historic resource study

the sandy hook defenses 1857-1948

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GATEWAY

SANDY HOOK UNIT

NATIONAL RECREATION AREA / NEW YORK-NEW JERSEY

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HISTORIC RESOURCE STUDY

THE SANDY HOOK DEFENSES

1857-1948

GATEWAY NATIONAL RECREATION AREA

NEW YORK AND NEW JERSEY

By

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PREFACE

This historic resource study has been prepared following discussions with then Chief of Professional Services F. Ross Holland of the North Atlantic Regional Office and his staff; then Area Manager Dale Engquist of the Sandy Hook Unit, Gateway National Recreation Area; Architectural Historian Gary W. Higgins formerly of the Denver Service Center; and Architectural Historian Mike Adlerstein of the National Park Services' Gateway Planning Team. Within constraints imposed by available funding, it was determined to: (a) provide management with a documented history of the Sandy Hook Defenses from 1857 to 1948; (b) evaluate the significance of the Sandy Hook Defenses to the United States during these years; (c) identify and evaluate structures and sites constituting the Sandy Hook Defenses; (d) identify structures and activities requiring additional investigation; and (e) provide data, both manuscript and iconographic, to assist other disciplines in furthering their Sandy Hook missions.

To accomplish these goals, extensive research was undertaken at the National Archives in Record Group 77 (Corps of Engineers), Record Group 156 (Ordnance Department), Record Group 92 (Quartermaster General), Record Group 392 (Coast Artillery), and Cartographic Records. The Annual Reports of the Chief Engineer and Chief of Ordnance found in the Executive Documents serial sets were studied. Because of their significance and character, much more time and energy were expended on the Endicott period defenses than on the Third System masonry fort. Because of the time factor, no cognizance was taken of the Nike and related Cold War sites. A study, similar to this in scope, titled Historic Resource Study, Fort Hancock: 1948-1974, was programmed, completed, and published in 1982. Important, but less pressing, should be a study of the Sandy Hook Defenses before 1857.

A number of friends and associates assisted with the preparation of this resource study. Particular thanks are due former Area Manager Dale Engquist and Historians Robert Holmes (now of Lincoln Home National

Historic Site) and Tom Hoffman of the Sandy Hook Unit, Gateway National Recreation Area, for assistance rendered on-site and answering numerous telephone requests. Former North Atlantic Regional Chief of Professional Services Holland and his capable staff, Architect Blaine Cliver and Historian Ricardo Torres-Reyes (deceased), shared their knowledge and reviewed the manuscript in draft.

Local Historian George H. Moss introduced me to Sandy Hook, and my friend and long-time mentor Dr. Emanuel R. Lewis shared his encyclopedic knowledge of seacoast fortifications.

Dedicated personnel at the National Archives (particularly Tim Ninninger, Dale Floyd, Mike Musick, Richard Cox, John Matias, William Lind, Albert Blair, and the staff of the Cartographic Branch) gave advice and counsel, while searching out and copying thousands of documents and hundreds of plans.

A special tribute is accorded former Chief Historian Harry Pfanz and former Chief Restoration Architect Henry Judd of the National Park Service. Besides reviewing the manuscript in draft and making worthwhile comments, they provided valued insights on a two-day reconnaissance of the Sandy Hook Defenses.

My colleague Charles W. Snell made available his "Brief History of the Construction of the Endicott System of Sea-Coast Defenses in the Continental United States," which expedited certain phases of this study. My genial and capable former supervisor, John F. Luzader, fought a good fight by absorbing bureaucratic distractions. He, along with Historical Architect Gary W. Higgins, reviewed the manuscript and made suggestions which resulted in its improvement.

Mrs. Virginia Fairman, Lael Cleys, and Sharon Spera had the most challenging and unrewarding task of all--typing the manuscript--while Editor Linda Wedel Greene and Historian Harlan D. Unrau wrestled with my graceless style and syntax.

Edwin C. Bearss

I. INTRODUCTION

A. Sandy Hook Defenses--An Overview

For 200 years Sandy Hook played an important role in the defense of the approaches to New York Harbor. In the summer of 1776 British warships and transports used Sandy Hook and Raritan bays as a rendezvous, while Maj. Gen. William Howe's army flexed its muscles on Staten Island. On August 22 the British and their Hessian allies crossed the Narrows and landed on Long Island. Defeating the American patriots under Gen. George Washington in the Battle of Long Island on the 27th, the British in a lightning-like campaign captured New York City and secured the adjacent area.

In the summer of 1778, following the Battle of Monmouth, the British Army stole a march on the victorious Americans and retired to Sandy Hook. From there, the troops were shuttled by the Royal Navy to New York City.

During the War of 1812, the United States military, to prevent His Majesty's fleet from again occupying sheltered anchorages in Sandy Hook and Raritan bays, rushed troops to Sandy Hook. Fortifications were erected and cannon emplaced, thus preventing British seapower from again using Sandy Hook as an anchorage and possible staging area for an attack on New York City, such as had succeeded more than one-third of a century before. At the end of the war, the troops were withdrawn from Sandy Hook, and the temporary fortifications and camps merged into the landscape.

By the 1850s the United States had completed an integrated system of masonry fortifications for defense of New York City's inner harbor. But during these same years there had been a technological revolution afloat. Many merchantmen and warships were now propelled by steam, and were no longer subject to the whims of the winds. Powerful long-range shellguns were now mounted on ships and available for emplacement ashore. The time had arrived for the United States to look to the outer defenses of New York Harbor. A site was selected and plans made for construction of a massive five-bastioned fort on Sandy Hook.

Besides commanding the channels skirting Sandy Hook, guns emplaced in the casemates and on the barbette tier of the fort would prevent a hostile fleet from employing Sandy Hook Bay as a base to blockade or attack the New York City area.

In 1857 the Corps of Engineers began preparing the site and two years later broke ground for the fort. Work was pushed during the Civil War years. By 1863 construction had progressed to the point where cannon were mounted in a number of casemates of the channel fronts. Troops were sent to the Hook to man this armament and guard the public property.

The Civil War accelerated a technological revolution in weaponry that made the handsome granite fort, and others like it around the world, obsolete before it was completed. Construction was suspended in 1868, by which time four of the bastions and the three channel fronts had been nearly completed. Two years before the garrison had been withdrawn and the fort, its armament, and supporting structures placed in charge of fort keepers' and ordnance-sergeants.

In 1886 the Endicott Board submitted its report calling for a comprehensive defense system to protect the United States' most important ports and harbors from naval attack. These defenses were to consist of high-powered guns and mortars mounted in concrete emplacements; submarine minefields; floating batteries and torpedo boats; and rapid-fire guns to protect the minefields.

Sandy Hook under this program and ensuing ones evolved into the most important complex guarding the approaches to New York Harbor. Construction of the Endicott defenses resulted in demolition of all the old granite fort, except the angle of the southwest bastion and a section of the northwest curtain. These survived, because they were incorporated into the submarine mine defense system.

In Fiscal Year 1890 work commenced on the mining casemate, which until 1905 was in the angle of the southwest bastion. Other

elements of the submarine mine defense system (torpedo storehouse, cable tanks, etc.) were completed within the next several years. In April 1898, only days before the United States declared war on Spain, the system was activated. In the early 1900s the mining casemate was relocated in the abandoned emplacements of the Dynamite Gun Battery, and additional structures and facilities to support this vital element of the Sandy Hook defense system were constructed.

Beginning in Fiscal Year 1890 and continuing through 1908 hundreds of thousands of dollars were spent on construction and armament of seacoast and mortar batteries. The Sandy Hook lift-gun battery (Battery Potter), emplacing two 12-inch rifles, was the nation's first completed Endicott emplacement. The mortar battery (Batteries Reynolds and McCook), armed with sixteen 12-inch mortars, was the system's prototype. Other emplacements completed during this period were three 12-inch batteries--Alexander, Bloomfield, and Richardson--each mounting two rifles on disappearing carriages; 10-inch Batteries Granger and Halleck; 8-inch Battery Arrowsmith; and a 3-gun dynamite battery. The Dynamite Gun Battery and Battery Potter soon became obsolete and were disarmed. The emplacements, however, were retained and given another mission.

An integral part of these batteries were the fire control structures--the primary, secondary, and supplementary stations--positioned at other points on the reservation, and the central powerhouse.

During World War I two 12-inch batteries (Kingman and Mills), each emplacing a pair of guns mounted on high angle barbette carriages with a 360-degree field of fire, were constructed. By 1921, when these batteries were transferred to the Coast Artillery, the mortar battery and Battery Arrowsmith had been disarmed and converted to other uses.

During World War II two batteries (Lewis armed with 16-inch guns and 219 with 6-inch guns) were added to the Sandy Hook Defenses. Located on the Highlands, they are not within the National Recreation

Area. To protect them against aerial attack, Batteries Kingman and Mills were modernized--this included placing their 12-inch guns in casemates and gasproofing the traverse.

Beginning in 1897 work commenced on the rapid-fire batteries. By 1909 the following permanent batteries had been completed and armed: Engle mounting one 5-inch gun on pedestal mount; Urmston emplacing four 15-pounders and two 3-inch guns; Morris with its four 3-inch rifles; Peck with two 6-inch guns on barbette carriages; and Gunnison with two 6-inch guns on disappearing carriages. These guns, which fired fixed ammunition, commanded the minefield and had the mission of preventing its penetration and removal by minesweepers and torpedo boats.

After World War I, Battery Engle was disarmed and the four 15-pounders on balanced pillar mounts removed from Battery Urmston. During World War II the rapid-fire guns were given the mission of defense against Axis motor torpedo boats. This resulted in a redeployment of the elements. The two 3-inch guns of Urmston were positioned in a new emplacement northeast of Gunnison; two batteries of 90 mm guns (nos. 7 and 8) were established; Batteries Peck and Gunnison were disarmed; and, after Gunnison had been remodeled, Peck's 6-inch guns and barbette carriages were remounted in this position.

The Sandy Hook Defenses also included searchlights, antiaircraft guns, and "movable" guns. To service and maintain the batteries there was a railway and road network, wharves, storehouses, shops, and an Engineer Reservation. To protect the site against the sea, beginning in the 1860s, a system of jetties and seawalls was constructed.

During the period 1943-48 the Sandy Hook batteries, because of development of the atomic bomb and rockets and the successful application of new principles of amphibious warfare, were phased out and disarmed. In the mid-1950s the missile age came to Sandy Hook with construction and activation of a Nike missile site. This site, along with other units in the system, defended the New York-Philadelphia corridor against

long-range bombers. In the early 1960s it was improved by introduction of the Nike-Hercules system and tracking radar. By the early 1970s this system had become obsolete and was phased out. Sandy Hook's days as a key element in the defense of the United States were over.

