticking up from the surrounding economic surface. The pole consists of the propulsive industries, those important enough to define the local economy in terms of their special characteristics. Like an electrical power plant, the propulsive industries illuminate and recharge the environment and make the region come alive in new ways. An urban center will be formed around the center of economic activity, if one does not already exist. This metropolis contains the key industries and houses the many service activities which come into being to complement the propulsive industries. The urban center provides goods and services, including government, to the surrounding regions, the degree of "reach" for each depending upon whether or not the surrounding areas can provide the service for themselves or must rely upon the metropolis. When development reaches the point where they key industries and the urban center can both create and attract industry, a cycle of self-sustaining growth has begun.[9]



Construction of the anchorage area, Charleston Harbor.

Snagboat **Wateree** *at work in Winyah Bay.*

At the core, the process of growth involves the importation of capital. In the South Carolina lowcountry this necessary attraction of investment capital occurred in the absence of the development of a manufacturing complex.

The fact that fortifications construction was the principal business of the Corps of Engineers before the Civil War set the stage. The engineers, as we have seen, were sent to Charleston originally when federal attention was drawn to the erosion problem at the site of Fort Moultrie. As they devised methods of extending the beach, the engineers made their expertise available locally, and from these contacts, a successful small-scale harbor improvement project developed. In the long run, however, the most important aspect of this project was the fact that it demostrated what might be accomplished when local interests entered into a partnership with the federal government, and thereby brought into being a system for investing public capital in projects which were too large for private interests or the local economy to bear.

The devastation of the Civil War made a partnership with the federal government an absolute necessity for Charleston. Recognizing this fact, Charlestonians turned to the Corps of Engineers for aid in developing and modernizing their harbor after the Civil War, and form his New York office, Quincy Gillmore responded. His plan for development was bold in scope and design. In the opinion of contemporaries, it obviously would be beneficial. When the harbor was improved, people assumed commerce would increase and prosperity would follow. The district engineers labored to complete the jetties. Gillmore did not live to see his vision fulfilled, but by 1895, the physical capacities of

Charleston Harbor equaled or were superior to those any port in the Southeastern United States.

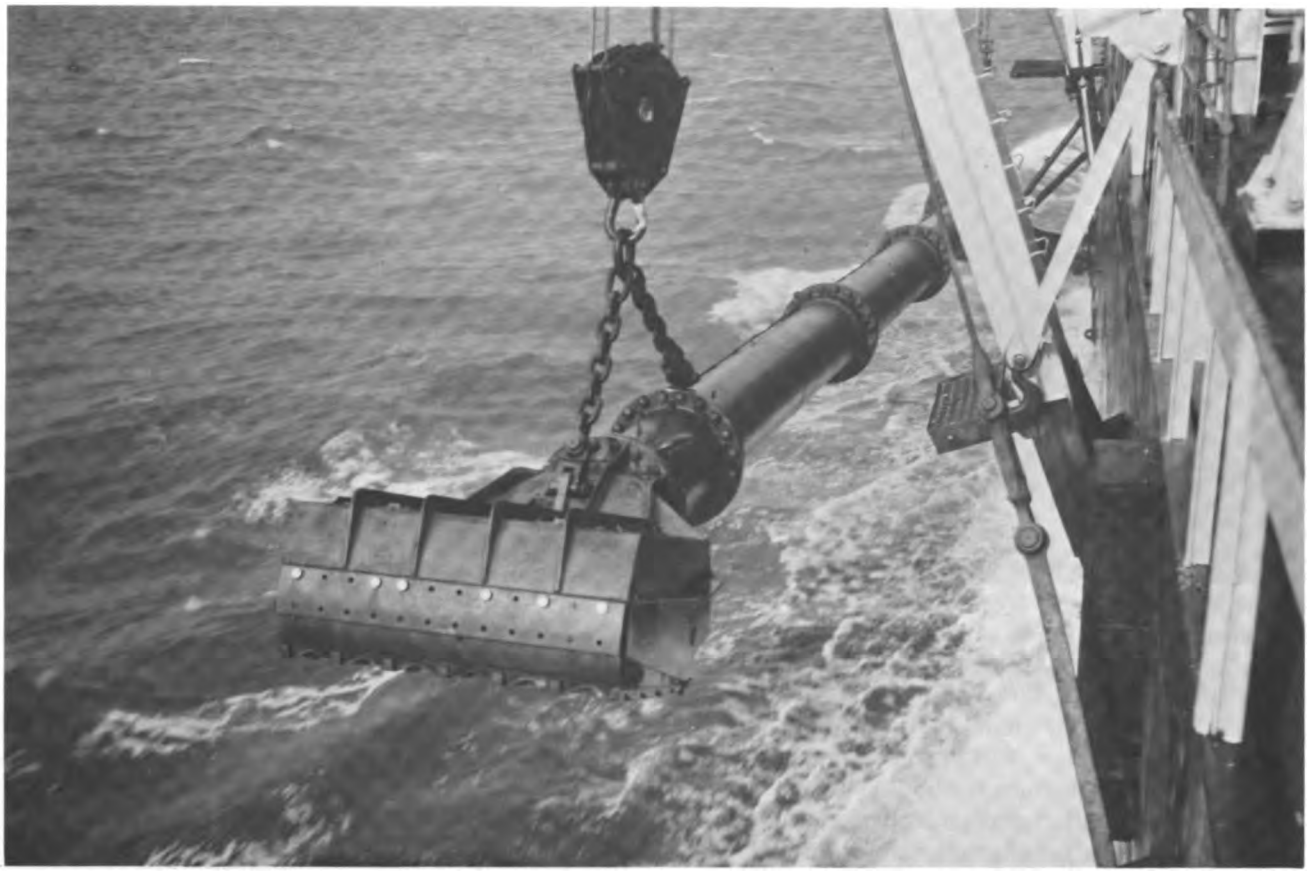
As we have seen, the region did not prosper. By 1895, the lowcountry was in the grip of a major depression with commerce declining. No one was more affected by this turn of events than Captain Frederick V. Abbott, engineer in charge at the Charleston District. Abbott had committed much of his life to the completion of the harbor project and to the future of the city in which he now resided. It is not difficult to imagine what went through his mind when he first heard the rumor that the Navy was planning to abandon its Port Royal station. We do know that Abbot spoke with his many and influential friends in the Charleston community and that these conversations set in motion the process which resulted finally in the transfer of the naval station to Charleston. The Navy's decision to relocate had far reaching consequences. Not only had a major new industry arrived, but the basis for a new regional economy was laid. That Charlestonians recognized what was involved was demonstrated by the reception given the 11 battleships constituting the three divisions of the Atlantic Fleet when they steamed up the Cooper River on Sunday, November 17, 1912. The largest naval force ever gathered in a Southern port lay at anchor for seven days. The city engaged in a general holiday with schools closed and businesses suspending work. There was a great naval and military parade, and the officers and men of the fleet were entertained royally.

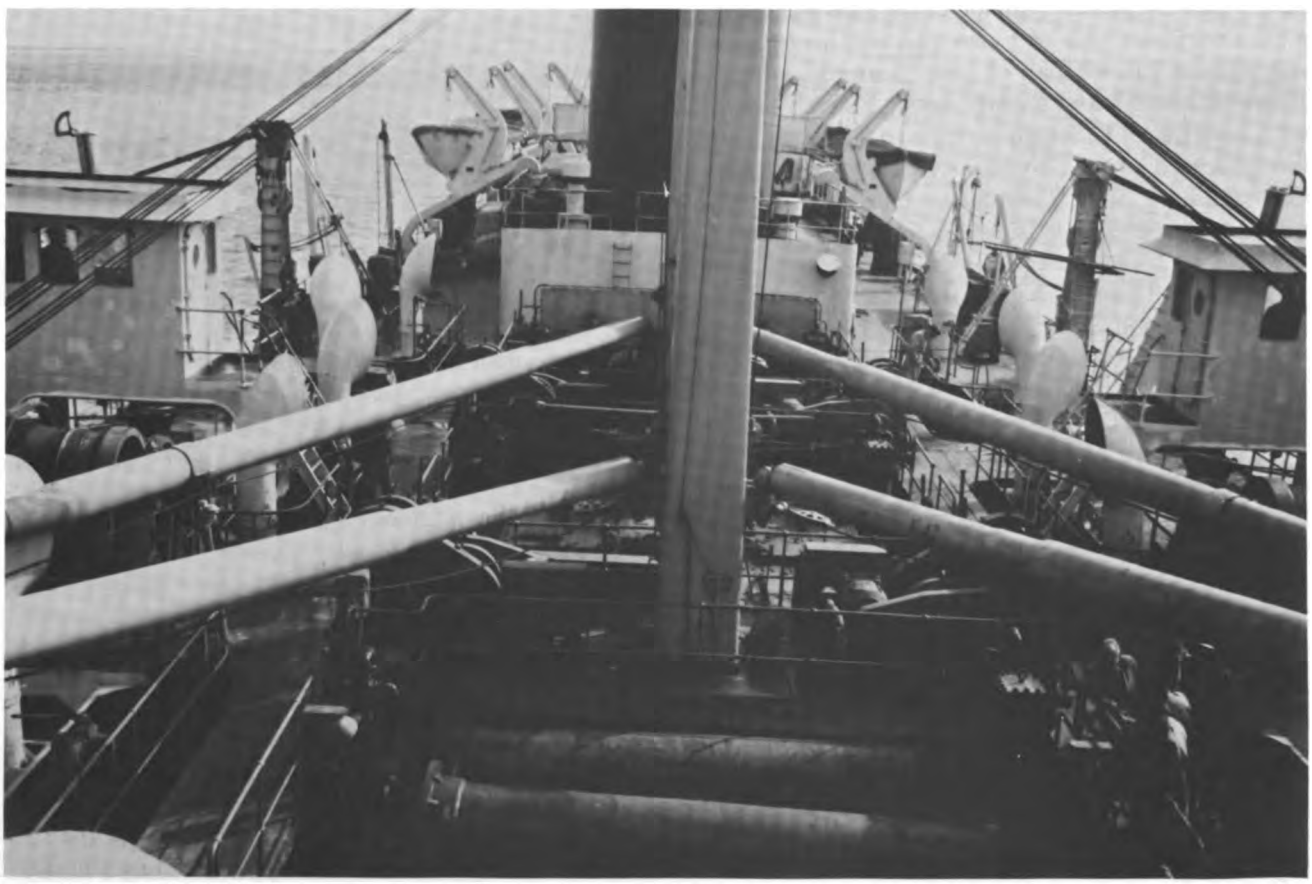
From this beginning, expenditures for national defense became more frequent and substantial, shaping the economic system of the lowcountry. During World War I, catonment construction, ordnance projects, and fortifications programs brought a considerable investment. Between July 1, 1917, and June 30, 1918, the federal government put over $35.5 million in six major projects. Camp Jackson, with its total of 42,408 officers and men, became the second largest urban area in South Carolina and contributed a payroll of over half a million dollars a month to the local economy. Camps Sevier, Wadsworth, and Green housed 27,152 officers and men. Each was larger that most Carolina cities.[10] Almost $16.5 million was spent in the lowcountry during World War I, principally in the expansion of the Navy Yard and construction of the quartermaster depot.

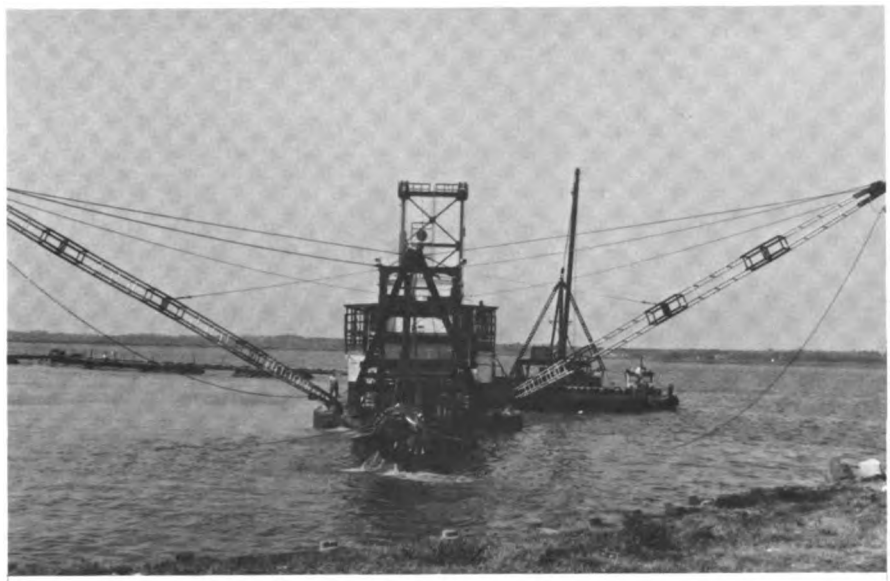
Although Charleston lost 16 per cent of its port tonnage between 1931 and 1941, the Navy Yard grew until it became the largest industry in the lowcountry and the third largest in the state. Between 1934 and 1940, the federal government earmarked $16 million for naval public works construction in the Southeast. The massive naval expansion program which began in 1937 more than doubled lowcountry payrolls at the

The sea-going hopper dredge **Gerig** *at work clearing the outer bar in Charleston Harbor. One of four modern sea-going hopper dredges owned and operated by the Corps of Engineers, the* **Gerig** *carries a crew of 78 Civil Service employees. Since commissioning in 1947 the vessel has operated on a full-time schedule, working 24 hours a day for a 10-day period before returning to port for supplies. The cost of the ship and improvements is about $5 million, and it costs approximately $100,000 a month to operate the* **Gerig.**

A hopper dredge operates somewhat like a vacuum cleaner. Two heavy dragheads attached to 28-inch diameter suction pipe lines are swung from both sides of the dredge with the dragheads moving along the channel bottom. The bottom materials are sucked up through the pipes by two centrifugal pumps, each of which has a pumping capacity of 100,000 gallons per minute. While the pumps are operating the water flows overboard until the hoppers are filled with solid materials. Then the dredge moves to deep water away from the channel area and discharges the dredged material through 12 openings in the bottom of the vessel.







A snagboat and a working dredge in the Charleston District.