B. Statement of Significance

For more than 50 years the Sandy Hook Defenses were the key fortifications guarding the approaches to America's most important harbor and its largest metropolis. It was during these years that the United States defeated Spain and emerged as a world power; tipped the scales against the Central Powers in World War I; retreated into the isolation of the 1920s and 30s; and emerged from World War II as a super power.

C. Recommendations for Additonal Research

As noted in the preface, this study focuses on the history of the Sandy Hook Defenses in the years 1857-1948. To provide structural data on the post-1948 structures and activities at Fort Hancock, a resource study of post activities during the Cold War era should be programmed in the near future. Such a project was undertaken in Fiscal Year 1980, and the resulting report, titled Historic Resource Study, Fort Hancock: 1948-1974, was published by the Denver Service Center in November 1982. Less urgent, because of the absence of structures, is a study of the military defenses at Sandy Hook in the years before 1857.

II. CONSTRUCTON OF THE MASONRY FORT

A. Work Gets Underway

1. Chief Engineer Totten Calls for a Fort at Sandy Hook

Although Sandy Hook's strategic significance had been long recognized, it was the mid-nineteenth century before the United States Corps of Engineers seriously considered it as a site for a Third System fort. In 1851 Chief Engineer Joseph G. Totten, known as the fortification expert in the United States, made a comprehensive report to Congress on the nation's coastal defenses. This was three years after the Treaty of Guadalupe Hidalgo had ended the war with Mexico, and the attention of many Americans was focused on the acquisition of Cuba, which might lead to war with Spain. With the expansion of the country's borders to the far Pacific, there was a need to reevaluate its defense needs and capabilities. A technological revolution afloat and in weaponry had to be considered.

A review of the Second and Third System defenses guarding New York City and harbor from an amphibious attack demonstrated to General Totten that something had to be done about Sandy Hook. Below the Narrows, he informed Congress, was "a capacious bay, affording good anchorage for any number of vessels-of-war and transports." Occupation of this bay by a hostile squadron, entrance into which would be easy, would seal this outlet to New York Harbor. No vessel could enter or depart at any season of the year. A foe would be able to intercept the water communication by way of the Raritan between New York and Philadelphia.

The same squadron could land an army on the beach of Gravesend Bay (where Sir William Howe's redcoats had come ashore in 1776 before the Battle of Long Island), within seven miles of Brooklyn and its commanding heights and navy yard. Between that bay and these vital points there were no obstacles.

The danger, General Totten warned, was imminent, and in the event of war, "it would not fail . . . to be as fully realized as it was during" the War of 1812, "when, on the rumor of an expedition being in

preparation in England, twenty-seven thousand militia were assembled to cover the city from an attack of this sort." It was apparent that the defenses near the city and those at the Narrows, indispensable as they were for other purposes, could not be expected to guard against such an attack, which could only be protected against by an "outer barrier" at the mouth of the harbor. This would accomplish two objects of great consequence. These were "rendering a close blockade of the harbor impossible, and obliging an enemy who should design to move troops against the navy yard to land at a distance" of more than 20 miles from its goal. In doing so, the foe would be compelled to land across dangerous beaches, leaving during the absence of the troops the transports anchored at sea.[1]

The hazard of such a land expedition would be increased by the possibility of counterattack by United States soldiers, crossing over to Long Island and cutting the enemy column off from its fleet if it were operating off Rockaway. Against a hostile landing in Gravesend Bay no such attack could be launched, because of the "shortness of his line of march, as well as its direction."

Consequently, the Board of Engineers had projected additional works, one for the east bank and another for the middle ground, these positions being on shoals on either side of the bar outside of Sandy Hook. Before deciding on these works, the board had investigated to ascertain whether the shoals were shifting and had learned that there had been "no material alteration in more than sixty years." The apparent stability of the shoals had encouraged the board to devise the projected works.

Recent surveys, however, had revealed a new channel or channels. If the new channels showed a want of stability in the shoals,

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1. U.S., Congress, House, "Report of General J. G. Totten," Nov. 1, 1851, in Permanent Fortifications and Sea-Coast Defenses, 37th Cong., 2d sess., 1863, H. Rept. 86, pp. 398-400.

they would "forbid any such structures as the batteries formerly contemplated." By removing these projects from the outer bar, they would have to occupy Sandy Hook. There they would afford "a very good defence of the main channel, and prevent the entrance to or occupation of the lower bay for any hostile purpose whatsoever, and cover a secure anchorage there for our own merchantmen and privateers, and for our steam and sailing cruisers." The Board had estimated the works at Sandy Hook to cost $1,200,000.[2]

2. Readying the Site

Six years later, in Fiscal Year 1857, steps were taken "preliminary to commencing the construction" of the "highly important" defense at Sandy Hook, for which the 2d session of the 34th Congress had made an appropriation of $250,000. This sum, General Totten reported, would suffice for commencement of operations scheduled to be begin in Fiscal Year 1858.[3]

In Fiscal Year 1858 preliminary operations began. A topographical map of the fort site and the head of the Hook was prepared under the supervision of Lt. Col. Rene E. De Russy, one of the Corps of Engineers' most competent officers. De Russy's map had a contour interval of one foot.[4]

Meanwhile, a crib wharf and piers were being positioned on the lee side of the Hook. The pier-head was built to a height of 12 feet by Babcock & Casey workmen, near Jersey City, and on October 16 was towed down to the Hook. There it was moored over the site it was

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2. Ibid.

3. Executive Documents, Printed by Order of the House of Representatives, During the 1st Session of the 35th Congress, 1857-58 (Washington, 1858), Ser. 994, II, 175.

4. "Plan of Contour Surveys of Sandy-Hook, executed under the direction of Lt. Col. R. E. De Russy, U.S. Engrs., 1857," Records of the Office, Corps of Engineers, Record Group 77, National Archives.

to occupy, 675 feet from the highwater mark on the west shore of Sandy Hook. After some adjustments, the pier-head was sunk, so that its floor was 12 feet above ebb tide and there was sufficient depth alongside to bring vessels drawing 11-1/2 feet of water. The wharf leading from the shore to the pier-head, which was positioned at nearly a right angle to it, rested on stone-filled cribs.[5]

Ashore artisans and laborers, supervised by Capt. Henry W. Benham, who had been placed in charge of the project by Chief Engineer Totten, erected seven frame buildings--an office, barracks, mess halls for workmen, and storehouses. These structures were grouped on the high ground 200 yards southeast of the wharf.[6]

When he made his annual report for Fiscal Year 1858, General Totten noted that construction of the fort would be commenced as soon as the plans, then being prepared by a special board of engineers, had been completed, reviewed, and approved.[7]

Plans for the fort prepared by the special board were approved by Secretary of War John B. Floyd in Fiscal Year 1859. The plans called for a five-bastioned masonry fort, with three sea fronts and two land fronts. On the sea fronts there would be a tier of casemates surmounted by a barbette tier, while on the land fronts there would be a solid rampart with loopholes and relieving vaults supporting the barbette battery.

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5. "Plan of the Point of Sandy Hook, Showing the location proposed by Col. R. E. De Russy, Corps of Engrs. for the Crib Wharf & Piers . . .," NA, RG 77.

6. Ibid.

7. Executive Documents, Printed by Order of the House of Representatives, During the 2d Session of the 35th Congress, 1858-59 (Washington, 1859), Ser. 999, II, 818.

During the 12 months ending June 30, 1859, Captain Benham had his employees erect additional frame support structures. A hay scale and coal shed were built near the approach to the wharf; a stable, two sheds, and a blacksmithy west of the road leading to the fort site; a stone shed west of the future position of the northeast bastion; and a second office west of the wharf. Roads were graded and planked and led from the wharf to the storehouses, stone shed, barracks, workshops, fort site, and telegraph station. Jetties were constructed for protection of the site against the savage winter storms that pounded the New Jersey coast. Machinery was purchased, and contracts were let for stone and other construction materials.[8]

It was proposed in Fiscal Year 1860, General Totten advised Congress, to apply the funds on hand, and any which might be appropriated, to the two curtains of the sea fronts and the included bastion. Such action would secure, at the earliest practicable date, an efficient battery bearing on the entrance channel to the Lower Bay.[9]

B. Construction of the Masonry Fort, 1859-1868

1. Work Accomplished in Fiscal Year 1860

Captain Benham, having staked out the fort site, had his workmen break ground in the late summer of 1859. During the year ending June 30, 1860, the mechanics and laborers completed the foundations of the north and half of the northeast sea fronts (about 470 lineal feet) and the scarp-wall and attached piers to the height of four courses, or nearly 11 feet from the bottom of the foundations. Included were about 216 cubic yards of foundation paving, 1,675 cubic yards of concrete foundation and scarp backing, and 161 cubic yards or 2,085

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8. Executive Documents, Printed by Order of the Senate of the United States, 1st Session of the 36th Congress, 1859-60 (Washington, 1860), Ser. 1024, II, 643; "Tracing of Plot of a Survey at Sandy Hook, N.J., made under direction of Capt. H. W. Benham, U.S. Engrs., by T.M.R. Talcott, between July 1859 & May 1860," NA, RG 77.

9. Executive Documents, Ser. 1024, II, 643.

superficial feet of scarp-facing, making in all 2,052 cubic yards of masonry; and of earthwork 2,700 cubic yards of excavation, 1,800 cubic yards of fill, and 1,200 cubic yards transported for grading parades, making in all 5,700 cubic yards. A large quantity of building materials had been received and other preparations made that would enable the work to be pushed ahead rapidly.[10]

The fort was not yet ready to mount any cannon. To bring it to a state of efficiency as rapidly as practicable, Captain Benham estimated that an appropriation of $300,000 would be required in Fiscal Year 1861. With this sum he expected to prepare the north front and the adjacent halves of the northeast and northwest fronts for their casemate guns, "which would constitute an efficient battery bearing on the channels of approach to the lower bay." Chief Engineer Totten, however, slashed Benham's estimate by one-half.[11]

2. Work Accomplished in Fiscal Year 1861

In Fiscal Year 1861 work was confined to the three sea fronts, with the goal of readying them for "reception of the first tier of guns as soon as possible." The scarp-wall of the north front and more than one-half of the northeast front were raised to include the ninth course, and 38 embrasures, with flagging and traverse circles, were prepared for the guns.

The scarp of the adjacent portions of the channel fronts was raised to the fifth course, and the foundations of the scarp of the remainder of the channel fronts were positioned. The foundations of the piers and cisterns were constructed, the cisterns built, and the embankments for the casemate floors formed in corresponding proportions. One magazine had been completed, the masonry of another built, and that

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10. Executive Documents, Printed by Order of the Senate of the United States for the 2d Session of the 36th Congress, 1860-61 (Washington, 1861), Ser. 1070, II, 260-61.

11. Ibid., p. 261.

of two more was in progress. Roads, machinery, shops, stables, and barracks had been provided as needed. By winter, when construction would be closed down, Brig. Gen. John G. Foster, who had replaced Captain Benham as project engineer on May 10, 1861, hoped to have 60 gun platforms ready to receive their armament.

In Fiscal Year 1862 it was proposed to complete the barbette tier of the channel fronts, including the scarps, piers, arches, covering, terreplein, gun-circles, cisterns, magazines, and ramps. To fund this work, an appropriation of $300,000 was needed.[12]

3. Work Accomplished in Fiscal Year 1862

In the autumn of 1861 General Foster was reassigned to duty in the field, and one of the Corps of Engineer's senior officers, Col. Richard Delafield, assigned responsibility for overseeing construction of the Sandy Hook fort as well as the other New York Harbor defenses. When he filed his annual report for Fiscal Year 1862, Colonel Delafield noted that the progress of the work, during the preceding 12 months, had been "rapid and extensive." The scarps of the three sea fronts had been raised, with so much of a return on the land fronts, as to insure a sufficient abutment to the ranges of casemate arches of the adjoining fronts.

Fronting the channel, the scarps had been built along the entire extent to admit the laying of the gun platforms and the mounting of the casemate batteries in event of an emergency. Embrasures for 78 guns had been perfected, and the scarps built above them to form a "perfect cover" for these positions. Sixty-six emplacements had been provided wth platforms and traverse circles ready to receive 8- and 10-inch smoothbore or rifled guns.

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12. Executive Documents, Printed by Order of the Senate of the United States for the 2d Session of the 37th Congress, 1861-62 (Washington, 1862), Ser. 1118, II, 98-9; "Plan, Elevation, & Sections of Fort at Sandy Hook, N.J., Showing the portion constructed January, 1861," NA, RG 77.

All the foundations for piers of arches, with drainage pipes, had been laid on so much of the sea fronts as were raised in Fiscal Year 1861 to the necessary level, and some additions had been made to other parts. A magazine had been constructed in the gorge of the northeast bastion. The foundations of the northwest bastion magazine had been put down, along with the foundations for steps in the northeast and northwest bastions.[13] Excavations had been made for the foundations of the scarp and from the adjacent ditches, the spoil of which had been employed to form the ramparts and raise the terrepleins adjacent to the casemates.[14]

Although progress had been favorable, Colonel Delafield continued, there had been considerable delays caused by "a preference" for similar work on the part of mechanics and laborers at places more convenient to New York City. Delays had also resulted, because of shortages of stone, iron, and brick, while at defenses nearer the city, affording "better landings and more conveniences and comforts," they had been "freely and abundantly supplied."[15]

The quantities of work accomplished consisted of: 2,954 cubic yards of granite masonry in courses of large masses; 3,305 cubic yards of rubble stone masonry in the backing of scarps and filling of magazine walls; 3,514 cubic yards of stone in large and small pieces had been used in concrete foundations and for filling in and among masses of concrete; 666 cubic yards of brick masonry in bombproof magazines for lining and arches, together with cisterns under the ramparts, and some about the temporary quarters for mechanics and laborers; 4,094 square yards of quarry stone had been laid in the foundations and 5,310 square feet in the gun platforms; 1,170 running feet of cast iron drain pipes had

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13. Delafield to Totten, Annual Report for Fiscal Year Ending June 30, 1862, NA, RG 77, Ltrs. Recd., Chief Engineer.

14. Ibid.

15. Ibid.

been set and adjusted in the masonry; and 1,309 running feet of scarp foundation had been started, all of which had been built upon.[16] For the support facilities, 1,550 running feet of plank road had been built.

During the fiscal year, expenditures had been $184,844. With the funds currently available from existing appropriations, $150,000 would suffice to carry on operations at Sandy Hook in Fiscal Year 1863.[17]

4. Work Accomplished in Fiscal Year 1863

Colonel Delafield proposed to expend the funds available to first raise the scarp to such "a height as would admit of mounting the casemate guns, protect the gunners and give magazines for the ammunition." Second priority would be given to pushing the sea fronts forward to give bombproof protection to their casemates, and in the shortest time to allow emplacement of the barbette battery. The third priority would be to proceed with construction of the land fronts to enclose the fort.[18]

Carefully employing their resources, money, and materials, Colonel Delafield's artisans and laborers, during the year ending June 30, 1863, finished laying all the fort's casemate foundations. All the casemate traverse stones and pavements to half their depth were completed, which, in an emergency, would enable the troops to mount and man the casemate guns. Ninety-eight embrasures were enclosed and the adjoining scarps were built up to protect the guns, carriages, and cannoneers. The remaining six casemates had their platforms, traverse stones, and scarps nearly completed so that their guns could be mounted. The casemate piers of the northeast bastion, those of the northwest gateway, and some of those of the southeast bastion, were raised to the required height to

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16. Ibid.

17. Ibid.

18. Delafield to Totten, Annual Report for Fort at Sandy Hook, for Year Ending June 30, 1863, NA, RG 77, Ltrs. Recd., Chief Engineer.

receive their arches, including all the drain pipes and culverts to drain the ramparts throughout the casemate fronts to a height above the corresponding finished masonry.[19]

Whenever shortages of granite or other materials interfered with construction of priority items, Colonel Delafield had his hands work on the foundations of the scarps and relieving vaults of the two land fronts. By the end of the fiscal year, so much of these faces had been "returned" as would form an abutment against which to terminate the arches and at the same time provide a number of bombproof loopholed vaults along the land fronts. They thus afforded protection to the rear of the sea fronts.

Simultaneously and under similar circumstances, work had been undertaken on the faces, flanks, and curtains of the land fronts. To effect this, parts of the ditch, as well as the foundation had been excavated, and the spoil employed to fill the parade and to form the solid ramparts.[20]

Although much progress had been made during Fiscal Year 1863, Colonel Delafield reported the "quantity and extent has been limited by the greater inducements and facilities existing at other defensive works in the harbor of New York for both materials and services." Added to these was the inability of one officer to oversee the activities of more than 1,000 mechanics and laborers, all of whom had to be paid monthly by this one officer in conformity with the law. Sandy Hook, at certain seasons, was avoided by captains, when their vessels could secure cargo for the fortifications nearer the city, thus limiting the supply of stone from eastern quarries, as well as from those on the Hudson and East rivers. A similar situation existed in regard to vessels bringing down brick. Mechanics and laborers, if given their choice, preferred to

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19. Ibid.

20. Ibid.

work on the forts more convenient of access to the city. The unprecedented demand for ironwork caused by the Civil War, now in its third year, had retarded sections of the work--particularly the embrasure irons--dependent on that material.[21]

Notwithstanding these impediments to the "rapid prosecution" of the work, there had been executed during the year:

excavation and embankment	14,765 cu. yds.
pavement of foundations	4,531 sq. yds.
rubble and concrete masonry	7,456 cu. yds.
cutstone masonry (granite)	4,213 cu. yds.
brick masonry in arches	421 cu. yds.
pavement of casemates with stone flagging	3,089 sq. yds.
iron rampart drain pipes	2,124 running ft.
wrought iron traverse circles	66 sets
wrought iron for throats of embrasures	22 sets

The total cost of this work was $167,391.[22]

During the year 34 guns (5 100-pounder Parrotts, 12 10-inch columbiads, and 17 8-inch columbiads) had been received and emplaced in the fort's casemates. These pieces could hurl a volley of 3,124 pounds of metal at any vessel attempting to fight its way past Sandy Hook.[23]

5. Work Accomplished in Fiscal Year 1864

In April 1864 General Totten, who had served as Chief Engineer since December 1838, died. Colonel Delafield was promoted to

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21. Ibid.

22. Ibid.

23. Ibid.

brigadier general and moved to Washington as Chief Engineer. Capt. Frederick E. Prime, who had graduated from the U.S. Military Academy as no. 1 in the Class of 1850, succeeded Delafield as project superintendent overseeing construction of the defenses of New York Harbor.

When he filed his annual report of operations for the Sandy Hook fort for Fiscal Year 1864, Captain Prime noted that progress during the second half of the year had not been as great "as might have been expected from the amt. of material on hand." This, he explained, could be attributed to the difficulty in procuring "a sufficient number of mechanics in face of the large wages paid in New York & the neighbouring Towns."[24]

He was able, however, to report that some work had been accomplished on the scarp. This work included three courses of granite "laid in part on the S.E. curtain & right flank of S. E. Bastion--two courses partly laid on right face of S. E. Bastion"; four courses of granite laid on right face of southwest bastion, raising its scarp from reference 19' 2" to 28' 6", and completing the 13 embrasures in this section of the fort; a part of a fifth course had also been positioned on this face; the left face of the southwest bastion had been carried up from reference 19' 2" to 30' 9"; the three lower courses of granite had been laid for half of the southwest curtain; and the foundations of the other one-half of that curtain and of the right flank of the south bastion had been positioned.

By reference to the enclosed annual drawing, Chief Engineer Delafield could see "more clearly the amount of work" accomplished.[25]

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24. Prime to Delafield, Annual Report for Fort at Sandy Hook, for the Fiscal Year Ending June 30, 1864, NA, RG 77, Ltrs. Recd., Chief Engineer.

25. Ibid. A drawing entitled "New York Harbor, Plan of Main Work of Fort at Sandy Hook, N.J., as actually built and taken in hand on July 1, 1864," was included with the report.

Seven piers had been built in the left face of the southeast bastion, and no other piers of this face had been completed. The arches of the service magazine in this bastion, of one loophole gallery on the left and five on the right, had been turned and covered with concrete. The stairtower in the left shoulder angle of the southeast bastion had been raised to the height of the pier skewbacks (27' 9"), and one course of stone laid in the adjacent magazine.[26]

The casemate piers of the southeast curtain had been built, and the stairtowers of the northeast bastion and adjacent sections of the casemate piers had been completed, including the coping. The foundations of the curved part of the ramp of the northeast bastion had been laid. Ten piers of the north curtain had been completed, with the exception of the skewbacks.

The foundations of the ramp in the southwest bastion had been laid, and the service magazine had been built and its arch turned. The foundations, rear wall, and piers of nine loophole chambers had been raised on an average of 4 feet. Three sets of traverse irons had been laid, while the flagging and traverse stones were positioned in casemates nos. 104 and 105.

All the casemates were now flagged for 14' 4" from the scarp wall in the northeast and southeast bastions, and the "flagging had been continued to rear as far as the stock on hand would allow." The service magazine and 3 loopholed chambers in the southwest bastion had been flagged with "some course flag, to be used as a guard house & prison by the garrison."[27]

The parade in the vicinity of the temporary quarters occupied by the garrison had been graded. The 15-foot roadway of the

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26. Prime to Delafield, Annual Report for Fort at Sandy Hook, for Fiscal Year Ending June 30, 1864, NA, RG 77, Ltrs. Recd., Chief Engineer.