Navy Yard.[11] About $5.6 million of the total was spent in the Charleston area with concentrated investment beginning in the last half of 1940. National defense programs contributed slightly under $1.3 billion to the economies of 11 Southern states then, and federal money flowed into the Southeast at the rate of nearly $5.06 a minute. South Carolina received over $136.8 million, second only to Virginia. In the 10 months prior to May 1, 1941, over $1.6 billion was poured into the South. With an aggregate of almost $158 million during this period, South Carolina ranked 22nd out of 48 states. Net defense expenditures averaged $83.50 for each of South Carolina's 899,904 residents. In this respect the state ranked 23rd in the nation.[12]

Eighty percent of the defense funds appropriated for South Carolina were spent in Charleston County. The construction of 12 destroyers represented a national investment of $109 million. This and other defense work required a number of facilities: a general hospital ($1.3 million) and a naval hospital ($8 million); dwelling units for civilian workers ($1.4 million), naval personnel ($1.7 million), and Army enlisted men ($0.7 million); improvements to the Navy Yard ($1.4 million) and the yard's power plant ($0.4 million); rehabilitation of the quartermaster depot ($0.5 million); and construction of the depot ship loading dock and railroad approach ($1 million), an ammunition depot ($1 million), and shipbuilding facilities ($0.5 million).[13]

Even small defense expenditures had great local impact. An Army recreational camp for the use of Fort Jackson trainees was located in Charleston. Initially, the camp had a capacity of 500 men, later expanded to 1,000. Soldiers with less than $3.00 in their pockets were not allowed to make the trip to Charleston. Those who did come brought more than $3.00 to town and usually left their money there. The average weekly income to the city from this source was estimated at $5,000. The Darlington 178th Field Artillery unit of the National Guard contributed $13,000 annually to its community, making it an important local industry. The Georgetown Armory was designated as a subbase of the Charleston naval command, and some 200 naval reservists assigned to coastal defense duty received training at the facility. The operation added approximately $98,000

a year to local income. A new Coast Guard district with headquarters in Charleston and boundaries conforming to the 6th Naval District was established on March 1, 1941. The command included 10 vessels and the Coast Guard stations at Charleston; Ocracoke-Beaufort and Southport, both in North Carolina; and St. Simons, Georgia.[14]

The national defense programs boosted South Carolina's ability to accumulate social resources. At the turn of the century, no good roads exited to the north of Charleston. Except for rail and water transportation, the city was cut off from the rest of the state. By the late 1930s, a state roadbuilding program had made good progress in constructing a highway network, and the determination that national defense required a new national highway system meant that South Carolina would be able to obtain its roads quickly.[15] Schools were similarly benefitted. Compared to other states, South Carolina made a poor showing in public education. In 1940, the average salary of teachers across the United States was $1,441 a year. In South Carolina the average was $743. Federal authorizations for building schools in defense-impacted areas enabled the state to begin to close the gap. In 1941, Charleston received $2.5 million to provide schools for children of families employed at the Navy Yard. In addition, funds were available for education-related projects of the Federal Housing Authority and federal aid for construction of new buildings at The Citadel, a state liberal arts military college.[16] The effects of defense spending were similarly important across South Carolina, Richland County, site of the expansion of Fort Jackson, had defense activity totaling $14.3 million. Spartanburg was engaged in $7.3 million worth of defense work. Military orders to South Carolina textile mills brought $1.2 million to Greenwood County and $1.1 million to Aiken County.[17]

Fifteen and a half months after launching a large scale defense spending program in May, 1940, federal investments nationwide topped $10 billion. By April 1941, payrolls at the Charleston Navy Yard were $284,000 a week. They leaped to $350,000 a week in September and topped $400,000 a week in October. Between July, 1940, and June, 1941, when the per capita income in South Carolina averaged $301, Charleston received $856.60 for every man, woman, and child in the county. The city gained 218.95 per cent in consumer income between 1931 and 1941, standing sixth in the nation in the rate of increase. The surge was directly attributable to defense spending. Defense contracts in the area now amounted to $106 million, making Charleston 33rd in the nation in this respect. Columbia, South Carolina, showed increases of $7.8 million and a 19 percent gain in consumer income.[18]

That was just the beginning. Defense spending continued during the war, dropped slightly after the cessation of hostilities, and moved upward again with the national rearmament program which followed after the onset of the Korean War. The effect was to mold more closely the lowcountry economy and military spending. In 1940, the federal government had 10,184 civilian officeholders in South Carolina, adding some $18 million to the state payrolls. In addition, approximately $66,874,000 was channeled into the state in the form of nonrepayable grants, payments, and expenditures exclusive of military expenditures and federal payrolls.[19] By 1964, the Charleston Navy Yard alone was providing South Carolina with $155 million yearly. The full economic impact cannot be measured without taking economic multipliers into account. Considered as an industry, the Charleston Navy Yard was worth about 6 per cent of the state net product.[20]

In the South Carolina lowcountry, increases in personal income population correlate with the intensity of federal investment, as does the proliferation of establishments servicing the local economy. Military payrolls rose from $1.71 million annually in 1921 to $15.79 million in 1940, more than doubled by 1950, rose to $50.8 million in 1959, and increased to $139.8 million by 1969. Federal sources accounted for 35.5 per cent of personal income in 1950, and 34 per cent in 1969, more than four times their contribution in 1921.[21]

Federal spending was translated into long term economic growth when defense construction was turned over to the states. The South Carolina State Ports Authority acquired the military port terminals without cost and began operations with major facilities. With the solid backing of the state governments, more terminals were constructed and port traffic climbed, benefitting textile manufacture and agriculture.[22] A study of the impact of South Carolina ports on the state's economy in 1964 concluded that direct and indirect revenues exceeded $303 million, about 6 per cent of the total net state product of $5 billion. In 1973, the figures were even more dramatic. Directly or indirectly, the ports contributed, exclusive of all port-related military impact, 30,064 jobs, representing a payroll of over $207 million and revenues in excess of $506 million.[23]

The contributions of the engineers of the Charleston District were significant at every stage in the development of the new regional economy. To begin with, the jetties project made Charleston Harbor usable by the Navy. It was the modernization of the port that tipped the balance in the delicate discussions which preceeded the decision in the Navy's Bureau of Yards and Docks to relocate. Construction of the fortifications system carried out by the engineers under the program recommended by the Endicott Board established an

The South Carolina State Ports Authority facilities at Charleston: the Columbus Street Terminal, one of the busiest container terminals in the South Atlantic area; the North Charleston docks, and the Grain Export Elevator.

Two former homes of the district: the U.S. Customs House, and the Copperthwait Building on King Street (used from 1956 to 1961).

Army garrison on a permanent basis. Around the turn of the century, the lowcountry engineers had played a critical role in bringing a modest coastal defense and naval complex to Charleston. During World War I, cantonment construction, ordnance projects, and fortifications programs added to the system. The engineers improved the harbor further. Between the world wars, Fort Moultrie was designated a sub-port of embarkation. Many of the construction programs of World War II, so massive that they boosted the region's capacity to accumulate social resources, were supervised by the lowcountry engineers. The first modern system of commercial airports in the Carolinas evolved from the military fields built by the district. After the Second World War, the South Carolina State Ports Authority acquired, without cost, terminals that had been built by the federal government. These facilities, and the later easy access to the interior provided by the interstate highway network, opened the way for the first real commercial growth at the Charleston port in over a century and a half, and the long sought commercial revival, diversifying the economy, was developed in the lowcountry in the third of a century after World War II. That economic system owes much to the development of the port, to modern aviation facilities, and to the complex of federal installations.[24] All are substantial "secondary benefits" of individual construction projects traceable to the work of the Charleston Engineer District.

Today, the Engineer District at Charleston is a large and complex organization, a sub-unit of the even larger and more complex system of government which serves American society. District engineers find themselves at the center of the decision-making processes which deal with the demanding problems posed by the modern age. The need to balance economic growth with environmental protection of the nation's water resources is a representative example of the seemingly intractable questions which must be faced today. Resolution of this and other issues will be neither simple nor clear cut, but in the decision-making process, the lowcountry engineers can be expected to play an important and lively role.

The District Offices

Quincy Gillmore exercised his command of the Charleston District from New York City, but resident engineers worked out of Fort Moultrie. With the completion of the Customs House, the district obtained a permanent home on the peninsula. Castle Pinckney, abandoned by Confederate forces in February, 1865, and returned to federal service by the 21st U.S. Colored Troops, served as a repair yard for the dredges owned by the district. At the turn of the century it had a fairly modern machine shop, a laundry, and working space for the 20 machinists, carpenters, and laborers. During the two world wars the district expanded into temporary quarters wherever they could be acquired. Today the district occupies the equivalent of two floors in the L. Mendel Rivers Federal Building and has a separate vehicle garage and storage facility.

NOTE:

The boundaries of the Charleston District of the United States Army Corps of Engineers have changed since the writing of this history. In 1980 the district was made responsible for civil works within the political boundaries of the State of South Carolina, up to but not including the Savannah River.

Col Q.A. Gillmore . . . . . 1870 - Apr 5, 1888
Col Henry L. Abbott . . . . Apr 6, 1888 - Apr 19, 1888
Capt Frederic V. Abbott Apr 20, 1888 - Sep 15, 1897
Lt Edwin A. Stuart . . . . . Sep 15, 1897 - Oct 9, 1897
Maj Ernest H. Ruffner . . . Oct 9, 1897 - May 7, 1900
Capt J.C. Sanford . . . . . May 8, 1900 - Apr 28, 1903
Capt G.P. Howell . . . . . Apr 29, 1903 - Jul 24, 1907
Capt E.R. Stuart . . . . . Jul 25, 1907 - Jul 13, 1908
Col Dan C. Kingman . . . . Jul 13, 1908 - Jul 24, 1908
Capt E.M. Adams . . . . . Jul 24, 1908 - Jun 2, 1909
Capt Earl I. Brown . . . . . Jun 2, 1909 - Aug 6, 1909
Capt E.M. Adams . . . . . Aug 6, 1909 - Mar 16, 1911
Col Dan C. Kingman . . . Mar 16, 1911 - Jul 28, 1911
Maj G.P. Howell . . . . . Jul 28, 1911 - Aug 14, 1914
Col John Biddle . . . . . Aug 14, 1914 - Aug 31, 1914
Maj G.A. Youngberg . . . . Sep 1, 1914 - Jul 21, 1917
LTC W.B. Ladue . . . . . Jul 21, 1917 - Aug 23, 1917
Col John Millis . . . . . Aug 23, 1917 - Oct 5, 1917
Mr. James P. Allen . . . . . Oct 6, 1917 - Dec 31, 1918
Col G.R. Lukesh . . . . . Jan 1, 1919 - Jul 31, 1920
Col G.P. Howell . . . . . Aug 1, 1920 - Oct 31, 1920
Maj G.R. Young . . . . . Nov 1, 1920 - Jun 5, 1922
Col Spencer Cosby . . . . . Jun 6, 1922 - Jul 25, 1922
Col Edgar Hadwin . . . . . Jul 26, 1922 - Jun 11, 1924
Maj Dan I. Sultan . . . . . Jun 12, 1924 - Aug 4, 1924
Maj F.K. Newcomer . . . . Aug 5, 1924 - Dec 29, 1925
Col J.C. Oakes . . . . . Dec 20, 1925 - Nov 3, 1926
Maj Wm. P. Thompkins . . Nov 6, 1926 - Jan 31, 1927
Col J.C. Oakes . . . . . Feb 1, 1927 - May 8, 1927
Maj Wm. P. Thompkins . . May 9, 1927-May 31, 1927
Maj Notley Y. Duhamel . . . Jun 1, 1927 - Jul 24, 1931
Maj Douglas L. Weart . . . Jul 25, 1931 - Aug 25, 1931
Maj Gilbert V.B. Wilkes . . Aug 26, 1931-Nov 23, 1933
Maj W.G. Caples . . . . . Nov 24, 1933 - Apr 22, 1936
Capt Fred T. Bass . . . . . Apr 23, 1936 - Aug 6, 1937
Col Jarvis J. Bain . . . . . Aug 7, 1937 - Apr 30, 1938
LTC R.F. Fowler . . . . . May 1, 1938 - Aug 23, 1938
Col Reading Wilkinson . . . Aug 24, 1938-Dec 15, 1940
Col W.B. Ladue . . . . . Dec 16, 1940 - May 31, 1941
Col Reading Wilkinson . . . . Jun 1, 1941 - Apr 1, 1942
Col D.W. Griffiths . . . . . Apr 2, 1942 - Mar 4, 1943
LTC J.W. Patton, Jr. . . . . Mar 6, 1943 - Mar 16, 1943
Col Ira F. Bennett . . . . . Mar 17, 1943 - May 15, 1943
LTC J.W. Patton, Jr. . . . . May 16, 1943 - Jul 19, 1944
Col Holland R. Robb . . . . . Jul 20, 1944 - Dec 2, 1944
LTC John P. Larsen . . . . . Dec 3, 1944 - Feb 4, 1945
Col Carl R. Shaw . . . . . Feb 5, 1945 - Sep 11, 1945
LTC John P. Larsen . . . . . Sep 12, 1945 - Jan 3, 1946
Col Ellis E. Haring . . . . . Jan 4, 1946 - Sep 30, 1946
Col John B. Hughes . . . . . Oct 1, 1946 - Apr 27, 1947
Col Paschal N. Strong . . Apr 28, 1947 - May 11, 1947
Col John B. Hughes . . . . May 12, 1947 - Oct 31, 1947
Col Paschal N. Strong . . . . Nov 1, 1947 - Jan 30, 1948
Col Edward Daly . . . . . Jan 31, 1948 - Jun 11, 1949
Mr. Worth Candrick . . . . Jun 12, 1949 - Jun 19, 1949
LTC J.B. Lampert . . . . . Jun 20, 1949 - Jul 14, 1950
Col R.C. Brown . . . . . Jul 15, 1950 - Jan 8, 1951
Col C.L. Landaker . . . . . Jan 9, 1951 - Aug 14, 1953
Col Clyde C. Zeigler . . . . Aug 15, 1953 - Jul 19, 1956
Col Parker O. Stuart . . . . . Jul 20, 1956 - Jun 17, 1959
Col John R. Thompson . . . Jun 18, 1959 - Jun 8, 1962
Maj Jack G. Becker . . . . . Jun 9, 1962 - Jul 19, 1962
Col Sears Y. Coker . . . . . Jul 20, 1962 - Jul 11, 1965
Col Robert E. Rich . . . . . Jul 12, 1965 - Jul 11, 1968
Col Burke W. Lee . . . . . Jul 12, 1968 - Jul 8, 1971
LTC Robert L. Broughton . . . Jul 9, 1971-Aug 10, 1971
Col Robert C. Nelson . . . . Aug 11, 1971 - Jul 11, 1974
Col Harry S. Wilson, Jr. . . Jul 12, 1974 - Jun 19, 1977
Col William W. Brown . . . Jun 20, 1977 - Jun 24, 1980

Notes

Chapter 1

[1]Charles Towne was founded during the first or second week of April, 1670. The precise date is not known. This account is plausible reconstruction based on contemporary descriptions and sailing practices and the investigations carried on by the staff at Charles Towne Landing State Park. See Thomas Petigru Lesene, *History of Charleston County South Carolina* (Charleston, 1931), 21-25; Stanley South, "Archeology at Charles Towne Site on Albemarle Point in South Carolina," III, Prepared by the Institute of Archeology and Anthropology, University of South Carolina, Charles Towne Landing files, and Joseph I. Waring, *The First Voyage and Settlement at Charles Town, 1670-1680* (Columbia, 1970), 22-25.

[2]*The Shaftesbury Papers and Other Records Relating to Carolina and the First Settlement on the Ashley River Prior to the Year 1676, Collections of the South Carolina Historical Society* (Charleston, 1897), 225, 228, 343; Patrick Melvin, "Captain Florence O'Sullivan and the Origins of Carolina," *South Carolina Historical Magazine,* 76 (1975), 235-249. The military authority granted the Carolina Proprieters in 1663 allowed them to raise and build "forts, fortresses, castles, cities, boroughs, towns, villages, and other fortifications" and "to fortify and furnish them with ordnance, powder, shot, armor, and all other weapons."

[3]Max Savelle, *The Origins of American Diplomacy, The International History of Angloamerica, 1492-1763* (New York, 1967), 66-67, 262-270, 298, 348, 512, 515, 527, 535.

[4]The narrative of colonial events is taken from Joseph Ioor Waring, ed., "An Account of the Invasion of South Carolina by the French and Spaniards in 1706," *South Carolina Historical Magazine,* 66 (1965), 98; Eugene Sirmans, *Colonial South Carolina, A Political History 1663-1763* (Chapel Hill, 1966), *passim;* Verner W. Crane, *The Southern Frontier, 1670-1732* (Durham, 1928), 22, 71-73, 86-87, 93-96, 169-171, 187, 240-244, 247; Douglas E. Leach, *Arms for Empire, A Military History of the British Colonies in North America, 1607-1763* (New York, 1973), xi-xii, 61, 137-138, 249, 275; J. Leitch Wright, Jr., *Anglo-Spanish Rivalry in North America* (Athens, 1971), 6, 48-50, 66-69; Larry E. Ivers, *Colonial Forts of South Carolina 1670-1775* (Columbia, 1970), 5, 31-33; Jack M. Sossin, *The Revolutionary Frontier* 1763-1783 (New York, 1967), 67-70; Ernest M. Lander, *A History of South Carolina 1865-1960.* 2nd. ed. (Columbia, 1970). Ch. 1.

[5]Commander W. E. May, "His Majesty's Ships on the Carolina Station," *South Carolina Historical Magazine,* 71 (1970), 162-169; Leo Francis Stock, ed., *Proceedings and Debates of the British Parliaments Respecting North America,* 4 Vols. (Washington, 1924-1937), II, 441; III, xii-xiii, 438, 445, 488; IV, 51, 685; *Journal of the Commissioners of Fortifications, 1755-1770,* South Carolina State Archives, *passim.*

[6]On the changing technology of warfare see J. F. C. Fuller, *Armament and History, A Study of Armament on History from the Dawn of Classical Warfare to the Second World War* (New York, 1945); Robert Wilkinson-Latham, *British Artillery on Land and Sea 1790-1820* (London, 1973); Oliver Lyman Spaulding, Hoffman Nickerson, John Womack Wright, *Warfare, A Study of Military Methods From the Earliest Times* (Washington, 1937); B. H. St. J. O'Neil, *Castles and Cannon, A Study of Early Artillery Fortifications in England* (Oxford, U. K., 1960); Bernard and Fawn M. Brodie, *From the Crossbow to the H-Bomb* (Bloomington, 1962); O. F. C. Hogg, *Artillery, Its Origin, Heyday, and Decline* (Hamden, Conn., 1970), 276.

[7]Michall Lewis, *The Navy of Britain, A Historical Portrait* (London, 1948), 425-426; Peter Padfield, *Guns at Sea* (London 1973), 159-170; Theodore Ropp, *War in the Modern World* (Durham, 1959), 60-75; (Albert Manucy, *Artillery Through the Ages* (Washington, 1949), 41-52.

[8]Robert M. Weir, *"A Most Important Epocha," The Coming of the Revolution in South Carolina* (Columbia, 1970); Walter J. Fraser, Jr., *Patriots, Pistols and Petticoats* (Charleston, 1976), 66-80.

[9]The fort is described in Edwin C. Bearss, *The First Two Fort Moultries, A Structural History, Fort Sumter National Monument* (Washington, 1968), 8-9. Americans, Carolinians in particular, have overestimated the importance of the battle, which seems to have given the defenders an uncalled for overconfidence. Britons considered the handling of the assault a disgrace, and an official investigation was held. When the results were reported, King George III said he did not feel his forces dishonored themselves. He did add that he would have been pleased if the attack had not been attempted. G. R. Barnes and J. H. Owen, eds., *The Private Papers of John, Earl of Sandwich, First Lord of the Admiralty, 1771-1782* (London, 1932), 129-143.

[10]Lee Kennett, "Charleston in 1778: A French Intelligence

Report," *South Carolina Historical Magazine*, 66 (1965); Francis V. Greene, *The Revolutionary War and the Military Policy of the United States* (New York, 1911); Fraser, *Patriots, Pistols, and Petticoats*, 132-135. The Americans surrendered 7 generals, 290 other officers, 5,169 rank and file, including continentals, militia, and armed citiens, a total of 5,466 men and also gave up 391 guns, 5,316 muskets, 15 regimental colors, 33,346 rounds of small arms ammunition, 8,394 round shot, 376 barrels of powder.

[11]Ropp, *War in the Modern World*, 97.

[12]Francis Paul Prucha, *The Sword of the Republic, The United States Army on the Frontier 1783-1846* (Toronto, 1969; 3rd Cong., 1st ses., Feb. 28, 1794, *American State Papers, Military Affairs*, 1, 61-67; James Ripley Jacobs, *The Beginnings of the U.S. Army 1783-1812* (Princeton, 1947), 286-287; Harry M. Ward, *The Department of War, 1781-1795* (Pittsburgh, 1962), *passim*. The definitive work on the origin of the federal military establishment is Richard H. Kohn, *Eagle and Sword* (New York 1975).

[13]3rd. Cong., 1st. sess., Feb. 28, 1794, *American State Papers, Military Affairs*, I, 64. By statute, Charles Towne became Charleston in 1783.

[14]Bearss, *The First Two Fort Moultries*, 36-43.

[15]"Statement of Moneys applied for the defense of certain Ports and Harbors in the United States, in pursuance of the 'Act to provide for the defense of certain Ports and Harbors in the United States,' passed the 20th March, 1794, distinguishing the moneys expended for the Fortifications of each Harbor to the 16th November, 1801, inclusive." *American State Papers, Military Affairs*, I, 153; Bearss, *The First Two Fort Moultries*, 72-76.

[16]Bearss, *The First Two Fort Moultries*, 51-66.

[17]President John Adams to Congress, "Military Academy, and Reorganization of the Army," Jan. 14, 1800, *American State Papers, Military Affairs*, I, 133.

[18]Forest G. Hill, *Roads, Rails & Waterways, The Army Engineers and Early Transportation* (Norman, 1957), 3-36.

[19]Emanuel Raymond Lewis, *Seacoast Fortifications of the United States: An Introductory History* (Washington, 1970), 31-32.

[20]S. Ex. Doc. 196, 47th Cong., 1st sess.; "Fortification," 12th Cong., 1st sess., 1811, *American State Papers, Military Affairs*, II, 307; "Fortifications and Gunboats," 10th Cong., 1st sess., 1807, *American State Papers, Military Affairs*, I, 217-219; Jacobs, *Beginnings of U.S. Army*, 370-371.

[21]U.S. Department of Commerce, Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970*, 2 Parts (Washington, 1975), II, 115; S. Ex. Doc. 196, 47th Cong., 1st sess., "Statement of Appropriations and Expenditures for Public Buildings, Rivers and Harbors, Forts, Arsenals, Armories and other Public Works from March 4, 1789 to June 30, 1882."

Chapter 2

[1]16th Cong., 2nd sess., 1821, "Fortifications," *American State Papers, Military Affairs*, II, 304 ff.; Hill, *Roads, Rails & Waterways*, 6-9; Lewis, *Seacoast Defenses*, Parts II-IV; John Gross Barnard, *Eulogy on the Late Bvt. Maj. Gen. Joseph G. Totten, Chief Engineer, United States Army* (Washington, 1866), reprinted in Engineer School Occasional Paper 16.

[2]Printed in *American State Papers, Military Affairs*, II, 304-313.

[3]S. Ex. Doc. 196, 47th Cong., 1st sess., 1882; Jamie W. Moore; *The Fortifications Board 1816-1828 And The Definition of National Security*, No. XVI, *The Citadel Monograph Series* (Charleston, 1981).

[4]Message of Governor Andrew Pickens, Nov. 25, 1917, South Carolina State Archives; S.C. Stat. L., VI, 58-60, "Report of the Civil and Military Engineer of the State of South Carolina for the Year 1818."

[5]Daniel W. Hollis, "Costly Delusion: Inland Navigation in the South Carolina Piedmont," *Proceedings of the South Carolina Historical Association*, 1968 (Columbia, 1968), 29-43.

[6]Cited in George D. Brown, "A History of the Blue Ridge Railroad, 1852-1874," M.A. thesis, University of South Carolina (Columbia, 1967), 2. On the South Carolina economy in general for the period see Alfred Glaze Smith, Jr., *Economic Readjustment of an Old Cotton State, South Carolina 1820-1860* (Columbia, 1958).

[7]"First Semi-Annual Report to the President and Directors of the South Carolina Canal and Rail-Road Company by their Committee of Inquiry" (Charleston, 1828); "Semi-Annual Report of the Board of Directors of the South Carolina Canal and Railroad Company" (Charleston, 1829); William Howard, *Report on the Charleston and Hamburg Rail-Road* (Charleston, Aug. 27, 1829), South Caroliniana Library, University of South Carolina.

[8]H.S. Tanner, *A Description of the Canals and Railroads of the United States* (New York, 1840); Eugene Alvarez, *Travel on Southern Ante-Bellum Railroads 1828-1860* (University of Alabama, 1974), pg. 168, 172; "Statistics of the So. Carolina Railroads in 1846," *Hunts Merchants Magazine* (Oct., 1847), 426-427.

[9]Office of Chief of Engineers, "Revised Report of the Board of Engineers on the Defense of the Coast of the United States 1826," B-53 ½, Record Group 77, National Archives (hereafter cited RG 77, NA); "On the Means and Measures Necessary for the Military and Naval Defenses of the Country," 24th Cong., 1st. sess., 1837, *American State Papers, Military Affairs*, III, 365-403; S. Doc. 1, 25th Cong., 3rd sess., Nov 28, 1838, 98-99; HH, Doc. 206, 25th Cong., 1st sess., May 15, 1840; S. Doc. 85th, 28th Cong., 2nd sess., Feb 7, 1845; S. Rpt. 141, 32nd Cong., 1st sess., March 23, 1852. On the subsequent evolution of defense and fortifications doctrines see Harold and Margaret Sprout, *The Rise of American Naval Power*, 1776-1918 (Princeton, 1946); C. Joseph Bernardo and Eugene H. Bacon, *American Military Policy, Its Development Since 1775* (Harrisburg, 1955), 165-171; Kenneth Bourne, *Britain and the Balance of Power in North America 1815-1908* (Berkeley and Los Angeles, 1967), *passim*; Moore, *Fortifications Board 1816-1828*.

[10]Notes of former Chief Engineer Henry R. Rivers. Charleston District files. The highest present-day elevations

in the old city part of Charleston are 17 feet above the mean low water line. The problem is, what were the elevations in 1752? During the past 200 years streets have been built over and over again, with additional fill each time, and landfilling has been an ongoing process. Rivers' estimate was that the highest point in the city in 1752 could not have been more than 15 feet.

[11]Lt. Joseph K. Mansfield to Chief Engineer Charles Gratiot, July 25, 1838, RG 77, NA.

[12]Edwin C. Bearss, *Fort Moultrie, No. 3, Fort Sumter National Monument, Sullivan's Island, South Carolina* (Department of the Interior, National Park Service, Division of History, Office of Archeology and Historic Preservation Dec. 30, 1968), 29-36, 125-133.

[13]Petition of Citizens of Moultrieville to President Andrew Jackson, Aug. 4, 1835, RG 77, NA.

[14]Bearss, *Fort Moultrie No. 3*, 123-156; S. Ex. Doc. 196, 47th Cong., 1st sess.; Bowman to Joseph G. Totten, Chief of Engineers, Jan. 29, 1853, RG 77, NA.

[15]Frank Barnes, "Fort Sumter National Monument, South Carolina," National Park Service Historical Handbook Series No. 12 (Washington, 1952); Lewis, *Seacoast Fortifications*, 42-53; South Carolina Attorney General R.B. Gilchrist to Secretary of War Lewis Cass, Nov. 29, 1834, RG 77, NA.

[16]John G. Van Duesen, *Economic Basis of Disunion in South Carolina* (New York, 1928), 104-144, 334, 336, 339. In 1841 Holmes secured $25,000 for an arsenal at Cannonsboro, $75,000 for Fort Sumter and $48,000 for other works in Charleston Harbor. In 1850, Holmes was responsible for appropriations for Charleston totaling $63,000. In 1847, he secured $30,000 to build a customs house. This sum was frequently increased until by 1875 a total of nearly $1.5 million had been spent.

[17]Quoted without citing the author in *The Seaport of the South, A description of Charleston Harbor and the Jetties to be constructed by the United States Government to Render the Entrance Accessible at all Times to the Largest Vessels* (Charleston, 1878), 5.

[18]A.D. Bache, *Report on the Harbor of Charleston to the Chamber of Commerce* (Charleston, 1852); Totten to Bowman, Oct. 7, 1852 and Bowman to Totten, Jan. 28, 1853, RG 77, NA: Annual Reports to the Chief of Engineers, 1853, 1854. These reports are cited hereafter ARCE.

[19]Totten to Bowman, Oct. 7, 1852, June 17, 1853; Bowman to Totten, Jan. 28, 1853; Newton to Totten, Dec. 16 and Totten to Newton, Dec. 22, 1954; Cullum to Totten, July 13, 1855, July 18, 1856, March 9, 1857, RG 77, NA: *Seaport of the South*, 6: William Murray Black, "The Improvement of Harbors on the South Atlantic Coast of the United States," *Transactions of the American Society of Civil Engineers*, XXIX (July, 1898), 223-276.