27. Ibid.

northeast and north curtain and part of the northwest curtain had been brought up to grade, and the interior of the southwest bastion had been filled in to parade level. To accomplish this, about 10,000 cubic yards of sand had been excavated from a barrow pit near the storehouse. Another 11,000 cubic yards of sand had been taken from the sand hills screening the north front and part of the northwest front to unmask the guns emplaced in their casemates.[28]

Quantitatively the amount of work on the fort included the following items:

sand moved	24,121 cu. yds.
paving laid in foundations	2,159 yds. of cobble paving
concrete and rough stone masonry	2,526.54 cu. yds.
cut granite	1,717.31 cu. yds.
bluestone masonry	939.65 cu. yds.
brick masonry	132.27 cu. yds.
bluestone flagging	1,384.13 sq. yds.
granite traverse circle stones	32.56 sq. yds.
brick flooring	19.50 sq. yds.
traverse circles laid	39 sets
embrasure irons set	13 sets
6-inch water pipe laid in piers	300 running feet
rail and plank roads finished	1,111 running feet[29]

In Fiscal Year 1864 the sum of $171,798.05 had been spent on the project. In the U.S. Treasury available for expenditure on the fort as of June 30, 1864, was the sum of $148,540.94 in appropriated funds. Meanwhile Congress had recently voted another $125,000 for expenditure in the year ending June 30, 1865.[30]

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28. Ibid.

29. Ibid.

30. Ibid.

With the amount of $273,540.94, Captain Prime proposed in Fiscal Year 1865 to "carry up the land fronts to reference 26' 2", to complete the piers of the sea fronts, turn the casemate arches of the NE Bastion and complete the barbette of this bastion if possible." There was on hand, he reported, a large quantity of cut granite for the scarp and casemate piers, sufficient, it was believed, to raise to their desired height the regular casemate piers of the northwest bastion, one-half of the northwest curtain, and the remaining piers of the north curtain.[31]

Captain Prime had had his workmen extend the railroad from the blacksmith shop to the fort. The southern wing of the laborers' barracks had been remodeled into "boarding houses & sundry necessary additions made to the different sets of quarters to carry out the system of boarding." An office had been outfitted in the south end of the storehouse.[32]

In accordance with orders from Chief Engineer Delafield, steps had been taken to protect the site from the sea. Two breakwaters--jetties nos. 1 and 2--had been built for protection of the eastern shore. Their total length was 788 feet, and they consisted of frames of 3- by 4-inch scantling sheathed with inch boards and filled with sand. The sand above the waterline was planted in beach grass.

On the western shore a breakwater was built to shield the Engineer force's temporary quarters. One hundred feet of this structure were similar to the east beach breakwaters, while the remaining 200 feet consisted of an inclined inch-board fence, the posts of which were tied to anchor stakes in the protected bank.[33]

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31. Ibid.

32. Ibid.

33. Ibid.; "Fort at Sandy Hook, N.J., Shore Changes of Sandy Hook, during the month of September 1867," NA, RG 77.

6. Work Accomplished in Fiscal Year 1865

During July, August, and September 1864, Captain Prime had his work force assigned to the scarp confine its efforts to the southwest front and to the right face of the southwest bastion. Four hundred and forty-two running feet of granite were set and, for the most part, backed with concrete masonry. The gallery walls, with skewbacks for communication between the main arches of the second gallery chambers in the right face and the corresponding two in the left face of the southwest bastion, were carried up to their full height, and the communication and three of the main brick arches turned. The parade arches of casemates nos. 35 and 38 and that to the entrance of the rotunda had been trimmed. In casemates nos. 1-6 of the southeast bastion the stones of the tenth course of interior facing had been set. The 15 casemate piers and parade piers between casemates nos. 55 and 56 and 56 and 57 in the north curtain were pushed ahead. The brick piers adjacent to the scarp in the left flank and face of the northeast bastion had been taken down and rebuilt of stone.

A detached communication arch over the main communication between the casemates having been approved, skewbacks for this arch were cut in the casemate piers of the casemates in the north curtain, running from nos. 46 to 55. The curbstone was set and the flagging of the casemates of the southeast and northeast bastions completed, and some additional flagging was laid in the casemate of the northeast curtain. The first loopholed chamber in the right face of southwest bastion was flagged, and a brick floor was laid in the ready gallery chambers of the southeast bastion.

The pavement for the foundation of part of the scarp of the right flank of the entire right face of the south bastion was laid, and the concrete foundation in the right flank and face was advanced considerably. The embrasure shutters of the casemates in the southwest bastion and northwest curtain were hung.

Besides building centres, patterns, making repairs, etc., the carpenters erected a small kitchen at the superintendent's quarters

and built fences and additional latrines for workmen's quarters. Eleven fender piles were driven for the wharf.[34]

During the three months ending December 31, 1864, work on a portion of the foundations of the right flank and right face of the south bastion was continued, and these foundations nearly completed. The first through fourth courses of the scarp of the southwest front were built up further and about 123 feet was added to the 12th course of the right face of the southwest bastion. The rear walls of the two gallery chambers on the right and that of the chamber next to the salient on the left face were carried up to their full height, and the walls of the third and fourth chambers were raised on an average of 4' 6". The rear wall of casemate no. 105 was built up some 3' 8" in height. The piers between casemates nos. 102 and 105 were raised 4' 6" above the foundations. The scarp in the salient and to the extent of the ready gallery chambers "aside of salient" in the southwest bastion was backed with concrete. The haunches of the arches of said chambers were filled, and the arches themselves were covered with concrete.

The parade arches of both faces and the left flank of the northeast bastion had been completed. A number of adjacent piers in the northeast bastion were rebuilt with stone. The casemate (15-foot) piers were cut down to receive the skewback for the communication arches, and a number of these arches were turned in the faces of the northeast bastion. The casemate piers were topped off and readied for receiving the casemate arches.

Flagging had been laid in all the casemates (except eastern casemates) of the northeast curtain, and the curbstone set and flagged in. Six casemates of the north curtains were nearly completed.

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34. Prime to Delafield, Annual Report for Fiscal Year Ending June 30, 1865, NA, RG 77, Ltrs. Recd., Chief Engineer.

Seventy-four sets of embrasure shutters were hung, leaving only five casemates without shutters. One hundred running feet of railway were added in the southeast bastion, while some repairs were made to the workmen's quarters with fences erected around them.[35]

During the quarter ending March 31, 1865, much of the construction was closed down because of the weather. With trifling exceptions all masonry work was limited to the northeast bastion. The adjacent brick piers of the right and left flanks, except the left shoulder pier, were cut down and rebuilt with stone. Skewbacks were fitted on the casemates' piers for communication arches, and one of the 12-foot communication arches and the arch connecting the little adjacent pier at the service magazine with the rotunda pier to form the skewback for casemate arch no. 36 was turned. The skewback of the rotunda piers was trimmed to receive the arch.

Extensive repairs were made to the wharf crane. The building of fences around the workmen's quarters was continued and the lumber yard fenced. The plank roads and breakwater on the cove south of the workmen's quarters were repaired.[36]

In the fourth quarter all the adjacent piers of the northeast bastion were completed, and the skewbacks were fitted on the main casemate piers for the communication arches. All these arches, except the one on the left shoulder, were turned and the piers topped off and made ready to receive casemate arches. The arch over the rotunda in the salient and those of casemates nos. 32, 36, and 37 were completed, and the arch over casemate no. 35 nearly so. One hundred and eleven feet and six inches (running feet) of the tenth course, 33 feet of the 11th course of scarp on the right face and shoulder, and the interior facestone for casemates nos. 32, 35, 36, and 37 had been set and backed

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35. Ibid.

36. Ibid.

with concrete. Some concrete had been deposited in the haunches of the subject arches.

The parade arches of the right flank of the northeast bastion and 13 arches in the north curtain had been turned. The adjacent (brick) pier between casemates nos. 45 and 46 was cut down and rebuilt with stone. The magazines were faced with stone on the communication between casemates nos. 45 and 46, and the arch over this communication was turned.

All the casemate piers of the north curtain had been completed, except for several skewback courses. The magazine in the left reentering angle of the north curtain had been carried up five courses in the main walls, and the anterooms connected through 3 to 4 courses. The cistern arches, for the part in rear of the guns, in eight casemates of the north and northeast curtains had been cut down about 2 inches. The manholes had been refitted square to the arch, the overflow pipes inserted in the parade wall of the cisterns, and the wall closed up.

The flagging of casemates nos. 46-59 in the north curtain and of the cistern arches in the northeast curtain were finished, except for a few small closures. The curbstones were set, and some additional flagging was laid in casemates nos. 61 and 62.

In late June work was started again on the service magazine in the right reentering angle of the northeast curtain. The repair of the wharf crane and fencing at the workmen's and superintendent's quarters were finished. Twelve 10-inch Rodmans were received at Sandy Hook and emplaced in casemates nos. 28-36, 50-63, 77-79, and 93-95. Five 200-pounder Parrotts, with four chassis and top carriages, were landed and positioned on the parade.[37]

On August 29, 1864, a canal boat was scuttled below the flood tide line, at a point on the east shore in prolongation of the axis

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37. Ibid.

connecting the salients of the southeast and southwest bastions, and partially filled with concrete. Tides and high winds, however, caused a suspension of the work until November, when 560 cubic yards of concrete were positioned.[38]

During Fiscal Year 1865 there had been expended on the project $122,959.63, leaving an unexpended balance of $166,991.33. This figure did not include the $50,000 appropriated for the fort on Sandy Hook by the 2d Session of the 38th Congress.[39]

7. Work Accomplished in Fiscal Year 1866

In Fiscal Year 1866 Major Prime, who had been promoted from captain on June 1, 1863, proposed to: (a) complete the casemate arches of the northeast bastion; (b) carry up the scarp of the north curtain; (c) complete the casemate piers and communicaton arches of that curtain ready for the casemate arches; and (d) build the right face of a "new" land front to reference of the parade. The following year he would: (a) turn the casemate arches of the north curtain; (b) prepare the piers of the northwest bastion and curtain for the casemate arches; (c) build the scarp to its full height; and (d) carry up the entire land front to reference of the parade.[40]

During the year no work was accomplished on the northwest face of the southwest bastion. As of July 1, 1866, the irregular spaces in the salient and the two adjoining loopholed casemates were arched and roofed with concrete, and the piers of casemates Nos. 102-105 had been carried up about 5-1/2 feet in height. The rear wall of casemate No. 105 was also raised to 5-1/2 feet. The foundations for all the piers, stairtower, and service magazine were completed, and the

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38. Ibid.

39. Ibid.

40. Executive Documents, Printed by Order of the House of Representatives, During the 2d Session of the 39th Congress, 1866-67 (Washington, 1867), Ser. 1285, III, 424-25.

adjacent piers were partly carried up, only requiring the skewback to finish them. The flagging was laid in the irregular space in the salient, the two loopholed casemates, and all the gun traverses of the casemates, and the traverse circle irons were laid and the embrasure shutters hung.