Chapter 3

[1]S. Rpt. 555. Pt. 2, 45th Cong., 3rd sess., 1878, 339, 348; Letter-books, 1838-1860, RG 77, NA.

[2]Major Richard Delafield, "Report of National Defenses, 1851." D4268, SW2365, RG 77, NA; "Military commission to Europe in 1855 and 1856, Report of Major Alfred Mordecai of the Ordnance Department," S. Ex. Doc. 60, 36th Cong., 1st sess., 1860; "Report on the Art of War in Europe in 1854, 1855, and 1856," S. Ex. Doc. 59, 36th Cong., 1st sess., 1860; see also Annual Report of the Chief of Engineers (hereafter ARCE) for 1854. 1855, 1856, 1857.

[3]S. Ex. Doc. 196, 47th Cong., 1st sess., 1882; H. Ex. Doc. 64, 34th Cong., 1st sess., 1856; S. Ex. Doc. 1, 35th Cong., 2nd sess., 1858.

[4]*Civil War Official Records, Army*, I, 1;IV, 4,9; Chief Engineer Totten to Secretary of War Jefferson Davis, 1856, RG 77, NA. Eighteen fortifications comprised the part of the system of coastal defenses located from Virginia to Pensacola. Three were in Charleston Harbor. Only Fort Monroe, Virginia, headquarters of the U.S. Army's Artillery School of Practice, was completely garrisoned. The typical state of readiness could be glimpsed at Fort Moultrie, Key West, and Barrancas, where housekeeping units were on duty. But when querried about the system's readiness, Totten told Davis that although individual forts were not ready to fight immediately, they could be put into first class condition in short order.

[5]*Battles and Leaders of the Civil War*, 4 Vols. (New York, 1884-1887), I, 611-616. The fleet which had been dreamed of by the American navy but never submitted to Congress for approval in a budget was an armada of 90 steamers of war and a reserve of between 100-150 merchant steamers which could be converted to naval use.

[6]The complex issue of the origins of the Civil War is beyond the scope of this study. But the militia response and the volunteering and the attitude of the lowcountry population—see*Mary Boykin Chestnut, A Diary from Dixie*, Isabella D. Martin and Myrta Lockett, eds., (New York, 1905), 42—lend credence to the compelling interpretation advanced in Steven A. Channing, *Crisis of Fear, Secession in South Carolina* (New York, 1970). By the late 18th century, the South Carolina militia had taken on the functions of being both a ready reserve force and the visible representation of the state's power to control slaves. In 1794 and 1797, the militia was reorganized in the expectation of foreign attack. Following the War of 1812, Carolinians became concerned about the possibility of slave uprisings and the militia was pointed in this direction. With the advent of the nullification crisis and the concomitant acceptance of the states' rights philosophy, the militia became, in the theory, the body which guaranteed South Carolina's sovereignty. According to a report to the state legislature in 1838, the militia establishment had to be maintained to protect the state against "the potential federal usurper." The concept was not as implausible as it might seem today. The regular U.S. Army of the day numbered less than 10,000 men and was stationed mainly in the West. See "Report of the Commission Appointed at the First Session of the Legislature to Make a Digest of the Militia and Patrol Laws," Senate Report, 1839, South Carolina State Archives, and related materials in the Military Affairs files; Jean Martin Flynn, "South Carolina's Compliance with the Militia Act of 1792," *South Carolina Historical Magazine*, 69 (1968), 26, 43.

[7]Gilbert Sumter Guinn, "Coastal Defense of the Confederate Atlantic Seaboard States, 1861-1862, A Study in Political Military Mobilization," Ph.D. dissertation, University of South Carolina (Columbia, 1973); Thomas Lawrence Connelly and Archer Jones, *The Politics of Command, Factions and Ideas in Confederate Strategy* (Baton Rouge, 1973), 3-30; Robert C. Black III, *The Railroads of the Confederacy* (Chapel Hill, 1952) 161-162 and *passim.*

[8]*Battles and Leaders of the Civil War,* II, 1-12; Virgil Carrington Jones, *The Civil War at Sea,* 3 Vols., (New York, 1960-1962), I, *passim;* Guinn, "Coastal Defense of the Confederate States," 199-213.

[9]*Battles and Leaders of the Civil War,* IV, 5.

[10]For a resume of the military campaigns see E. Merton Coulter, *The Confederate States of America 1861-1865,* Vol III, Wendell Holmes Stephenson and E. Merton Coulter, eds., *A History of the South* (Baton Rouge, 1950); E. Milby Burton. *The Siege of Charleston, 1861-1865* (Columbia, 1970); Q.A. Gillmore, *Engineer and Artillery Operations Against the Defenses of Charleston Harbor in 1863; Comprising the Descent Upon Morris Island, the Demolition of Fort Sumter, the Reduction of Forts Wagner and Gregg, With Observations on Heavy Ordnance, Fortifications, etc.* (New York, 1865), *passim.*

[11]Willard B. Robinson, *American Forts, Architectural Form and Function* (Urbana, 1977), 129. The siege spawned an interservice quarrel. Army generals like Gillmore said it was self evident the Navy could have run by the fortifications in Charleston if the naval commanders had been bolder. Naval authorities disagreed. The argument could not be settled, of course, but it tended to disappear as an issue when the Corps of Engineers again identified coastal defense as its primary military mission and fortifications construction as its organizational interest in the postwar decade. See Gillmore, *Engineer and Artillery Operations* and Chapter 6, below.

[12]Charles R. Suter to Chief Engineer Richard Delafield, April 2, 1866, RG 77, NA. Part of the harbor survey is in Suter to Delafield, Jan. 3, 1866.

Chapter 4

[1]ARCE, 1873, 1726-1732; ARCE, 1874, 4-5; ARCE, 1884, 1078-1089; ARCE, 1880, 126-127, 922 ff.

[2]ARCE, 1875, 30-31, 82-83. A report the following year indicated no perceptable improvement from dredging in the channel. The project was also touched by allegations of local scandal. ARCE, 1876, 431; "Seaport of the South," 5.

[3]"Seaport of the South," 6; ARCE, 1876, 431; ARCE, 1877, 369-371.

[4]Carl V. Harris, "Right Fork or Left Fork? The Section-Party Alignments of Southern Democrats in Congress, 1873-1897," *Journal of Southern History,* XLII (Nov., 1976), 471-506.

[5]"Seaport of the South," 7.

[6]The tidal basin formed by Charleston Harbor, as computed by coastal survey charts, was about 15 square miles. During each flood tide this area was filled with a layer or prism of water 5.1 feet in height above the main low-water level. In addition, the adjacent reaches of the tributary rivers were resting on the sloping low-water line of the river and extending up to a point where the influence of the tidal wave ceased to produce a rise and fall in the surface of the water. Each ebb tide the lower portions of these wedge-shaped masses flowed out throught the gorge of the harbor. Land drainage added an additional volume of water. Assuming that one-half the rainfall reached the sea, this amounted to 76,571,000 cubic feet in the Charleston harbor. The total drainage, normally, was 3,655,443,686 cubic feet. For two or three days during the period of spring tides, the average ebb-discharge was augmented to about 4,228,846,000 cubic feet.

This immense volume of water flowed due south from the Cooper River and southeast from the Ashley, coming together at the tip of the peninsula. There the relative strength of the discharge diverted the flow according to the laws of physics into a south-southeast current. This current's movement toward the sea was checked by the land mass of James Island, and a substrata of hard rock, causing the current to be deflected due eastward. The next interruption to the water flow was Sullivan's Island, again with a substrata of hard rock, which deflected the ebb flow to the harbor mouth. A second ebb current moved through Hog Island Channel. It too was deflected by Sullivan's Island. The impact of the two currents probably had caused the massive erosion of the southern end of the island.

[7]ARCE, 1875, 35; ARCE, 1882, 1057-1065.

[8]The report on the Charleston harbor survey and Gillmore's design is printed in ARCE, 1878, 554-572. Up to 1878, the removal of wrecks and work in Beach Channel had consumed $93,700 in federal funds. The City of Charleston spent $30,578 for the work in Pumpkin Hill Channel. ARCE, 1879, 731-739; "Seaport of the South," 6.

[9]ARCE, 1896, 1191.

[10]ARCE, 1878, 554-572; ARCE, 1896, 1189-1192; "Seaport of the South," 6-9.

[11]ARCE, 1879, 731-739.

[12]ARCE, 1879, 731-739; ARCE, 1894, 1101 ff.; ARCE, 1896, 1192-1193; Articles of Agreement (contract) with Eli T. Bangs and Moses Dolby, Aug. 19, 1879, NA, Federal Records Center, East Point, Georgia.

[13]Charleston *News and Courier,* Aug. 13, 1878.

[14]ARCE, 1882, 1135.

[15]Black, "The Improvement of Harbors on the South Atlantic Coast," 252; ARCE, 1875, 38-41. Built in Brooklyn, the *Charleston* was 122 feet 6 inches long, 30 feet at the beam, and had a 12-foot depth at the hold. She was furnished with a steeple, compound Sullivan propelling engine, with cylinders 17 and 32 inches in diameter, and 22 inches stroke. She had one propeller wheel 7 feet 1 inch in diameter. Her pumping machinery was of the B.C. Howell pattern, and consisted of a 230 H.P. compound condensing reciprocating engine and centrifugal pump, with a 15-inch discharge pipe and 14½-inch suction. Her carrying capacity was estimated at 225 cubic yards. The *Charleston* carried a crew of 16 men. ARCE, 1891, 1472.

[16]ARCE, 1883, 880-882; ARCE, 1884, 1078-1089. The survey of 1883 provided the first complete map of the area.

It also showed that in the inner harbor the Hog Island Channel had receded 350 feet between 1823 and 1881 and an additional 35 to 40 feet between 1881-1883. The width of the harbor channel, which measured 1,400 feet from 1823 to 1835, had increased to 1,900 feet. Further cutting away of the Mount Pleasant shoreline was noted, although this was attributed to the increased volume of water in the ebb flow in Hog Island Channel and not to the jetties.

[17]Abbott held every commission in the Corps of Engineers from second lieutenant to brigadier general. During World War I he commanded 36,000 engineer replacements and special troops in Washington. He married Sara Julie Devon, granddaughter of the Episcopal Bishop of South Carolina in 1885. Notes of Henry R. Rivers, Charleston District files; E.D. Sloan. Jr. to the author, May 25, 1979.

[18]ARCE, 1887, 140.

[19]ARCE, 1887, 140; Charleston *News and Courier,* July 21, 1886. The boosterism was based on a comparison of trade statistics for the years 1878 and 1886, and if one neglected the fact Charleston's trade in 1878 was still below prewar levels in many categories, the rise seemed spectacular.

	1878	1886	
Vessels arrived	769	1,103	+43.4%
Vessels arrived tons	505,830	668,430	+36.1%
Vessels cleared	609	1,116	+83.3%
Vessels cleared (tons)	347,360	675,671	+94.5%
Value of receipts	$47,536,832	$66,948,552	+40.1%
Cotton exports (bales)	430,225	498,170	+15.8%
Rice Exports (barrels)	41,843	69,497	+66.1%
Naval stores (tons)	290,832	311,334	+ 7.0%
Phosphate rock (tons)	120,490	198,588	+64.8%
Lumber (bd. feet)	9,595,053	27,615,705	+187.8%

[20]ARCE, 1889, 1150-1154.

[21]ARCE, 1895, 1103-1105.

[22]In 1891 the government plant deposited stone on the south jetty at a cost of $1.70 per ton. A private contractor, doing the same work in the north jetty, had a cost of $2.20 a ton. In a measured work period in 1892-1893, the contractor deposited 54,686 tons of stone at a cost of $114,990.89. The cost of the government's own operation was $91,420.60 for depositing 53,641 tons of stone, a savings of 40 cents a ton. ARCE, 1890, 1190 ff.; ARCE, 1891, 175-176, 1467; ARCE, 1892, 173-174; ARCE, 1896, 1194.

[23]ARCE, 1893, 1496-1499. The plant at the Trenton Quarry was first operated in 1890 and furnished 106,462 tons of granite. Private contractors took out 56,860 tons, the government the rest. In 1892 the plant and quarry were valued at $7,500 and leased for $200 a month and 2½ cents a ton for rock taken out. The total amount received from this rental was $7,200, and the plant was returned in good condition. The net cost of the operation was $300. However, the value placed on the plant by the government was artificially high; real value was $5,000. In 1896 arrangements were made to begin quarry work again, especially to crush stone and furnish it for use in construction of the mortar battery. Practically an entire new plant was built, and it was leased on similar terms. ARCE, 1896, 512-515.

[24]This velocity occurred at 12:36 AM and held for one minute. Weather Bureau Table, ARCE, 1894.

[25]ARCE, 1894, 1103-1105.

[26]Report of the Hearings Before the Senate Committee on Naval Affairs "Relative to the Proposed Transfer of the Naval Station from Port Royal, S.C. to Charleston, S.C.," Feb. 1 and Feb. 5, 1901, printed in *Charleston Year Book, 1900,* Appendix, 83-205 at p. 159.

[27]ARCE, 1895, 1422; ARCE, 1899, 1552-1557; ARCE, 1897, 1487.

[28]ARCE, 1896, 1189-1199. Up until the First World War expenditures amounted to $5,084,771.90. Of this $4,037,256.70 was spent on the project approved in 1878 and modified in 1888 and $636,749.86 on the project of 1899. In 1910 an improvement for a 28-foot channel was authorized. ARCE, 1915, 577.

Chapter 5

[1]Charleston Chamber of Commerce, *Annual Review of Trade and Commerce of Charleston, 1892* (Charleston, 1893), 19.

[2]Mordecai T. Endicott, Chief of Bureau of Yards and Docks, Navy Department, to Secretary of the Navy John D. Long, May 7, 1900, pamphlet; remarks of George S. Legare in the House of Representatives on Feb. 23, 1904, South Caroliniana Collection, U.S.C.

[3]ARCE, 1885, 1154-1170; ARCE, 1885-1886, 1157-1170. In 1884 Georgetown handled about 150,000 tons of outbound freight and 200,000 tons of inbound freight.

[4]ARCE, 1885-1886, 1157-1170.

[5]ARCE, 1889, 1102-1116; ARCE, 1893, 1444-1449.

[6]ARCE, 1893, 1444-1449.

[7]ARCE, 1915, 1806-1807.

[8]ARCE, 1873, 754; ARCE, 1879, 87-88, 727; ARCE, 1883, 864-866; ARCE, 1885, 162-163, 172-173.

[9]ARCE, 1873, 754; ARCE, 1883, 866; ARCE, 1885, 172-173.

[10]Charleston *News and Courier,* July 21, 1886. The articles in the issue dealing with Charleston's future were later published separately.

Chapter 6

[1]Viktor Ernst Karl Rudolph vou Scheliha, *A Treatise on Coast-Defense* (London, 1868), Greenwood Press ed., 1971, pt. I. The Civil War impressed foreign observers as well as Americans with the fact that when ships and forts dueled on anything like even terms, fortifications got the better of the exchange. From an examination of the structures involved at the sieges of Charleston and Georgetown, one could conclude that with thicker walls and iron embrasures, casemate works would become as formidable as ever. Yet, the American experience had little effect on developments abroad because foreign governments treated the Civil War as a unique event and preferred to rely on their own experts. See Jay Luvaas, *The Military Legacy of the Civil War* (Chicago, 1959), 44-46.

[2]Report of the Secretary of War, 1870, 440. These reports are cited hereafter RSW.

[3]"Sea Coast Defenses," RSW, H. Ex. Doc. 271, 41 Cong., 2nd sess., 1870.

[4]H. Ex. Doc. 271, 41st Cong., 2nd sess., 1870; H. Rpt. 354, 49th Cong., 1st sess., 1874; RSW, 1882, 7; RSW, 1883, 52; ARCE, 1876, 31; ARCE, 1879, 4-5; ARCE, 1880, 4-18; ARCE, 1881, 399-417; ARCE, 1884, 4-9. The Engineer School of Application at Willets Point, New York Harbor, offered in its winter term in 1888 a 21-week course which had, for the first year officers, a curricula of 19 weeks training on submarine mining and two weeks on civil engineering. In the second year, submarine mining required four weeks, civil engineering five weeks (the subjects concentrated mostly on river improvements), four weeks were devoted to photography, and seven weeks were spent on other aspects of military engineering. ARCE, 1888, 357-364.

[5]In addition to Endicott the members were: Brig. Gen. Stephen V. Benet, Chief of Ordnance; Brig. General John Newton, Chief of Engineers; Lt. Col. Henry L. Abbott, Corps of Engineers; Capt. Charles S. Smith, Ordnance Dept.; Cmdr. W.T. Sampson, U.S.N.; Cmdr. Caspar F. Goodrich, U.S.N.; Joseph Morgan, Jr. of Pennsylvania; and Erastus Corning of New York.

[6]"Report of the Board on Fortifications or Other Defenses Appointed by the President of the United States Under the Provisions of the Act of Congress, Approved March 3, 1885, William C. Endicott, Secretary of War, President," H. Ex. Doc. 1, Pt. 2, Vol. II, Pt. 1, 49th Cong., 2nd sess., RSW 1886, 499-525.

[7]RSW, 1894, 13; RSW 1895, 14.

[8]ARCE, 1896, 502-503, 508.

[9]ARCE, 1896 508-511; Edwin C. Bearss, *Battery Jasper. Historic Structures Report*-Part II (National Park Service, Oct. 21, 1978), 11-19.

[10]ARCE, 1897, 682-687.

[11]So reads the report: ARCE, 1898, 8. And people personally familiar with the civil defense preparations made in American cities during World War II could relate to the account. But a close reading of the Charleston and area newspapers does not reveal a civilian population under stress. Rather, people displayed an interest in what was going on. In short order, the American victories shifted all thoughts to what would happen in fighting that would take place *elsewhere.*

[12]ARCE, 1898, 706-707.

[13]ARCE, 1898, 25, 702-703; ARCE, 1899, 861-865.

[14]ARCE, 1899, 862-863; ARCE, 1900, 914; ARCE, 1914, 561; "Coast Defenses of the United States and the Insular Possessions," S. Doc. 248, 59th Cong., 1st sess., 1906.

[15]Report from Committee on Appropriations to accompany H.R. 12235, 63rd Cong., 2nd sess., 1914 printed also in *Cong. Rec.* LI (Jan. 29, 1914), 2513-2533. Appropriations for the 26 fiscal years 1889-1914 aggregated $146,956.72. $127,492,732.72 was appropriated for the U.S., $19,414,264 was appropriated for insular possessions. The average was $5,652,192.18 per year. During fiscal years 1889 and 1900, $14,287,396 was appropriated in fortifications acts and $13,049,751.87 was allotted in the $50 million national defense act of March 9, 1898, making the total for the 55th Congress $36,012,045.86. In addition to the above, sums were appropriated for fortification purposes in acts making appropriations for the support of the Army as follows: 1888, $2,500; 1901, $35,000; 1902, $259,200; 1903, $389,000, a total of $685,700. There were also sums from acts making appropriations for sundry civil expenses of government: 1904, $591,046.25; 1905, $40,000; 1906, $158,953.75, a total of $790,000. In addition, urgent deficiency acts in 1902 and 1907 carried for fortifications the sums $3,000 and $977.79 respectively.

Chapter 7

[1]*Historical and Descriptive Review of Charleston* (Charleston, 1884), 22. South Caroliniana Collection, U.S.C.; C. Van Woodward, *Origins of the New South* (Baton Rouge, 1951), 107. Municipal difficulties are fully described in the "Report of a Special Committee of City Council in regard to the Report of the Committee of the Chamber of Commerce, Appointed to investigate the Financial Condition of the City of Charleston," August 20, 1875 and "The Report of a Special Committee of the Chamber of Commerce, Presented and Adopted March 29, 1880" (Charleston, 1880), both in the South Caroliniana Collection, U.S.C. Economic resources simply were not available for industrial development. The Charleston *News and Courier* reported November 1, 1888:

Financial Data

	1860	1888
Banking Capital, Charleston	$ 12,000,000	$ 1,500,000
Banking Capital, U.S.	420,000,000	700,000,000
Taxable Realty, Charleston	26,000,000	17,000,000
Taxable Personalty, Charleston	37,000,000	11,000,000
Manufacturing Investment, U.S.	740,000	6,000,000

[2]Willie Frank Putnam, "An Anaylsis of Public Aid to Railroads in South Carolina, 1865-1900," M.A. thesis (University of South Carolina, 1957), 13-49.

[3]Van Woodward, *Origins of the New South,* 121; Herbert L. Satterlee, *J. Pierpont Morgan, An Intimate Portrait* (New York, 1939), 227, 265-266, 274; Frederick Lewis Allen, *The Great Pierpont Morgan* (New York, 1949); "Southern Railroad, Plan of Reorganization, By-Laws, and Charter," (Richmond, 1884), Caroliniana Collection, U.S.C.; Edwin P. Hoyt, Jr., *The House of Morgan* (New York, 1966), 179 ff; John K. Winkler, *Morgan the Magnificant, The Life of J. Pierpont Morgan* (New York, 1930), 127-130; Thomas J. Wertenbaker, *Norfolk, Historic Southern Port,* Rev. Ed. (Durham, 1962), 179-280; Edward G. Campbell, *The Reorganization of the American Railroad System, 1893-1900* (New York, 1938), 322 as quoted in Van Woodward, *Origins of the New South,* 295; Lander, *History of South Carolina,* 99-101.

[4]Cotton Movement 1865-1892, Selected Years

Crop Year	Upland Crop (bales)	Receipts at Charleston (bales)	Per Cent Received at Charleston	Price per Pound ¢
1865-66	2,193,987			36-38
1869-70	3,154,946	250,761	11.43	32
1872-73	3,930,308	386,128	9.82	17¾
1877-78	4,773,865	429,292	8.99	11⅛-11¼
1881-82	5,435,845	502,304	9.24	12¼
1884-85	5,669,021	512,039	9.03	9¼
1887-88	7,004,434	540,068	6.43	9⅜
1891-92	9,015,970	511,273	5.67	6¾

Source: Annual Review of Trade, Charleston *News and Courier, 1892.*

[5]Consumption and production of Cotton in South Carolina 1850-1903

Year	No. of Mills	No. of Spindles	No. of Bales Consumed	No. of Bales Produced	% of Crop Used Instate
1849-50	18	36,500	9,929	300,901	3.3
1859-60	17	30,890	8,648	353,412	2.4
1869-70	12	34,940	10,811	224,500	4.8
1874-75	18	70,282	19,945	360,000	5.5
1879-80	14	82,424	33,624	522,548	6.4
1884-85	31	217,761	77,451	511,800	15.1
1889-90	34	332,784	133,342	747,190	17.8
1894-95	48	619,849	229,580	862,604	26.6
1899-1900	93	1,693,649	489,559	830,714	59.9
1902-03	136	2,479,521	587,126	925,490	63.4

Source: State Department of Agriculture, Handbook of South Carolina (Columbia, 1980), 430.

[6]"Petition of Sundry Mills." A statement of adverse discrimination of South Carolina by the Southern Railway, South Caroliniana Collection, U.S.C.

[7]ARCE, 1880, 1049-1052; Chamber of Commerce Reports on the Trade and Commerce of Charleston for 1873 and 1874, South Caroliniana Collection, U.S.C.; Jamie W. Moore, "The Great South Carolina Interstate and West Indian Exposition of 1901," *Sandlapper,* 11 (July, 1978), 11-15.

[8] Value of Foreign and Domestic Commerce Through Charleston Harbor

Year[1]	$	Year[2]	$
1882-83	75,115,400	1901	29,454,515
1883-84	64,512,190	1902	34,746,997
1884-85	67,650,058	1903	47,659,427
1885-86	66,948,552	1904	49,994,894
1886-87	66,279,571	1905	51,631,040
1887-88	67,805,754	1906	56,301,096
1888-89	76,653,442	1907	56,138,444
1889-90	80,619,717	1908	61,444,244
1890-91	98,554,719	1909	79,253,684
1891-92	83,905,397	1910	100,619,552
1892-93	75,126,498	1911	77,388,475
1893-94	71,319,702	1912	73,440,486
1894-95	67,246,348	1913	79,225,772
1895-96	67,265,129	1914	46,800,741
1896-97	75,740,261		

[1]Sept. 1 - Aug. 31
[2]calandar year

Sources: Charleston *News and Courier* Annual Trade Review ARCE.

[9] Value of Exports of Domestic Merchandise[9] Through Charleston

Year	$	% of U.S. Total	Year	$	% of U.S. Total
1856	17,328,503	5.58	1888	15,464,752	2.26
1858	16,887,882	5.75	1890	13,788,751	2.10
1860	21,179,350	5.68	1892	16,718,387	1.65
1866	9,624,229	1.75	1894	13,063,090	1.50
1868	9,913,776	2.68	1896	8,497,732	.98
1870	10,772,071	2.37	1898	11,440,130	.95
1872	10,933,430	2.29	1900	7,151,720	.52
1874	14,200,041	2.47	1902	5,857,364	.43
1876	18,088,152	3.04	1904	2,330,675	.16
1878	17,727,783	2.55	1906	661,285	.04
1880	19,590,627	2.38	1908	2,510,965	.14
1882	19,475,433	2.66	1910	8,104,821	.47
1884	16,231,892	2.24	1912	12,423,035	.57
1886	17,629,902	2.65			

Source: Statistical Abstracts of the United States 1856-1912.

[10]Charleston *Year Book 1910,* xiii.

[11]Value of Imports Through Charleston Harbor

Year	$	% of U.S. Imports	Year	$	% of U.S. Imports
1856	1,905,234	.31	1888	490,102	.07
1858	2,070,249	.74	1890	646,644	.08
1860	1,569,570	.43	1892	896,681	.11
1866	587,260	.13	1894	670,879	.10
1868	497,300	.14	1896	502,297	.06
1870	505,699	.12	1898	1,311,533	2.13
1872	740,976	.12	1900	1,124,671	.13
1874	803,575	.14	1902	1,590,078	.18
1876	455,562	.10	1904	1,685,832	1.70
1878	134,564	.03	1906	2,751,482	.22
1880	202,790	.03	1908	3,375,997	.28
1882	577,148	.08	1910	5,228,053	.34
1884	462,949	.07	1912	5,024,674	.30
1886	721,581	.11			

Source: Statistical Abstracts of the United States for appropriate years.

[12]*American State Papers, Naval Affairs,* I, 715-716, 951; II, 465-482, 636; III, 275-276; IV, 565-589.

[13]*Charleston Year Book, 1900,* Appendix, a reprint of Report of Hearings Before the Senate Committee on Naval Affairs; *Charleston Year Book, 1901,* "Notes of Establishment of the Naval Station;" *Charleston Year Book, 1902,* Appendix.

Parris Island became a major military facility during World War I. The first Marine Corps post was established

when a small detachment was posted for duty at the Port Royal Naval Station. The naval station was retained after the Charleston station was opened, although most operations were transferred. In 1909 a school for Marine officers was established. In 1911 a small recruit depot was added. This was transferred to Norfolk later in the year and the building used by the Marines was turned into a naval disciplinary barracks. On November 1, 1915, the recruit depot was moved back to Parris Island. In 1917 the entire island was taken over by the government and used to train Marines. Port Royal, however, declined rapidly in commercial importance and in 1922 the *Silver Leaf* picked up a load of lumber and sailed away, the last commercial vessel to ply the harbor until 1958 when the new $1.5 million pier of the State Ports Authority opened. Katherine M. Jones, *Port Royal Under Six Flags* (New York, 1960), 335-336, 347-348.

[14]ARCE, 1889, 1551; ARCE, 1902, 1167; ARCE, 1904, 1574-1585; S. Doc. 300, 61st Cong., 2nd sess. By 1909 Charleston had 26 feet at low water and was the deepest port south of Cape Hatteras. Data in the table below is from *Charleston Year Book, 1909*, 17.

Comparative Depths

	Low Water	High Water
Portland, Me.	30 ft	38 ft 8 in
Boston, Mass.	27 ft	36 ft 5 in
New York, N.Y.	35 ft	39 ft 5 in
Philadelphia, Pa.	22 ft	27 ft
Baltimore, Md.	35 ft	36 ft
Norfolk, Va.	28 ft	30 ft 7 in
Wilmington, N.C.	20 ft	24 ft 6 in
Charleston, S.C.	26 ft	31 ft 2 in
Savannah, Ga.	21 ft	28 ft
Brunswick, Ga.	20 ft	27 ft
Jacksonville, Fla.	24 ft	24 ft 8 in
Fernandina, Fla.	23 ft	29 ft

[15]Remarks of Congressman George S. Legare in the House of Representatives, Feb. 23, 1904, pamphlet, South Caroliniana Collection, U.S.C.; John Joseph Duffy, "Charleston Politics in the Progress Era," Ph.D. dissertation (University of South Carolina, 1963), 96-97

[16]"A Story of the Coast Defense Squadron and the Cruiser Charleston," *Charleston Year Book, 1905*, Appendix, 29-56.