In the southwest face of the subject bastion, foundations for gallery walls had been laid in loopholed casemates nos. 1-8. Casemate no. 1 had been arched over, and the walls of casemate no. 2 had been raised to reference 25' 8".[41]

During the year workmen had raised the casemate piers of the northwest curtain, between casemates nos. 80 and 85, to reference of the bottom of the skewback course (25' 8"). The adjacent pier between casemates nos. 79 and 80 had been raised to its desired height, while that between casemates nos. 80 and 81 had been partially built, and that between casemates nos. 84 and 85 had been provided with a skewback for the communication arch. The walls of the service magazine in the curtain angle had been brought up from two to three courses in height.

Other portions of the northwest curtain were the same as they had been 12 months before--all adjacent piers built and needing only the skewback to complete them; a few of the parade and casemate pier quoins of the first course set; the gateway piers raised to reference of the skewback; and the flagging laid to the extent of the gun traverses in all casemates.[42]

In the northwest bastion the construction people in Fiscal Year 1866 had taken down the brick piers adjacent to the scarp between casemates nos. 61 and 75. All the adjacent piers were rebuilt with stone. Except for the irregular piers in the salient, all the 15-foot casemate piers had been built to reference of the bottom of the skewback course. Additions had been made to the walls of the right flank service magazine

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41. "New York Harbor, Plan & Elevations of Main Works of Fort at Sandy Hook, N.J., Showing its Condition on July 1, 1866," NA, RG 77.

42. Ibid.

and anteroom. The walls of the service magazine on the left flank had been carried up two to three courses.[43]

On July 1, 1866, the scarp of the north curtain remained as reported 12 months before: 10 courses of granite carried up--the tenth course was not backed, however. The adjacent piers between casemates nos. 55-61 had been rebuilt with stone to a height of 6' 7" from the casemate floor, and the adjacent piers between casemates nos. 46-50 had been completed. The communication arches between casemates nos. 46-50 had been turned, and the parade arches of casemates nos. 59 and 60 and the spandrels between them had been set. The wall on the 12-foot communication of the service magazine in the left curtain angle had been raised to its full height, and the skewback course and other slight additions had been made to the other walls of this magazine.[44]

New construction at the northeast bastion included: (a) the brick pier adjacent to the scarp between casemates nos. 27 and 28 was taken down and rebuilt with granite and the skewback fitted; (b) the wall of the magazine on the 12-foot communication between casemates nos. 27-28 was faced with stone; (c) the communication arches between casemates nos. 27-28 and 43-44 were turned and partly covered with concrete; (d) the scarp was raised, with the exception of some parts of the left flank, to reference of the top of the 13th course (35') (the 13th course being only partially backed was concrete); (e) the arch over casemate no. 35 was finished; (f) the arches over casemates nos. 33-34 and 38-40 were turned and partly roofed over with concrete; and (g) concrete was positioned over the haunches of the completed casemate arches.[45]

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43. Ibid.

44. Ibid.

45. Ibid.

During the year workmen on the northeast curtain had raised the scarp of casemates nos. 26 and 27 by four courses. The walls of the service magazine in the right curtain angle had been raised the same extent; that of casemate no. 14 to an average height of 5 feet from the floor; the parade floor of magazine to reference 18' 1"; and the wall in the communication between casemates nos. 13-14 to reference 24' 5".[46]

On the northeast face of the southeast bastion the following work had been accomplished: (a) the walls of the left flank service magazine had been raised to 24' 5"; the wall in casemate no. 12 had been raised 3' 6"; and the front pier and most of the parade face to reference 18' 1".[47]

Major Prime, in compliance with Engineer Order No. 3, dated June 20, 1865, had suspended work on the land fronts. This order constituted a special Board of Engineers (Cols. J. G. Brewerton and John G. Barnard, and Majs. J. C. Duane, Frederick E. Prime, and William P. Craighill) to modify the plans for the Sandy Hook fort, which would incorporate the technological lessons of the Civil War. During the war a number of masonry Second and Third System forts had been pounded into rubble by heavy rifled guns. There had been a revolution in weaponry, and the United States had developed the huge Rodman and Dahlgren shellguns.

The revised plan submitted by the Board called for: (a) the replacement of the south bastion with a caponniere and gateway; (b) a realignment of the southeast and southwest curtains into the southeast, south, and southwest land fronts; (c) the modification of the casemates and terrepleins of the northwest, north, and northeast sea fronts to emplace the heavy shellguns and rifles developed during the Civil War; and (d) the enlargement of the casemates of these fronts to facilitate the

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46. Ibid.

47. Ibid.

emplacement of modern ordnance. When, and if, this plan were implemented, the fort would mount two 20-inch Rodmans, twelve 15-inch Rodmans, fifty-two 8-inch rifles, and six 10-inch columbiads. The trace of the three new fronts would be: the southeast and southwest each 646 feet and the south 252 feet.

On June 1, 1866, there were 105 sea front casemates ready for their armament. Sixty-six of these were provided with two sets of traverse circle irons for either iron or wooden carriages. The other 39 casemates were arranged for iron carriages. Mounted in the fort's casemates were: twenty-four 10-inch Rodmans on iron carriages, eight 8-inch Rodmans on iron carriages, nine 8-inch columbiads (three on iron and six on wooden carriages), and five 100-pounder Parrotts on iron carriages. On hand but not mounted were four 15-inch Rodmans with centre-pintle iron carriages, one 15-inch Rodman with front-pintle iron carriage, four 300-pounder Parrotts with centre-pintle iron carriages, five 200-pounder Parrotts with front-pintle iron carriages, one 100-pounder Parrott with front-pintle iron carriage, and sixteen iron front-pintle carriages for 10-inch Rodmans.[48]

The unexpended balance in the Treasury for the fort at Sandy Hook on October 1, 1866, had shrunk to $118,000, and Major Prime expected to spend this sum by June 30, 1867.[49]

8. Work Accomplished in Fiscal Year 1867

In the autumn of 1866 Major Prime was replaced as District Engineer by Lt. Col. John Newton. Under Newton's supervision, work was pushed on the new land fronts. The change in trace made it necessary to remove such parts of the scarp and piers built on the old trace as did not conform to the new plan. Four hundred cubic yards of granite and 725 cubic yards of concrete and rubble were taken up. No masonry was taken down on the land faces of the southeast and southwest

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48. Ibid.; "Modified Plan of Fort at Sandy Hook, Projected by the Board of Engineers Convened by Engineer Order No. 3, NA, RG 77.

49. Executive Documents, Ser. 1285, III, 425.

bastions, except a few stones to make a junction with the scarp of the prolonged faces of the new trace.

On the southwest face of the new land front foundations for gallery walls (old plan) were laid for seven 2-loopholed casemates. Casemate no. 1 was completed and arched; the walls of casemate no. 2 were up to reference 25' 8"; the rear wall of casemate no. 3 averaged 5' 4" in height; that of casemate no. 4 5' 8"; and the others about 5' 2". The adjacent piers, built on the old plan, had been carried up to the same height as the scarp. The new part of the scarp was taken in hand before a final decision had been made as to the arrangement; thus, the adjacent arches were not carried up along with the scarp.

The scarp of the southeast front was handled as follows: (a) the first course of granite was backed with concrete; (b) the second course backed, except for 24 feet; (c) the third course backed for 63 feet; and (d) the fourth course not backed. The five loopholed casemates next to the salient of the southeast bastion were completed, arched, and in part roofed over with concrete. The rear wall of casemate no. 6 was raised to reference 27' 4"; the rear wall of casemate no. 7 to reference 25' 1"; and the rear wall of casemate no. 8 to reference 25' 3". All the adjacent piers (old trace) corresponded in height to the scarp. Of the adjacent piers of the new trace, two had been raised to the top of the fourth course, while ten averaged 3' 6" from the foundations. The foundations for two adjacent piers and 30 feet of scarp had been laid.[50]

The scarp of the northeast bastion was raised, and the north curtain casemate arches and communication arches in the northeast bastion and north curtain were constructed. The piers of the northwest

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50. Executive Documents, Printed by Order of the House of Representatives, During the 2d Session of the 40th Congress, 1867-68 (Washington, 1868), Ser. 1325, II, 10-11; "New York Harbor, Plans and Elevations of Main Work of Fort at Sandy Hook, N.J., showing its condition on July 1, 1867," NA, RG 77.

curtain were built, and additions were made to the walls of the service magazines, etc., in the northwest and southeast bastions. Overall, however, work on the sea fronts was held to a minimum, and none of the changes called for in the "Modified Plan" had been implemented. All work ceased on the sea fronts in September 1866.[51]

When he filed his annual report for Fiscal Year 1867, Maj. Gen. Andrew A. Humphreys, who had replaced General Delafield as Chief Engineer in 1866, noted that in Fiscal Year 1868 Colonel Newton planned to complete the foundations of the scarp and piers of the land fronts, not including the caponniere, and to raise the subject scarps uniformly four courses. To fund these operations Congress was asked for an appropriation of $150,000.[52]

9. Work Accomplished in Fiscal Year 1868

No work was done on the sea fronts during the year. The southeast, south, and southwest land fronts were advanced. The scarp of the southeast front had been raised "generally" to the sills of the loopholes; that of the southwest front to reference 14' 3", two courses below the sills; and the south (short) front had had about one-half the foundation finished as well as a small portion of the scarp, east of the gateway, built to reference 7 feet.

Chief Engineer Humphreys, in submitting his annual report to Congress, urged that funds be appropriated to continue construction of the land fronts, which were independent of the modifications contemplated for the sea fronts, and should not be delayed. He asked for the largest sum that could be conveniently expended with propriety in a year.[53]

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51. Ibid.

52. Executive Documents, Ser. 1325, II, 11.

53. Executive Documents, Printed by Order of the House of Representatives, During the 3d Session of the 40th Congress, 1868-69 (Washington, 1869), Ser. 1368, III, 14.

C. Fort in 1869

Beginning in 1868 Congress refused to appropriate any funds for construction of seacoast fortifications for three successive years. Work on the fort at Sandy Hook was closed down in Fiscal Year 1869. Hands were laid off, and the Engineer property secured and placed in charge of a fort keeper.

The Sandy Hook fort, discounting the proposed modifications called for to its sea fronts, was about seventy percent completed. All foundations of the face and flank of the southwest bastion had been laid, all adjacent piers built, four of the 15-foot piers in the face raised up three courses, and the casemates flagged to the inner face of the 15-foot piers. The loopholed casemates on either side of the salient were completed, except the floors and arch of the second one on the land front. The salient magazine was finished, except for the doors.

The northwest curtain was completed, except for the 15-foot piers south of the gateway. In the northwest bastion, work required included construction of piers in the rear of casemates nos. 70 and 71 and the completion of the magazines and anterooms on the right and left flanks.

Along the north curtain piers had been built up to the spring of the arches, all parade arches, except the one at casemate no. 61, had been raised, and all communication arches to the right of casemate no. 54 had been built.