[17]Duffy, "Charleston Politics in the Progressive Era," 98-99, 279-280, Francis Butler Simkins, *Pitchfork Ben Tillman* (Baton Rouge, 1944), 527.

Chapter 8

[1]Henry L. Rivers notes, Charleston District files.

[2]H. Doc. 627, 63rd Cong., 2nd sess., 1914; H. Doc. 41, 71st Cong., 1st. sess., 1929.

[3]Committee on Rivers and Harbors, House of Representatives, Doc. No. 6, 75th Cong., 1st. sess.

[4]Committee on Rivers and Harbors, House of Representatives, Doc. No. 14, 72nd Cong., 1st sess.

[5]See Committee on Rivers and Harbors, House of Representatives, Doc. No. 6, 75th Cong., 1st. sess.

[6]S. Doc. 189, 78th Cong., 2nd sess., 18.

[7]ARCE, 1916, 613-618.

[8]"Report of Congaree Navigation Study Committee of the South Carolina General Assembly," (Columbia, 1961), 25; S. Doc. 189, 78th Cong., 2nd sess. (1944), 27.

[9]U.S. Department of Commerce, Maritime Administration, "Domestic Waterborne Shipping Market Analysis, Inland Waterways Trade Area, Final Report," Submitted by A.T. Kearney, Inc., (Feb., 1974); U.S. Department of Commerce, Maritime Administration, Domestic Waterborne Shipping Market Analysis, Domestic Ocean Trade Area, Final Report," submitted by A.T. Kearney, Inc. (Feb., 1974), Norfolk, Va., for example, was served by 35 coastwise carriers prior to World War II. In 1974, only three lines called at the port, even though total commerce had increased.

[10]S. Doc. 189, 78th Cong., 2nd sess., 18, 26.

[11]War Department, Board of Eng. for Rivers and Harbors, June 18, 1946, 824.02 (Yadkin R.-Upper Waters) Wilson Round Library, University of North Carolina at Chapel Hill cited hereafter UNC-WRL; Johnson J. Hayes, *The Land of Wilkes* (Wilkesboro, 1962), 341. According to engineer records, the Southern railway connected with today's North Wilkesboro in 1889.

[12]Leland R. Johnson, *The Falls City Engineers, A History of the Louisville District, Corps of Engineers United States Army* (Louisville, 1974), 193-199. The cost estimates were printed in H. Doc. 308, 68th Cong., 1st. session and the subsequent reports are known as the "308 reports."

[13]ARCE, 1953, 4-5.

[14]H. Doc. 308, 69th Cong., 1st. sess.; Public Law 738, 74th Cong.

[15]Design Memorandum No. 6-B, W. Kerr Scott Reservoir, Master Plan, July 21, 1965, Charleston District files.

[16]Johnson J. Hayes, *The Land of the Wilkes* (Wilkesboro, 1962), 341-343; Record of Public Hearing, Oct. 17, 1945, Wilkesboro, attached to War Dept., Bd. of Eng. for R & H, 824.02 (Yadkin R.-Upper Waters), UNC-WRL.

[17]H. Doc. 652, 78th Cong., 2nd sess.

[18]T. Sanville, N.C. Geological and Economic Survey, "Water Power Survey of Surrey and Wilkes Counties" (Economic Paper No. 53), 1922; Hayes, *Land of the Wilkes*, 342-343; Record of Public Hearing, Oct. 17, 1945, Charleston District files.

[19]War Department, Board of Engineers for R & H, 824.02 (Yadkin R.-Upper Waters), Wilson Round Library, University of North Carolina.

[20]Record of Public Hearing, Oct. 17, 1945, Charleston District files.

[21]P. L. 526, 70th Cong. The Corps of Engineers' evaluation was based on this computation:

Plan	Estimates	
	First Cost	Annual Carrying Charges
Single Dam (Wilkesboro)	$ 4,753,600	203,900
Two Dams (Wilkesboro, upper) (Wilkesboro)	4,266,000	183,000
Expanded Project (2 Dams on Yadkin, 2 on Reddies R.)	7,194,000[1]	308,600[1]
14 Concrete Gravity-Sectional Overflow Dams (Tributaries)	12,224,300	524,400
Levees	(unfeasible)	

[1]Figures as modified by Board of Engineers for R & H.

Source: War Dept. Bd. of Eng. for R & H, 824.02 (Yadkin R.-Upper Waters), CD files.

[22]Hayes, *Land of the Wilkes*, 342-343.

[23]"Transmittal of General Design Memorandum, Wilkesboro Reservoir, Yadkin River, North Carolina," Dec. 31, 1958, with indorsements, Div. Eng. So. Atlantic Div. to COE, Feb. 5 1959; South Atlantic Division *Water Resources Development by the U.S. Army Corps of Engineers in North Carolina* (Atlanta, 1975), 91-92.

[24]Design Memorandum 6-B, W. Kerr Scott Reservoir, Master Plan, July 21, 1965, Charleston District files; South Atl. Div., *Water Resources Development in North Carolina*, 92.

[25]So. Atl. Div., *Water Resources Development in North Carolina*, 91.

[26]ARCE, 1915, 1808; ARCE, 1922, 717-718.

[27]H. Doc. 288, 62nd Cong., 2nd sess.; H. Doc. 1946, 64th Cong., 2nd sess., 21-29, 57, 58, 64-68; 40 Stat. L., 725.

[28]H. Doc. 288, 68th Cong., 1st sess.; H. Doc. 249, 69th Cong., 1st. sess.; Committee on Rivers and Harbors, House of Representatives. Doc. No. 13, 71st. Cong., 2nd sess.; H. Doc. 449, 74th Cong., 2nd sess., Committee on Rivers and Harbors, House of Representatives, Doc. No. 38, 75th Cong., 1st. sess.

[29]In 1855, 1859, 1863-64, 1896 and 1900. H. Doc. 221, 58th Cong., 2nd sess., 2.

[30]H. Doc 221, 58th Cong., 2nd sess.; H. Doc, 469, 81st. Cong., 2nd sess., 10. In the 1880s and 1890s Port Royal was the principal port through which the Coosaw phosphate rock moved to foreign and domestic markets. Vessels drawing up to 22 feet moved this commodity from Port Royal to the ocean and then to dometsic and foreign ports. In 1870 phosphate rock production had amounted to 65,241 tons. Commerce steadily increased, and by 1885 production amounted to about 673,192 tons. The peak of the phosphate movement through Port Royal Harbor was about 1893, when 450,000 tons moved out of the harbor. After 1893, the industry in South Carolina declined and in 1898 a hurricane demolished most of the plant and equipment. These misfortunes, together with the discovery of higher-grade phosphate in Florida, put an end to operations in the vicinity of Port Royal. No other commercial statistics are available for the harbor at Port Royal or at Beaufort. It was believed that no deep-draft vessels used Port Royal Harbor for the next 45 years. See also H. Doc 199, 58th Cong., 2nd sess.

[31]H. Doc. 469, 81st. Cong., 2nd sess. A report for the South Carolina State Ports Authority showed that in 1945, 723.7 million board feet measure of lumber were produced in South Carolina and about 28 percent, some 400,000 tons in the Port Royal tributary area. In addition to the project cost, annual upkeep carrying charges of $131,000 were calculated in the cost. Benefits were estimated at $156,600 annually, yielding a cost-benefit ratio of 1.20.

[32]H. Doc. 211, 76th Cong., 1st. sess., 10-12.

[33]H. Doc. 21, 81st Cong., 1st. sess.

[34]H. Doc. 211, 76th Cong., 1st sess., 10-11.

Chapter 9

[1]George Brown Tindall, *The Emergence of the New South 1913-1945*, Vol. X, Wendell Holmes Stephenson and E. Merton Coulter, eds., *A History of the South* (Baton Rouge, 1967), 53-54.

[2]Charleston *News and Courier*, March 26, April 13, 14, 15, May 3, July 14, 1917.

[3]During World War I Congress appropriated for coastal defense: 1914, $250,000; 1915, $585,000; 1916, $2,300,000; 1917, $5,000,000; 1919, $380,000.

[4]Fort Sumter had two 12-inch rifles, one on disappearing mount, one mounted *en barbette*. At Fort Moultrie were Battery Jasper (4-10" guns), Battery Thomson (2-10" guns) Batteries Pierce Butler and Capron, each with 8-12" mortars, Battery Gadsden (4-6" guns), Battery Logan (1-6" gun), Battery Bingham (2-4.7" guns), Battery McCorkle (3-3" rapid fire guns), and Battery Lord (2-3" rapid fire guns). A 60-inch searchlight was in place at the east end of Sullivan's Island near Breach Inlet and a 30-inch searchlight was located in the town of Old Fort Moultrie to the right of Battery Lord. For mine defense, there were a mining casemate, mine storehouse, cable tanks, a loading room, and mine wharf, all at Fort Moultrie. The storehouse, tanks, and loading room were conected to the wharf by a tramway. The fort also had one primary fire control station, alternate fire direction centers, and two mine control elements, "The South Carolina Sector of the Coastal Frontier of the United States, a study made by Major G.R. Lukesh, Corps of Engineers, District Engineer, Charleston Engineer District, in compliance with instructions from the Division Engineer, Southeastern Division, dated June 11, 1919," RG 77, NA Federal Records Center, East Point, Georgia.

[5]The District Engineer reported that anti-aircraft guns should be placed on self-propelling cars and moved about on the electric railway which ran the full length of Sullivan's Island and extended well up into the Isle of Palms. All about the street railway system on the peninsula, suitable sites were to be prepared in advance to receive anti-aircraft guns for fire, and permanent anti-aircraft installations were to be made at key points. As if in an effort to dispose of the problem, these sketchy recommendations concluded with a request that the Eastern Department of the Army provide information as to the character and type of guns to be sited and other data, such as the capabilities of the attacking aircraft, bearing on the question. G. A. Youngbert, District Engineer Officer, Charleston to Department Engineer, Eastern Department, New York, March 17, 1917, Charleston District files. Coastal defense quickly became the war's rear echelon. Within a short time after American entry into the ighting, the Coast Artillery regulars

began moving overseas. Their places in the continental system were taken by Coast Artillery National Guardsmen.

[6]Lenore Fine and Jesse A. Remington, *The Corps of Engineers: Construction in the United States, United States Army in World War II* (Washington, 1972), 7-26.

[7]Leonard P. Ayres, *The War With Germany, A Statistical Summary* (Washington, 1919) in Charles F. Horne, ed., *Official Summary of America's Part in the War,* Vol. VII, *The Great Events of the Great War* (Washington, 1923), Appendix.

[8]Criteria for site selection was issued in a circular letter on May 21, 1917 from the Southeastern Military District. The fee system for contract work set a sliding scale running roughly from 10 per cent on small contracts of $100,000 or less to 6 per cent on contracts of $3.5 million. The maximum payment permitted was $250,000. Camp sites were studied by members of an engineer inspecting board dispatched out of Charleston Military District. The Greenville and Columbia camps were laid out by Major Albert Talton, Quartermasters, and Captain J.C.H. Lee, Corps of Engineers. Charleston *News and Courier,* May 18, 22, 1917.

[9]Spartanburg raised a guarantor's fund of $200,000 to show good faith to the War Department. Lander, *History of South Carolina,* 53-58; Robert M. Burts, "The Public Career of Richard I. Manning," Ph.D. dissertation (Vanderbilt University, 1957), 390-395; Fronde Kennedy, supervisor. *A History of Spartanburg County,* Compiled by the Spartanburg Unit of the Writers' Program of the Works Project Administration in the State of South Carolina (Spartanburg, 1940), 236-246.

[10]Charleston *News and Courier,* May 18, Aug. 23, Sept. 6, 1918; May 1, 1928; March 22, 1941; Unpublished history of the South Carolina State Ports Authority, State Ports Authority files, Charleston. The Charleston port terminal was one of eight projects begun by the War Department for Army use. By September, 1918, there had been budgeted: Brooklyn, $40 million; South Boston, $23 million; New Orleans, $10 million, Charleston, $23 million; Norfolk, $20 million; Philadelphia, $15 million; Newark, $10 million; Newport News, $5 million.

[11]Fine and Remington, *Construction in the United States,* 32-108.

[12]Charleston *News and Courier,* July 13, 14, 31, Dec. 14, 15, 1940; Feb. 23, April 1, June 22, 28, Aug. 11, 1941.

[13]Charleston *News Courier,* June 22, 23, Sept. 6, 11, 13, 18, 19, 21, 28, Oct. 13, 19, 1941.

[14]Frank Futrell, "The Development of Base Facilities," Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II,* Vol. VI, *Men and Planes* (Chicago, 1955), 119-145.

[15]Fine and Remington, *Construction in the United States,* 244-272.

[16]Walter M. Bell, Chief, Engineering Division, Charleston District, to Chief of Engineers, May 8, 1964 inclosing "Summary of Civil Works Contributions to Military and National Preparedness", Charleston District files.

[17]Charleston *News and Courier,* Nov. 23, 26, 28, Dec. 8, 1940.

[18]Charleston *News and Courier,* Nov. 8, Dec. 13, 1940; Jan. 30, April 13, 1941.

[19]Charleston *News and Courier,* Dec. 11, 1940; Jan. 30, April 21, 1941.

[20]Charleston *News and Courier,* Dec. 13, 1940; Columbia *State,* Dec. 22, 1931; Interview with Walter M. Bell; Charleston *News and Courier,* Jan. 30, 1941.

[21]Charleston *News and Courier,* Nov. 11, 1940; April 13, 1941; Bell interview.

[22]Charleston *New and Courier,* April 6, May 29, June 8, 28, 1941.

[23]Charleston *News and Courier,* June 21, 28, July 7, 1941.

[24]Bell to COE, May 8, 1964; Bell interview; Charleston *News and Courier,* Dec. 11, Oct. 28, 1941.

[25]Charleston *News and Courier,* Nov. 29, 1940; June 7, 1941; Bell interview.

[26]For similar work elsewhere see Frank E. Snyder and Bryan H. Guss, *The District, A History of the Philadelphia District U.S. Army Corps of Engineers* 1886-1971 (Philadelphia, 1974), 138.

[27]Luckesh, "The South Carolina Sector of the Coastal Frontier of the United States;" Charleston *News and Courier,* August 6, 1940; Bell to COE, May 8, 1964.

[28]Charleston *News and Courier,* Dec. 2, 1941; Bell to COE, May 8, 1964.

[29]Charleston *New and Courier,* March 22, 1941; "History of South Carolina State Ports Authority," Ports Authority files.

[30]Bell to COE, May 8, 1964; Charleston *News and Courier,* Dec. 2, 1940, April 5, May 18, June 1, 18, 26, 1941.

[31]Charleston *New and Courier,* Nov. 16, Dec. 14, 18, 1940; June 9, 1941.

[32]Charleston *News and Courier,* Dec. 3, 5, 1940; March 19, 22, April 5, June 23, 1941. The largest vessel ever to enter Charleston Harbor had been the steamship *John Jay,* in distress with a leak on October 31, 1935, which drew 37 feet and had to be pumped to 33 feet before entry. The previous record was the *Edgar F. Luckenback,* drawing 32 feet of water, which had put into port March 19, 1914.

[33]Columbia *State,* Feb. 9, June 11, 17, 18, 21, 1940; Charleston *News and Courier,* Aug. 8, Dec. 24, 1940.

Army Strength 1940

Site	Personnel
Fort Bragg, North Carolina	60,900
Fort Jackson, South Carolina	43,100
Forts Moultrie and Sumter (Charleston Harbor Defense)	1,100
Charlotte Army Air Corps Base	1,500
Camp Croft, South Carolina	15,200

[34]Charleston *News Courier,* Dec. 24, 1940.

[35]Charleston *News and Courier,* Nov. 8, 1941; Bell to COE, May 8, 1964.

[36]Edwin C. Bearss, *Special History Study Fort Moultrie HECP-HDCP Fort Sumter National Monument South Carolina* (Denver, 1974), *passim.* There were several alarms off Charleston Harbor in July, 1942, a result of submarine sightings, and mines, possibly laid by a submarine, were exploded near the harbor entrance in September, 1942.

When a mine was detonated about 2½ miles due east of a buoy near the entrance of Charleston Harbor, the port was closed until sweeping operations could clear the area.

[37]Bearss, *Fort Moultrie HECP-HDCP,* 41-45.

[38]Bell to COE, May 8, 1964.

Chapter 10

[1]Douglas Summers Brown, *A City Without Cobwebs, A History of Rock Hill, South Carolina* (Columbia, 1953) 237-241; Henry Savage, Jr., *River of the Carolinas, the Santee* (New York, 1956), 346-356; Tindall, *Emergence of the New South,* 71-72.

[2]Johnson, *Falls City Engineers,* 193-199.

[3]ARCE, 1918, 2397.

[4]Albert E. Cowdrey, "Pioneering Environmental Law: The Army Corps of Engineers and the Refuse Act," *Pacific Historical Review,* XLVI (August, 1975), 340-342.

[5]Charleston *News and Courier,* Nov. 2, 1941.

[6]Annual Cost of Maintenance* of Charleston Harbor** by Corps of Engineers

Date	Maintenance Cost in $	Date	Maintenance Cost in $
1925	37.925	1946	155,541
1926	43.825	1947	589.757
1927	143,475	1948	661,459
1928	60,320	1949	297,714
1929	46,493	1950	807,980
1930	78,090	1951	370,472
1931	18,778	1952	656,277
1932	118,317	1953	734,380
1933	11,609	1954	591,697
1934	55,460	1955	420,755
1935	21,670	1956	1,196,682
1936	21,422	1957	1,309,701
1937	5,708	1958	794,150
1938	105,838	1959	886,205
1939	83,191	1960	800,412
1940	26,204	1961	1,715,755
1941	1,554	1962	1,137,328
1942	13,639	1963	1,167,901
1943	30,779	1964	1,699,655
1944	302,897	1965	2,237,949
1945	765,166		

*Maintenance costs reflect availability of funds and equipment and do not necessarily represent amount of annual shoaling.

**Tabulation does not include maintenance costs of Shipyard River.

[7]Corps of Engineers, Charleston District, "Survey Report on Cooper River, S.C. (Shoaling in Charleston Harbor)" (July, 1966); W. Don Welch, S.C. State Ports Authority Executive Director to Charleston District Engineer, April 4, 1974, "Position Paper Endorsing the Cooper River Rediversion Project Submitted by the South Carolina State Ports Authority," printed in Charleston District, "Cooper River Rediversion Project, Public Meeting at Moncks Corner, April 4, 1974," Charleston District files, Exhibit 13. The State Ports Authority contributes to the cost incurred by the counties in treating disposal areas in the mosquito abatement program for Charleston and Georgetown harbors and the Charleston Engineer District reimburses the counties for all costs incurred in treating disposal areas for the Atlantic Intracoastal Waterway. The district is funding research to develop means to reduce mosquito production also.

[8]Charleston *News and Courier,* March 26, 1974.

[9]Chs. Dist., "Survey Report on Cooper River, (Shoaling)," 41-42.

[10]Chs. Dist., "Final Environmental Statement, Cooper-River Rediversion Project," Jan. 1975, 1-3; Rivers and Harbors Act of 1968; P.L. 90-483, 90th Cong., S. 3710.

[11]South Atlantic Division, *Water Resources Development by the U.S. Corps of Engineers in South Carolina* (Atlanta, 1975), 22.

[12]Greenville *Piedmont,* May 8, 1928.

[13]Charleston District files.

[14]Legal citations relating to the functions of the Corps pertaining to navigable waters are to be found in E. Manning Seltzer, General Counsel, "Attorney's Supplement, Definition of Navigable Waters of the United States." Department of the Army, Office of the Chief of Engineers, Office of the General Counsel. The publication was designed for the use of Corps of Engineers attorneys for their guidance in the application of ER 1165-2-302, a definition of the navigable waters of the United States. The regulation was published on Sept. 9, 1972, in Vol. 37 of the Federal Register on page 18289 with an editorial correction published on Sept. 16 on page 1891.

[15]Albert E. Cowdrey, "Pioneering Environmental Law: The Army Corps of Engineers and the Refuse Act." *Pacific Historical Review,* XLVI (August, 1975), 331-349.

[16]The Washington *Star,* July 7, 1976. The fear was unfounded, as the Corps took an interest in obtaining public participation in making engineering decisions. See Daniel A. Maxmanian and Jeanne Nienaber, "Prospects for Public Participation in Federal Agencies: The Case of the Army Corps of Engineers," John C. Pierce and Harvey R. Doerksen, eds., *Water Politics and Public Involvement* (Ann Arbor, 1976), 225-247.

[17]E. Manning Seltzer, General Counsel, Corps of Engineers, "Attorney's Supplement, Definition of Navigable Waters of the United States," Sept. 11, 1972, Charleston District files; Charles D. Ablard and Brian Born O'Neill, "Wetland Protection and Section 404 of the Federal Water Pollution Control Act Amendments of 1972: A Corps of Engineers Renaissance," *Vermont Law Review,* 57, quoted from 33 C.F.R. and 209. 120(d) (1968).

[18]Daniel A. Mazmanian and Jeanne Nienaber, *Can Oganizations Change? Environmental Protection, Citizen Participation, and the Corps of Engineers* (Washington: The Brookings Institution 1979), concludes (p. 3) that the Corps

of Engineers "seemed to be making a conscious and serious effort to accommodate itself to the spirit of the environmental movement as well as to the letter of the law." Following passage of the National Environmental Policy Act of 1969, for example, "the Corps was extremely active, reorganizing local and regional offices in an effort to redirect the agency toward greater environmental sensitivity." (p. 37) In sum, say the authors, "The Corps is noteworthy for managing to go through a change cycle while reconciling or at least juggling seemingly irreconcilable demands for water resource development, environmental protection, and open planning. After making a decision to change, the agency moved expeditiously and rather successfully to accommodate itself to a changing social and political environment." (p. 194)

Chapter 11

[1]George C. Rogers, Jr., *The History of Georgetown County, South Carolina*, (Columbia, 1970), 498-500.

[2]Durham *Morning Herald*, Sept. 15, 1965.

[3]Ernest A. Beaty and Carl W. McMurray, Lancaster County, *Economic and Social, A Laboratory Study in the Department of Rural Social Science of the University of South Carolina* (Columbia, 1923); Olin S. Pugh, *Difficult Decades of Banking: A comparative Survey of Banking Developments in South Carolina and the United States*, 1920-1940. University of South Carolina Bureau of Business and Economic Research, Essays in Economics, No. 10 (Columbia, 1964), 2-20.

[4]State Department of Agriculture, Handbook of South Carolina (Columbia, 1908), 430; Pugh, *Difficult Decades of Banking*, 11-14; William Alonso and Elliott Medrich, "Spontaneous Growth Centers in Twentiety-Century American Urbanization," Niles M. Hansen, ed., *Growth Centers in Regional Economic Development* (New York, 1972), 229-265.

[5]The port terminals in Charleston were owned by railroads. The belt rail line, warehouses, and pier properties were developed by the independent East Shore Terminal Company. It failed in 1903 and the properties were bought up by the Atlantic Coast Line, which gained a fairly extensive ocean terminal in Charleston. Shortly afterward the Southern was admitted to joint ownership of the Charleston Terminal Company. The real value of the property to the railroads lay in the railroad tracks of the terminal company which connected with most of the jobbing and wholesale houses in Charleston. Control of the local trackage was a powerful economic lever, and it was in the hands of the corporations. John P. Grace spoke out against corporate ownership, "thirty years of penal servitude to the railroads," he called it, and was elected mayor in 1911 and 1919. Edwin J. Clapp, *Charleston Port Survey 1921* (Charleston, 1921), xv-xxii, 32, 33-61, 108; Duffy, "Charleston Politics in the Progressive Era," 238 ff.; Blaine A. Brownell, *The Urban Ethos in the South 1920-1930* (Baton Rouge, 1975), 31-32, 198-200, 202.

[6]Bureau of the Census, *Census of Manufactures*, 1919, 1972

[7]John Harleston, "50 Years on the Waterfront," South Carolina State Ports Authority *Port News* (Jan., 1966), 10-11.

[8]War Department, Corps of Engineers, U.S. Army and United States Shipping Board, Port Series No. 9, *The Ports of Charleston, S.C., and Wilmington, N.C.* (Washington, 1935); War Department, Corps of Engineers, United States Army and United States Maritime Commission, Port Series No. 9, The Port of Charleston, S.C., Revised 1940 (Washington, 1940).

[9]Joseph Pratt, "Regional Development in the Context of National Economic Growth," Glenn Porter, ed. *Regional Economic History, The Mid-Atlantic Area Since 1700* (Wilimington, 1976), 30; Harvey S. Perloff, Edgar S. Dunn, Jr., Eric E. Lampard, Richard F. Muth, *Regions, Resources, and Economic Growth* (Baltimore, 1960), 358-359; Howard N. Rabinowitz, "Continuity and Change: Southern Urban Development, 1860-1900," Blaine A. Brownell and David R. Goldfield, eds. *The City in Southern History, The Growth of Urban Civilization in the South* (Port Washington, N.Y., 1977), 95-95, 105-110; Harry W. Richardson, *Elements of Regional Economics* (Baltimore, 1969), 19-22, 88.

[10]*Charleston Year Book 1912*, Appendix; U.S. Department of Commerce Bureau of the Census. 16th Census of the United States: 1940, Manufacturers, 1939, III, 942-944; ARCE, 1917, 13, 25, 200; ARSW, 1919, 1310; Charleston *News and Courier*, May 18, 1917. Allotments from July 1, 1917 to June 30, 1918 were: Camp Jackson, $10,723,384; Camp Green, $4,633,081; Camp Sevier, $2,949,894; Camp Wadsworth, $761,510; Charleston Coast Defense, $1,056,200; Charleston Ordnance Depot, $15,433,000.

[11]Charleston *News and Courier*, July 20, 1940; March 28, April 2, June 16, July 2, 7, Sept. 27, 1941.

[12]Charleston *News and Courier*, Jan. 17, May 8, Aug. 3, 1941. Spending in North Carolina amounted to $145 million or $41 per capita.

[13]Charleston *News and Courier*, April 18, Aug. 3, 1941.

[14]Charleston *News and Courier*, Feb. 21, July 20, 23, Nov. 11, 1941.

[15]Duffy, "Charleston Politics in the Progressive Era," 79; Charleston *News and Courier*, Aug. 4, 18, 1940; March 4, 1941.

[16]Lander, *History of South Carolina*, 130; Charleston *News and Courier*, Aug. 4, 18, 1940; March 4, 1941.

[17]Charleston *News and Courier*, April 18, Aug. 3, 1941.

[18]Charleston *News and Courier*, June, 9, 28, Oct. 20, 1941.

[19]Survey conducted by Marketing Division, Hearst Magazines, Charleston *News and Courier*, July 4, 1941. On June 30, 1941, the Charleston *News and Courier* suggested that given the influx of federal funds the only sensible thing for South Carolina to do was reduce local taxes to raise area income.

[20]David R. Pender, "South Carolina Ports and the State's Economy," *Business and Economic Review*, (Bureau of Business and Economic Research, University of South Carolina), XIII, No. 8 (May, 1967), 3-7.

[21]Lander, *History of South Carolina*, 213-215; U.S. Department of Commerce, *Census of Manufacturing: 1947*, III, 452, 554; Robert E. Graham, Jr. *Personal Income in South Carolina by Type, Source, and Geographic Areas, 1929-1969*, University of South Carolina Bureau of Business

and Economic Research. Essays in Economics. No. 24 (Columbia, 1971). In North Carolina, federal wartime investment was almost $2 billion. More than 100 military bases were established and more than two million men were trained in these various installations. Eighty-three of the state's industrial plants delivered more than $1.3 billion in war material.

[22]Unpublished history of the South Carolina State Ports Authority, SCSPA files.

[23]Pender, "South Carolina Ports and the State's Economy"; David R. Pender and Ronald P. Wilder, *Impact of the State Ports Authority Upon the Economy of South Carolina*, Division of Research, Bureau of Business and Economic Research, Occasional Studies, No. 6 (Columbia, 1974), 61-88.

[24]August John Marjenhoff, "The Effects of Defense Spending on the Economy of the Charleston, South Carolina, Standard Metropolitan Statistical Area," unpublished Ph.D. dissertation (Indiana University, 1974), uses a 22 equation model with a fair amount of disaggregation to measure the federal defense impact. The conclusions are that there is a high defense dependency and high correlation between events affecting the national economy and local changes. Charleston is a satellite of the much larger national unit. See too Jamie W. Moore, "The Lowcountry in Economic Transition, Charleston Since 1865," *South Carolina Historical Magazine*, 80 (April, 1979), 156-171.