The northeast bastion was completed with stair towers, rotunda, magazine, and anterooms raised to an average of one course above the parade arches, except casemate arches nos. 43-45. The arches, so far as built, were covered with concrete. The foundations for the circular ramp were laid.

The northeast curtain was completed. To finish the southeast bastion, it would be necessary to: (a) roof with concrete the flank magazine; (b) raise the piers adjacent to casemate no. 13; (c) place a floor and doors in the salient magazine; (d) construct a floor in the first

loopholed casemate north of the salient; (e) build an arch and rear wall in the second loopholed casemate; and (f) put floors in the two loopholed casemates on the land front.

The three land fronts were beginning to take shape, with four to five courses of granite in position on the southeast and southwest fronts, and three on the east one-half of the south front. Foundations for two barracks had been laid parallel to and in the rear of the northeast curtain.[54]

D. Garrisoning the Fort, April 1863-July 1866

The third year of the Civil War was about to commence before the masonry casemates of the north and northeast sea fronts were ready to be armed. To assist in mounting the big columbiads and Parrotts and to guard and man them, troops were ordered to Sandy Hook. On April 3, 1863, Capt. Adam Cleghorn and his command, Company E, 10th New York Heavy Artillery, boarded a vessel at Fort Richmond and an hour later landed on the Engineer wharf.

In July Company E was relieved at Sandy Hook by Companies H and J, 26th Michigan Infantry, and Company C, 11th New York Heavy Artillery. Captain Cleghorn and his men, along with other companies of the 4th Battalion, 10th New York Heavy Artillery, had been ordered to reinforce its regiment in the defenses of Washington, D. C. The Michigan regiment on July 11 had been rushed from Yorktown, Virginia, to New York City by ship to help suppress the draft riots. After order had been restored, the companies of the 26th Michigan pulled garrison and provost duty in the harbor forts until October 13, when they

54. "Fort at Sandy Hook, N.J., Plan of Main Work and Elevation of Scarp Wall, showing condition of work on June 30th, 1869," NA, RG 77.

rendezvoused, preparatory to joining the Army of the Potomac in the field.[55]

Company C, 11th New York Heavy Artillery, had left Sandy Hook two days before the Michiganders. To guard the fort and serve the big guns pending arrival of a new garrison, Company K, 4th U.S. Infantry, arrived from Fort Richmond on October 13. Seven days later, the regulars were relieved by Companies L and M, 14th New York Heavy Artillery. Four months later, on April 23, the companies of the 14th were pulled out of the harbor forts and headed for Virginia, where they would report for duty with the IX Corps.[56]

The 28th Battery, New York Light Artillery, formerly posted at Forts Columbus and Schuyler, replaced Companies L and M as the unit responsible for security of the massive Sandy Hook fort. In August 1864 Capt. Josiah C. Hannum of the 28th Company, bored with garrison duty, wrote Chief-of-Staff Henry W. Halleck, complaining that he and his men had been mustered in on December 27, 1862. Since then they had been serving as heavy artillery in the harbor forts. His command being in a "good state of discipline," he asked that it be equipped as a light battery and given an opportunity for drill and practice with the same, preparatory to being ordered into the field.[57]

Lt. Col. E. Steen, who had commanded the Sandy Hook post for months, urged that Captain Hannum's request be rejected, unless the

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55. Record of Service of Michigan Volunteers in the Civil War, 1861-1865, Twenty-Sixth Michigan Infantry (Kalamazoo, 1906), p. 1; Frederick Phisterer, comp. New York in the War of the Rebellion, 1861 to 1865 (5 vols., New York, 1912), II, 1,442; Returns from U.S. Posts, 1800-1916, National Archives, Microcopy M-617; Edward P. Webb, History of the 10th New York Heavy Artillery from Madison Barracks to Appomattox . . . (Watertown, N. Y., 1887).

56. Phisterer, New York in the War of the Rebellion, II, 1476-77; Returns from U.S. Posts, 1800-1916, NA, Microcopy M-617.

57. Hannum to Halleck, Aug. 25, 1864, Company Papers, Records of the Adjutant General's Office, 1790s-1917, Record Group 94, National Archives.

28th New York Battery could be replaced by a regular unit. Hannum's company, Steen pointed out, was "well instructed and equal to any regulars in the service."[58]

Brig. Gen. Lewis C. Hunt, the officer in charge of the troops charged with defense of New York City, likewise opposed sending the 28th New York into the field, as he had no troops to replace them at the fort on Sandy Hook, which he characterized as "one of the most important in the outer defense of this harbor." This doomed the 28th New York to spend the last winter of the war on Sandy Hook.[59]

While posted at Sandy Hook, the 28th Battery, like units which preceded it, was quartered in the frame barracks erected by the Quartermaster Department several hundred yards east of the wharf. Besides manning the guns emplaced in the lower casemates of the masonry fort, the men of the 28th performed the other duties expected of troops in similar situations--there were long hours of standing guard, close order drill, and fatigue details. Men were frequently detailed to the provost marshal for duty in New York City.

On April 9, 1865, Gen. Robert E. Lee surrendered the Army of Northern Virginia to forces led by Lt. Gen. Ulysses S. Grant at Appomattox Court House, Virginia. During the next six weeks, the other armies of the Confederacy laid down their arms.

With the end of the Civil War, the nation rushed to demobilize. On July 22, 1865, Company C, 4th U.S. Infantry, arrived at Sandy Hook and relieved the 28th New York Battery, which in turn took the same boat to New York City where the Company was mustered out on July 31.[60]

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58. Steen to Hunt, Aug. 27, 1864, NA, RG 94.

59. Hunt to Halleck, Aug. 30, 1864, NA, RG 94.

60. Phisterer, comp., New York in the War of the Rebellion, II, 1620; Returns from U.S. Posts, 1800-1916, NA, Microcopy M-617.

Some four weeks later, on September 2, Company K, 5th U.S. Veteran Volunteers, was sent to Sandy Hook and relieved Company C, 4th U.S. Infantry. The garrison was reinforced on March 23, 1866, by the arrival of Company B, 2d U.S. Veteran Volunteers. Company K was mustered out in May, and two months later in July 1866 Company B was mustered out. The fort and engineer property would be in charge of ordnance-sergeants and fort keepers for the next 24 years.[61]

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61. Returns from U.S. Posts, 1800-1916, NA, Microcopy M-617.

III. TWENTY YEARS OF RETRENCHMENT

A. A Technological Revolution in Weaponry Has Repercussions

The Civil War triggered a technological revolution in fortifications and weaponry. The handsomely designed and costly masonry forts protecting the ports and harbors of the United States were made obsolete by rifled artillery. Steam now propelled warships, freeing them from dependence on winds, greatly increasing their tactical mobility, and lessening the exposure of their motive power, while the addition of armor further reduced their vulnerability to fire from shore batteries.

By 1865 several European powers, having partially evaluated the technical lessons of the Civil War, had prepared plans for construction of new--and expensive--fortifications armored with masses of iron. The United States, having emerged from a terrible conflict, was unready to embark on construction of a new system of coastal defense. The Corps of Engineers, mindful of the suddenness with which the "Third System" masonry fortifications (of which the fort at Sandy Hook was the ultimate example) had been made obsolete, was hesitant for technical reasons to return "to elaborate works that might quickly become outmoded, as there was much to suggest . . . a coming period of further rapid advances in artillery." Congress, its energy occupied with Reconstruction legislation and its struggle with the Executive Department, was in no mood to spend huge sums on the military.[1]

The years immediately after the Civil War found the Corps of Engineers undertaking experiments to determine the feasibility of facing existing masonry works with armor-plate, while the Ordnance Department was engaged in designing and testing rifled guns of increased size and power. The armor studies were inconclusive, though such a means of preserving the utility of existing Second and Third System forts would have been prohibitively expensive. Experiments by the ordnance people gave promise of success. Because of their great weight, the new guns

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1. Emanuel R. Lewis, Seacoast Fortifications of the United States: An Introductory History (Washington, 1970), pp. 66-68.

could not be mounted in most existing masonry works. In addition, they could be equipped with depressing carriages to permit them to be retracted below the parapet for loading and servicing. Thus, as fortification expert Dr. Raymond E. Lewis has written, "the inability of masonry to withstand modern weapons, the post war shortage of funds for military purposes, and the need for emplacements large enough to receive the new armament combined in the closing years of the [1860s] to bring about a return to an inexpensive mode of permanent fortification in which earth once again became the principal substance of protection."[2]

The coastal fortifications erected by the United States in the 1870s were similar to the barbette batteries of the Second and Third Systems. Differences were to be found in detail; for example, improved magazine placement and more space between guns. Because they were designed for larger weapons, the new emplacements would be of greater size. Facings would be of brick; gun platforms of granite or concrete; and the magazine well protected by many feet of earth over concrete.[3]

B. Unfinished Fort Guards Sandy Hook

1. No Construction Funds for the Sandy Hook Fort

Although Congress, beginning in 1870 and continuing through 1876, passed legislation annually appropriating considerable sums for construction of coastal fortifications, no money was allotted for the Sandy Hook fort. During this seven-year period, as work was pushed at many of the nation's seacoast fortifications in the construction of detached earth and masonry batteries and modification of Second and Third System forts to mount heavier guns *en barbette*, the fort at Sandy Hook stood partially armed, unfinished, and tended by its fort keepers and ordnance-sergeant.

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2. *Ibid.*, pp. 68-69.

3. *Ibid.*, p. 69.

When he filed his annual report for Fiscal Year 1870, Colonel Newton noted that the fort as projected was principally casemated, but as yet no satisfactory plans for its modification had been devised. The only work accomplished during the year had been confined to preservation of the site.[4] No work was done at Sandy Hook the following year for in the annual report of Fiscal Year 1871 the keepers were listed as the only men employed at the site.[5]

This situation continued through the next two years. In the autumn of 1873, at the time when international tensions were honed by the crisis over resolution of the Alabama Claims, Chief Engineer Humphreys, as an emergency measure, ordered a temporary six-gun battery erected at the Hook. But, after a site was selected and wooden platforms built, the work came to a stop. The dispute with Great Britian had been solved by arbitration, and the funds allotted for the project reverted to the Treasury in accordance with a ruling by the Comptroller.[6]

The Ordnance Department, at the time when sabers were rattling, made a study of the fort's armament. Emplaced in the casemates in December 1873 were: 24 10-inch Rodmans, 8 8-inch Rodmans, 9 8-inch columbiads, and 5 100-pounder Parrotts. Eight of the 8-inch columbiads, however, were mounted on "worthless wooden carriages." On hand, but not mounted, were 5 15-inch Rodmans, 4 300-pounder Parrotts, 4 200-pounder Parrotts, and 1 100-pounder Parrott. There were no

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4. Executive Documents, Printed by Order of the House of Representatives, During the 3d Session of the 41st Congress, 1870-71 (Washington, 1871), Ser. 1447, II, 20.

5. Executive Documents, Printed by Order of the House of Representatives, During the 2d Session of the 42d Congress, 1871-72 (Washington, 1872), Ser. 1504, II, 15.

6. Executive Documents, Printed by Order of the House of Representatives, During the 2d Session of the 43d Cngress, 1874-75 (Washington, 1875), Ser. 1636, III, 15.

platforms available for mounting the 15-inch Rodmans and the 300- and 200-pounder Parrotts.

On hand were these projectiles: 493 15-inch shell, 1,739 10-inch spherical shot, 1,839 10-inch spherical shell, 1,700 8-inch spherical shot, 1,681 spherical shell, 110 200-pounder Parrott shot, 390 200-pounder Parrott shell, 493 100-pounder Parrott shot, and 500 100-pounder Parrott shell. The projectiles for the mounted guns were conveniently stored. In addition, there was stored in the fort's magazines 60,250 pounds of cannon powder, 300 pounds of mortar powder, and 200 pounds of mealed powder.[7]

In Fiscal Years 1875 and 1876 the only projects undertaken at the fort were maintenance-oriented. During the latter year, the southern boundary of the Sandy Hook Military Reservation was surveyed and delineated with granite blocks. On April 21, 1877, there was a personnel change, when Capt. James Mercer relieved Colonel Newton as District Engineer.[8]

2. Plans Prepared and Approved for Modification of Fort

By the mid-1870s Congress was becoming reluctant to appropriate large sums for coastal fortifications until the War Department could develop and present plans for a comprehensive scheme for the defense of the nation's harbors and ports. The second session of the 44th Congress, which convened in December 1876, refused to vote any funds for construction of seacoast fortifications. Succeeding Congresses over the next 14 years held that same position. Although money, except

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7. Butler to Crispin, Dec. 6, 1873, Ltrs. Recd., Chief of Ordnance, Records of the Office, Chief of Ordnance, Record Group 156, National Archives. Lt. Col. Silas Crispin was commander of the New York Ordnance Agency and Lt. John Butler was on his staff.

8. Executive Documents, Printed by Order of the House of Representatives, During the 1st Session of the 44th Congress, 1875-76 (Washington, 1876), Ser. 1675, II, 16; Executive Documents of the House of Representatives for the 2d Session of the 44th Congress, 1876-77 (Washington, 1877), Ser. 1743, II, 16.

in Fiscal Years 1887-1888, was appropriated for preservation and repair of existing fortifications and for contingencies, no construction funds were voted.

Except for routine maintenance no funds were spent on the Sandy Hook fort in Fiscal Years 1877-78. Col. Henry Benham, who replaced Captain Mercer as District Engineer on July 30, 1877, noted in his annual report for Fiscal Year 1878 that the fort remains in "the condition in which it has been for several years past . . . with the lower tier of casemates essentially completed upon the north, east, and west fronts, providing positions for about 100 guns."[9]

A Special Board of Engineers (Cols. Horatio G. Wright, John G. Barnard, and Zealous Tower) spent hours studying proposed modifications of the fort in Fiscal Year 1879. Almost every possible combination was reviewed and drawn to exhibit "the power and capacity of the fort if finished on its present lines. The various phases of the question thus presented gave, by comparison and arrangement, the final plan adopted, which though not the strongest possible combination, seemed quite proportionate to the development elsewhere; as well as to the needs of the position."

The plan for the modification and completion of the Sandy Hook fort, "the most advanced of all the defenses of the southern approach by sea to the harbor and city of New York," called for the emplacement of the heaviest available rifled guns in casemates and turrets. These guns would command the channel, which is, opposite the Hook, more than a mile wide, and of a depth sufficient to float the "largest and most efficient ironclad yet built or designed."

Emplaced in the casemates of the three sea fronts would be 12 81-ton rifled guns, 23 12-inch rifles, and 9 8-inch rifles. The

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9. Executive Documents of the House of Representatives for the 3d Session of the 45th Congress, 1878-79 (Washington, 1879), Ser. 1844, III, 15.

casemate arches would be bombproofed with several feet of concrete covered with a number of feet of sand. The garrison would be quartered in the casemates of the northwest front of the southwest bastion. The partially completed southwest, south, and southeast land fronts would be razed. Mounted on the terrepleins of the northwest, northeast, and southeast bastions would be an armored turret mounting a large caliber gun.[10] To begin work on the approved plan for modernization of the fort, Colonel Benham asked for an appropriation of $150,000 for Fiscal Year 1881.[11]

No money was appropriated for construction, and thus no work was done on the fort in Fiscal Year 1881. Sums allotted by the Chief Engineer from the general preservation and maintenance appropriation were expended "in the care and oversight of the military reservation and the public property stored there, with such repairs to storehouses and other engineer buildings as were found to be necessary for their safety and preservation."

In calling for an appropriation of $150,000 for Fiscal Year 1882, Colonel Benham pointed out that occupation by an enemy fleet of the "capacious bay" just within the Hook would prevent all egress from the harbor southward to the sea, and effectually seal up the main outlet from New York City. The modification and completion of the Sandy Hook fortifications for the reception of the heaviest modern rifled guns, shielded by impenetrable armor, and protection of the site against encroachments by the sea, Congress was reminded, were of great importance.[12]

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10. Executive Documents of the House of Representatives for the 2d Session of the 46th Congress, 1879-80 (Washington, 1880), Ser. 1904, III, 19, 34; "Fort at Sandy Hook, N.J., showing modifications proposed by the Board of Engineers for Fortifications, June 25, 1879," NA, RG 77.

11. Executive Documents, Ser. 1904, III, 19, 34.

12. Executive Documents of the House of Representatives for the 1st Session of the 47th Congress, 1881-82 (Washington, 1882), Ser. 2011, III, 32-33.

Once again, Congress refused to vote construction funds. In Fiscal Year 1882 Colonel Benham used money allotted by the Chief Engineer from preservation funds for such small repairs to buildings as could be made by the keepers. The fort's condition was unchanged except for such injuries as are due to "the never-ceasing influence of the atmosphere, storms, etc."[13]

On July 21, 1882, Maj. George L. Gillespie replaced Colonel Benham as Engineer in charge of the inner defenses of New York Harbor. Gillespie, a Tennessean, had graduated from the U.S. Military Academy as no. 2 in the Class of 1862. Commissioned a 2d lieutenant in the Corps of Engineers, young Gillespie on August 3l was assigned to duty with the Army of the Potomac as commander of a company in the Engineer Battalion. At the Battle of Fredericksburg, Gillespie and his company bridged the Rappahannock River. He was awarded the Medal of Honor for gallantry at Bethesda Church, Virginia, on May 31, 1864. On October 31, 1864, he was assigned to Maj. Gen. Philip H. Sheridan's staff as first assistant and then chief engineer. He was with Sheridan at Appomattox Court House on April 9, 1865. The end of the Civil War found Gillespie a captain of Engineers, with two brevets for gallantry.

During the first six years following the end of the war, Gillespie served in the Southwest, South, New England, and Great Lakes area. From April 1871 to May 1873, he was on detail in the Shenandoah Valley, making surveys to illustrate Sheridan's campaigns. While engaged in this work, he was promoted to major. From June 30, 1874, until May 1877 he was chief engineer of the Division of the Missouri. After spending 14 months in Europe, Gillespie was ordered to the Pacific Northwest, where he remained until July 1881. From September 1881 until July 1882, Major Gillespie was in charge of harbor improvements on Lake

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13. Executive Documents of the House of Representatives for the 2d Session of the 47th Congress, 1882-83 (Washington, 1883), Ser. 2092, III, 29-30.

Champlain and river improvements and surveys in northeast New York and western Vermont.[14]

In Fiscal Years 1883 and 1884 Major Gillespie was allotted minimal sums for maintenance of the Sandy Hook fort. A few repairs were made to the fort and its dependencies in Fiscal Year 1886. Fifty-seven shot beds were built for storing in an orderly manner the shot and shell on hand in the fort. In March the outbuildings southwest of the fort occupied by the keepers and ordnance-sergeant were repaired.[15]

Major Gillespie reported in Fiscal Year 1887 that no work was accomplished on the fort or jetties. The latter were in good condition, having suffered no damage from the winter storms.[16]

C. Protecting the Site

1. Construction of Jetties Nos. 3-8

Between June 30, 1865, and September 1867, the Corps of Engineers had continued to spend money to protect the site of the Sandy Hook fort from the sea. Three more jetties, nos. 3, 4, and 5, had been constructed in Fiscal Year 1867. They were positioned along the beach from a site 500 feet northwest of jetty no. 1 to a point fronting the salient of the northeast bastion. Two additional canal boats had been scuttled and filled with concrete. The first of these had been employed to prolong jetty no. 2, and the second to reinforce and extend to the

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14. George W. Cullum, Biographical Register of the Officers and Graduates of the U.S. Military Academy at West Point, N.Y., from its Establishment in 1802 to 1890 . . ., 3d ed. (4 vols., Boston, 1891), II, 844-46.

15. Executive Documents of the House of Representatives for the 1st Session of the 49th Congress, 1885-86 (Washington, 1886), Ser. 2370, III, 24-25.

16. Executive Documents of the House of Representatives for the 2d Session of the 49th Congress, 1886-87 (Washington, 1887), Ser. 2462, III, 24-25.

seaward the barrier at jetty no. 1 formed by the canal boat positioned in July 1864.[17]

In September 1867 construction was commenced on jetty no. 6 in the bight between jetties nos. 1 and 2.[18]

Four years later, in 1871, it became necessary to build two more jetties to protect the fort site. Jetty no. 7, of sheet piling and 66 feet in length, was positioned several hundred yards in front of the fort's north curtain, and jetty no. 8 of cedar piles and brush and 185 feet long, was sited midway between jetties nos. 3 and 7. These jetties, along with the others previously built, checked the beach erosion east and northeast of the fort and resulted in some beach accretion.[19]

2. Colonel Benham's Bulkhead

In Fiscal Years 1875 and 1876 funds were spent by the Corps of Engineers for maintenance of the jetties. Colonel Benham, who had replaced Captain Mercer as District Engineer in March 1878, employed a crew to construct a sand-box bulkhead to afford additional protection to the fort site. The triangular-shaped, rock-filled cribs, forming the bulkhead and paralleling the beach for about 1,400 feet, beginning at jetty no. 1 and running north to a point midway between jetties nos. 3 and 8, had been completed by June. Colonel Benham hoped the bulkhead, along with the jetties, would provide the necessary protection

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17. "Fort at Sandy Hook N.J., Shore Changes of Sandy Hook, during the month of September 1867," NA, RG 77.