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TABLE I

1896-1975 Charleston Harbor Commerce

a. 1896-1900

Year	Tons	Year	Tons
1896	3,317,497	1899	1,018,366
1897	1,015,140	1900	992,661
1898	997,158		

Note: 1896 probably includes through commerce.

b. 1901-1921

Year(1)	Tons	Vaine	Year(4)	Tons	Vaine
1901(1)	962,132	32,187,115	1912(4)	986,206	73,440,486
1902(2)	966,010	37,384,478	1913(4)	1,043,058	79,225,772
1903(2)	872,841	50,921,062	1914(2)	919,184	46,800,741
1904(2)	1,120,372	53,208,224	1915(2)	920,802	57,389,658
1905(3)	1,102,490	55,169,691	1916(4)	1,165,894	74,020,684
1906(3)	835,360	56,301,096	1917(2)	776,026	73,560,679
1907(3)	772,338	56,138,444	1918(2)	520,686	68,564,958
1908(4)	651,232	61,444,244	1919(2)	863,987	127,094,176
1909(4)	828,329	79,253,684	1920(3)	2,224,606	116,574,118
1910(4)	1,111,952	100,619,552	1921	1,509,261	154,454,542
1911	1,163,732	77,388,475			

Notes: (1) Includes local and internal commerce through Wappoo Cut.
(2) Includes local and internal commerce through Wappoo Cut and waterways north of Charleston.
(3) Does not include local or internal commerce.
(4) Uncertain as to whether or not local or internal commerce is included.

c. 1922-1938

	Vessel Traffic		Freight in transit, other traffic (1)	
Year	Tons	Value ($)	Tons	Value ($)
1922	1,500,385	109,129,689	899,905	71,709,048
1923	1,944,383	224,035,937	898,393	128,400,142
1924	1,882,406	185,467,152	1,248,923	188,423,297
1925	2,831,843	202,695,179	1,277,123	163,258,161
1926	3,032,116	209,139,611	1,188,472	211,645,966
1927	2,561,431	198,475,042	1,157,939	233,211,806
1928	2,782,596	186,624,052	1,027,651	171,129,401
1929	2,136,608	177,506,661	1,113,522	201,255,550
1930	2,377,908	123,434,744	981,135	175,434,336
1931	1,784,457	106,680,399	920,058	131,949,407
1932	1,578,910	97,030,322	886,578	38,763,075
1933	1,640,969	111,680,118	1,084,718	86,669,801
1934	1,892,141	70,028,957	707,732	76,772,661
1935	1,942,319	84,238,458	1,116,186	104,710,819
1936	1,933,823	101,911,936	1,392,231	156,794,563
1937	2,785,912	129,819,937	1,690,150	134,571,455
1938	2,313,151	88,309,805	1,634,142	136,303,125

Notes: General ferry traffic declined from a high of $82 million in 1927 following bridging of Cooper River.

d. 1939-1975

Year	Vessel traffic (tons)	Add'l & thru traffic (tons)	Year	Vessel traffic (tons)	Add'l & thru traffic (tons)
1939	2,375,582	1,130,375	1958	4,359,327	575,919
1940	2,242,550	1,478,586	1959	4,636,653	557,668
1941	2,354,391	780,924	1960	4,974,962	513,044
1942	1,158,187	394,794	1961	5,016,729	531,297
1943	838,538	443,016	1962	5,055,512	581,245
1944	2,275,466	956,877	1963	5,295,022	574,749
1945	3,818,034	456,340	1964	5,106,523	614,223
1946	4,855,518	375,655	1965	4,950,395	452,989
1947	5,185,669	524,356	1966	5,419,919	534,563
1948	4,027,647	815,316	1967	5,564,620	576,493
1949	2,627,088	362,542	1968	6,390,490	514,094
1950	3,427,586	933,380	1969	6,043,725	391,411
1951	4,632,732	1,100,701	1970	6,874,993	469,444
1952	4,181,695	259,725	1971	6,945,951	455,432
1953	4,020,134	389,302	1972	7,476,635	591,126
1954	3,419,929	367,491	1973	9,379,766	469,286
1955	4,345,915	523,370	1974	8,992,563	425,763
1956	4,117,583	567,656	1975	8,379,831	342,506
1957	4,115,552	572,479			

Source: Annual Reports of the Chief of Engineers

TABLE II

Georgetown Commerce

Winyah Bay

a. 1896-1921

Year	Tons	Value ($)	Year	Tons	Value ($)
1896	unknown	12,900,453	1909	337,319	5,169,464
1897	unknown	10,201,516	1910	314,547	5,127,260
1898	unknown	9,863,658	1911	314,503	5,322,569
1899	120,587	6,337,853	1912	309,673	5,000,901
1900	120,639	6,749,433	1913	211,655	4,849,083
1901	247,989	8,457,906	1914	175,283	4,146,954
1902	387,471	9,310,682	1915	183,746	4,900,821
1903	368,502	9,359,581	1916	315,026	7,522,688
1904	369,774	9,546,843	1917	293,142	10,659,285
1905	363,916	10,401,879	1918	205,070	7,813,228
1906	392,770	10,139,751	1919	115,325	6,295,973
1907	382,915	9,432,575	1920	45,835	2,149,985
1908	283,470	8,078,583	1921	57,191	3,554,015

b. 1922-1938

	Vessel Traffic		Other & Through Traffic	
Year	Tons	Value ($)	Tons	Value ($)
1922	362,236	16,260,605	68,822	3,285,236
1923	231,566	5,259,837	152,941	690,618
1924	249,541	7,136,130	221,939	776,786
1925	226,168	6,711,094	132,348	10,860,249
1926	173,772	4,636,588	47,963	4,195,933
1927	174,544	5,020,614	38,368	3,224,462
1928	142,868	4,566,387	43,453	5,938,975
1929	244,953	2,327,097	27,660	12,287,448
1930	280,081	2,303,772	23,678	20,426,809
1931	477,295	2,933,525	36,917	22,289,654
1932	46,320	1,081,979	29,190	8,019,600
1933	41,236	802,905	57,355	11,507,690
1934	157,944	1,148,454	37,834	20,347,200
1935	86,279	853,852	31,407	12,929,708
1936	60,629	1,350,348	9,879	748,529
1937	302,767	6,289,588	19,488	935,205
1938	372,506	5,148,654	76,893	4,961,712

c. 1939-1975

Year	Vessel Traffic (tons)	Additional Traffic (tons)	Year	Vessel Traffic (tons)	Additional Traffic (tons)
1939	511,446	82,062	1958	989,313	768,802
1940	484,003	162,386	1959	1,041,169	393,134
1941	507,867	180,909	1960	869,772	546,536
1942	384,079	227,840	1961	1,028,961	515,698
1943	315,683	363,834	1962	962,563	556,500
1944	353,722	437,658	1963	1,124,331	549,900
1945	319,920	261,667	1964	1,126,662	564,626
1946	309,117	78,849	1965	1,082,511	466,577
1947	478,999	100,034	1966	1,092,629	494,458
1948	617,699	124,495	1967	1,168,101	588,271
1949	801,615		1968	1,252,062	647,223
1950	884,741	164,229	1969	1,265,900	534,607
1951	1,027,508	204,029	1970	1,172,531	571,010
1952	917,935	269,977	1971	1,190,637	460,534
1953	1,072,772	366,201	1972	1,524,102	571,588
1954	968,634	329,364	1973	1,485,731	490,884
1955	1,105,259	446,465	1974	1,619,986	488,770
1956	1,104,822	857,120	1975	1,359,697	412,576
1957	1,039,951	699,838			

Source: Annual Reports of the Chief of Engineers

TABLE III

Intracoastal Commerce

a. 1903-1922

Winyah Bay — Charleston

Year	Tons	Value	Year	Tons	Value
1903	33,344	579,520	1913	54,259	1,551,688
1904	39,064	573,770	1914	25,667	829,859
1905	58,421	608,761	1915	10,818	425,307
1906	49,440	797,747	1916	15,765	466,462
1907	36,230	921,675	1917	23,781	641,161
1908	32,388	1,146,240	1918	35,693	812,086
1909	39,348	1,164,637	1919	13,970	364,597
1910	36,441	1,165,161	1920	11,652	428,224
1911	44,267	924,876	1921	11,233	455,124
1912	42,136	1,440,710	1922	23,536	359,568

b. 1923-1938

	Winyah Bay - Charleston		Charleston - Beaufort	
Year	Tons	Value ($)	Tons	Value ($)
1923	99,124	962,043	77,318	6,494,159
1924	36,867	1,192,559	45,252	3,061,264
1925	29,115	1,451,919	55,591	3,705,108
1926	56,172	1,317,253	86,749	3,006,715
1927	80,674	2,171,493	87,921	4,031,418
1928	89,526	2,174,445	51,721	2,620,264
1929	45,636	1,110,625	39,761	2,032,258
1930	38,998	2,351,126	56,214	3,584,549
1931	101,074	1,798,529	51,938	2,331,872
1932	20,061	1,422,230	24,890	1,272,772
1933	47,299	1,033,627	36,848	2,121,013
1934	145,512	1,523,449	33,929	1,221,612
1935	78,707	1,265,381	24,507	1,979,484
1936	44,376	1,851,943	57,078	2,292,820
1937	181,885	3,016,349	78,852	3,397,603
1938	184,865	2,436,103	79,568	2,580,142

c. 1939-1945

Year	Winyah - Charleston Tons	Charleston - Beaufort Tons
1939	246,151	98,661
1940	221,257	139,583
1941	271,682	155,488
1942	428,189	245,482
1943	576,675	587,168
1944	736,320	855,269
1945	514,938	591,026
1946	340,787	128,789

d. 1947-1975

Atlantic Intracoastal Waterway Between Norfolk, Va. and the St. Johns River, Fla. (Charleston District)

Year	Tons	Year	Tons
1947	639,825	1962	1,486,060
1948	930,918	1963	1,484,033
1949	866,184	1964	1,488,744
1950	1,006,823	1965	1,400,181
1951	1,164,712	1966	1,292,496
1952	1,208,870	1967	1,420,056
1953	1,281,949	1968	1,579,869
1954	1,197,373	1969	1,621,016
1955	1,464,554	1970	1,395,750
1956	1,540,004	1971	1,367,161
1957	1,582,828	1972	1,559,024
1958	1,591,064	1973	1,614,002
1959	1,630,022	1974	1,593,801
1960	1,480,843	1975	1,404,608
1961	1,391,586		

Source: Annual Reports of the Chief of Engineers.

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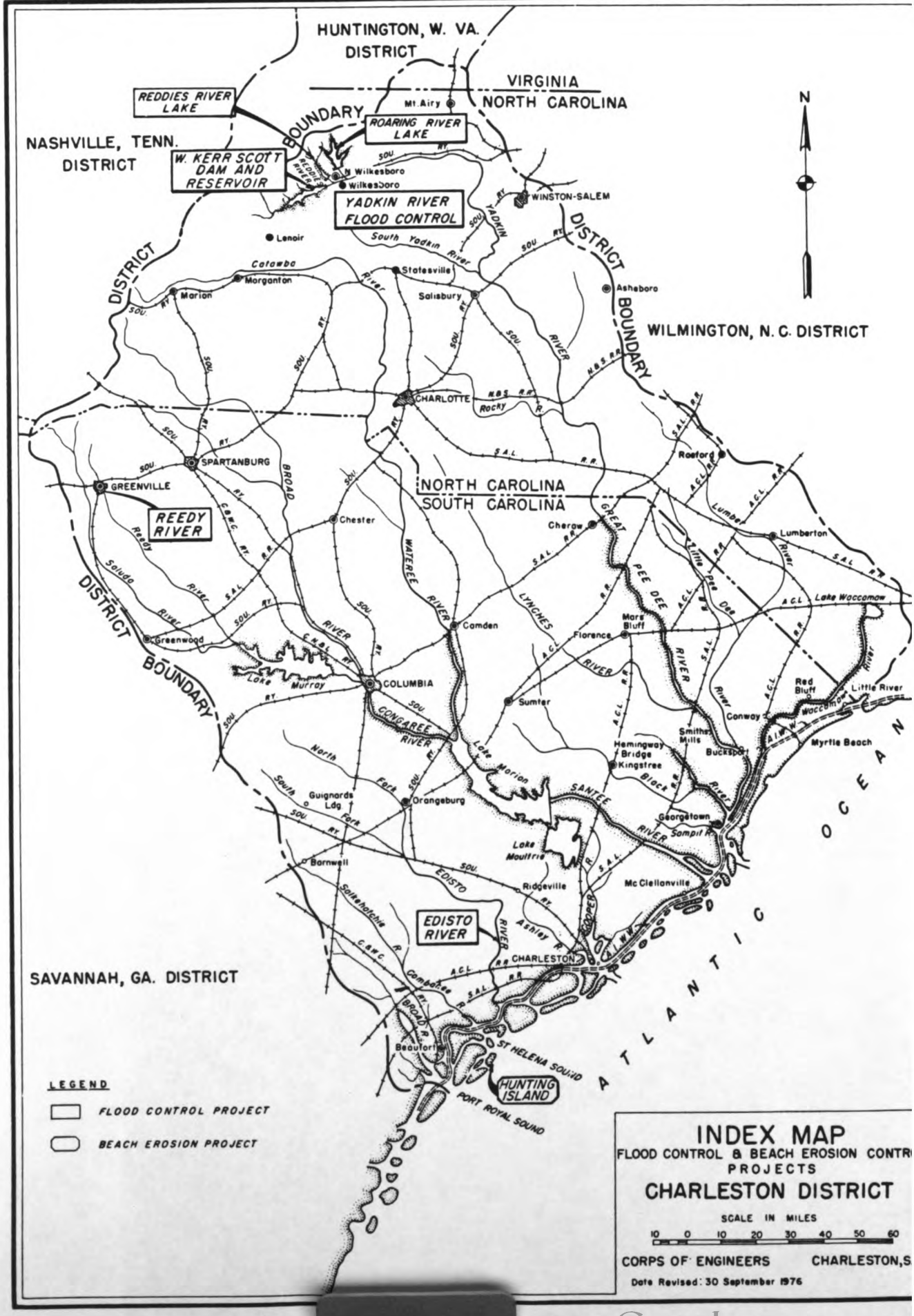

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FLOOD CONTROL & BEACH EROSION CONTRO PROJECTS

CHARLESTON DISTRICT

SCALE IN MILES

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CORPS OF ENGINEERS CHARLESTON, S

Date Revised: 30 September 1976