18. Ibid.

19. Executive Documents, Printed by Order of the House of Representatives, During the 3d Sesseion of the 42d Congress, 1872-73 (Washington, 1873), Ser. 1559, II, 13; Executive Documents, Printed by Order of the House of Representatives, During the 1st Session of the 43d Congress, 1873-74 (Washington, 1874), Ser. 1598, II, 12; "Sketch of Shore Line of the North Eastern Part of Sandy Hook, N.J., showing line of bulkhead as built under the direction of Genl. H. W. Benham, U.S. Engrs., March to June 1878," NA, RG 77.

against further encroachments by the sea at the proof battery and its support facilities, which had been established by the Ordnance Department in 1874 between the southeast bastion and the beach.[20]

In Fiscal Year 1881 a small sum was spent by Colonel Benham on repair of the broken extremities of the bulkhead which had been battered by a series of savage winter storms. Those cribs still in position were also refilled.

When he filed his annual report for the year, Colonel Benham observed that the works protecting the shore east of the fort were in comparatively good condition--commencing opposite the southeast bastion at a point 150 feet south of the canal boat, jetty no. 1, the land end of which was about 550 feet east of the salient of the southeast bastion. The concrete jetties (nos. 2, 4, and 5) built on this shore in former years were, with the exception of the canal boat jetty, so much reduced by the incessant wash of the sea as to render them practically useless. Nothing remained of the two brush jetties, nos. 3 and 8, north of the concrete jetties. Changes to the east beach in recent years did not indicate any great variations from a "certain approximately stable bank or highwater line, as the surveys for many years past seem to show, the sand washed away at one time being generally replaced at another in early succeeding storms."[21]

Savage storms in August 1881 threatened the proof battery and facilities belonging to the Signal Service and Western Union between the beach and the fort's northeast curtain. On filing his annual report for 1882, Colonel Benham noted that north and east of the fort no great changes in the shore line were apparent, except the "removal of the

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20. Executive Documents, Ser. 1844, III, 15; "Sketch of Shore Line of North Eastern Part of Sandy Hook, N.J., showing line of bulkhead as built under the direction of Genl. H. W. Benham, U.S. Engrs., March to June 1878," NA, RG 77.

21. Executive Documents, Ser. 2011, III, 32-33.

bluff-line, just north of the ordnance instrument house, by some 30 feet nearer the fort (the former sites of the Western Union telegraph tower and of the Signal Service building having been washed away), and an abrasion on that part of the beach formerly occupied by the east beacon, where all the jetties and protections built by the Lighthouse Department have been washed away." The point of the shore west of the northwest bastion of the fort, he reported, seemed to have a tendency to prolong itself in that direction, having increased during the last several years by 300 feet above highwater line.

Of the jetties on the eastern shore, with the exception of no. 1 built of canal boats and filled with concrete, nothing of value remained for shore protection. The sand-box bulkhead, about 560 feet of which was still in position in front and south of the ordnance instrument house, had been little affected by last year's storms. The problem of protecting the Hook, which recently had been seriously encroached upon by the sea near the fort, was referred to the board of Engineers in August 1881.[22]

3. Board of Engineers Studies the Problem

The three-man board (Cols. Zealous B. Tower and John B. Newton, and Lt. Col. Henry L. Abbot), after studying charts dating to 1778, reviewing reports prepared by the Coast Survey, and reconnoitering the area, concluded that, although the fort was in no immediate danger, it was probable that the encroachments by the sea on the east shore would continue if not arrested. They concluded from available evidence that the short jetties, before their destruction by the surf, had materially arrested "beach abrasion, helping rather to build up the beach by holding drift sand."

The beach south of Jetty No. 1, including the section protected by jetties nos. 6 and 2, had been extending seaward since

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22. Executive Documents, Ser. 2092, III, 29-30.

1872. The next three in order northward, nos. 1, 4, and 5, constructed of concrete, though still in place, were badly battered, their upper works having been carried away by storms. Consequently, whenever the surf was running high, it penetrated beyond the jetties, undercutting and washing away the bluff on which the instrument house stood. Jetties nos. 3, 7, and 8, built of brush or sheet piling, had been destroyed almost entirely.

The board recommended repair of jetties nos. 1, 4, and 5 by raising them with concrete made of the best possible materials above storm tides at their inshore ends. They should be extended into the bluff. To replace jetties nos. 3, 8, and 7, the board proposed to build near the remains of no. 8 a new jetty, extending sufficiently far into the ocean to arrest the currents of the False Hook Channel, which buffeted the shore in this area. Should the necessity arise for a second jetty of similar length, the prolongation of jetty no. 4 should be considered.[23] The proposed short jetties should be constructed of concrete next to the shore, and of large stones, supported on rafts or mattresses of brush, for the outer portion.

Though it would be better to repair jetties nos. 1, 4, and 5, as recommended, in an emergency or because of lack of funds, the extensions inshore could be formed of brush between piles loaded with stone, or new short jetties might be built in the same manner. In a crisis, the Board suggested that the beach could be protected by a bulkhead of triangular-boxes such as employed by Colonel Benham in 1878. Except in an emergency, however, it would not be advisable to employ such a bulkhead, until the beach had first been reformed within certain limits by the construction of jetties.[24]

The board submitted various estimates for protecting the site. The cost of a short jetty, 700 feet in length, depending on whether

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23. Ibid., III, 403-7.

24. Ibid., III, 407-8.

concrete or stone was used ranged from $26,689 to $42,452. The cost of two long jetties--one for the north end and the other for the east shore of Sandy Hook--again depending on materials employed varied from $151,864 to $187,459.[25]

4. Reconstruction of Jetties Nos. 1, 3, 4, 5, and 8, and Construction of Jetties Nos. 9-11

In Fiscal Year 1883, Major Gillespie, who had replaced Colonel Benham as District Engineer, received an allotment of $17,500 from the appropriation for Preservation and Repair of Fortifications for the protection of the site. Winter and spring gales had seriously encroached on the shoreline east of the fort. With this sum, Major Gillespie had a crew build 766 feet of concrete jetties on the sites and remains of jetties nos. 1, 3, 4, 5, and 8. The new jetties had an average cross section of 52 square feet. Although the money available was not sufficient to carry out the shore protection to the extent intended, the results showed a marked improvement to the section of the beach protected by the newly constructed jetties.[26]

In Fiscal Year 1884 the jetties built the previous spring caused an outward advance of the beach along the entire front covered by them. But to the northwest, where no beach protection existed, the shoreline receded from 25 to 150 feet over a front of 1,620 feet. At the site of the fog siren, one of the lighthouse buildings was undermined and destroyed, and the safety of the others (the east beacon, and two keepers' houses) endangered.

To arrest the threatened destruction of the remaining buildings, an allotment of $15,000 was made--$5,000 from the appropriation for Preservation and Repair of Fortifications and $10,000

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25. Ibid., III, 409.

26. Executive Documents of the House of Representatives for the 1st Session of the 48th Congress, 1883-84 (Washington, 1884), Ser. 2183, III, 26.

from the Lighthouse Department. This sum was for construction of concrete jetties similar to those built the previous year. Three jetties (nos. 9, 10, and 11) were built by Major Gillespie composed of 1,200 cubic yards of concrete. Gillespie believed he would be able to maintain, for the present, the existing highwater line by construction of short jetties which reached only to the low water mark. But for more certain and permanent protection of the fort site and other public buildings, it "may be necessary to adopt the system of long jetties anchored in deep water, proposed by the Board in 1881, the necessity for which will be determined after the action of the short jetties has been observed during the winter's storms."[27]

Chief Engineer Newton in August 1884 allotted to Major Gillespie $5,000 for positioning a stone revetment, resting on brush, between the north shore protection of jetties nos. 8, 9, and 10, to prevent the bluff line, into which these jetties were anchored, from being undercut by winter storms. Construction commenced immediately and was completed in November. Three hundred and thirty-four cubic yards of granite, taken from the supply on hand at the fort, were positioned. They covered the beach from the highwater mark to a distance outwards of about 40 feet from jetty no. 8 to the first fog signal.

Although the storms were no less violent than usual, the protection afforded by the revetment prevented any degradation of the bluff. The jetties also withstood the battering better than anticipated. The outer ends of nos. 8, 9, and 10, which were particularly exposed to the surf following easterly storms, were all undermined, and one or more of the outer 12-foot sections of these jetties were lowered and partially thrown out of alignment. The damage, however, was insufficient to destroy the usefulness of the parts displaced.

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27. Executive Documents of the House of Representatives for the 2d Session of the 48th Congress, 1884-85 (Washington, 1885), Ser. 2278, III, 30-1; "Chart of Sandy Hook, New Jersey, showing condition of the Shore Improvements, June 30th, 1884, executed under the direction of Maj. G. L. Gillespie, Corps of Engineers," NA, RG 77.

Successive destructive storms during the autumn of 1884 had lowered the beach from one end of the jetties to the other from three to six feet. Immediately after the winds and breakers ceased to roar, the beach grew rapidly, and within a week the spaces between the breakwaters were filled to nearly the height of the jetties, the growth of the east side being greater than that on the west. The entire beach front from jetty no. 1 on the southeast to jetty no. 11 on the northwest had improved during Fiscal Year 1885. The most notable advance of the highwater line was at jetty no. 5, where the width of the accretion was 140 feet. It was between jetties nos. 3 and 5 that the sea in 1881 had broken through the dune line opposite the northeast bastion and had threatened to undermine the foundations of the fort as well as destroy the adjacent buildings belonging to the Ordnance Proving Grounds and Signal Service. This area was now in a condition to afford protection to the buildings behind the bluff line.[28]

D. Quartermaster Department Cuts Its Sandy Hook Commitments

1. Quartermaster General Transfers the Barracks to the Engineers

Immediately following the July 1866 mustering out of the Veteran Volunteers, the Corps of Engineers asked the Quartermaster Department to transfer to it the Sandy Hook barracks for use as support facilities for its construction activities at the fort. The Quartermaster General, his department not having any need for the structures, approved the transfer on condition that they would be vacated by the Engineers, when and if soldiers were again posted on Sandy Hook.[29]

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28. Executive Documents of the House of Representatives for the 1st Session of the 49th Congress, 1885-86 (Washington, 1886), Ser. 2370, II, 24-5; "Sandy Hook, New Jersey, from a survey made under direction of Maj. G. L. Gillespie, Corps of Engrs., April 1885," NA, RG 77.

29. Meigs to Stanton, Sept. 17, 1866, Consolidated Correspondence File, Records of the Office, Quartermaster General, Record Group 92, National Archives.

2. Post Cemetery Falls on Evil Days

There were seven graves in the post cemetery east of the lighthouse, four of which were marked. Inscribed on the headboards of the marked graves were these names: John Moore, Pvt., Company D, 14th New York Heavy Artillery, Jan. 29, 1864; Bernard Quinn, Pvt., Company D, 14th New York Heavy Artillery, Jan. 30, 1864; Michael Wymbs, Pvt., 28th New York Battery, April 29, 1864; and Patrick Scott, Pvt., Company B, 2d U.S. Veteran Volunteer Infantry, May 27, 1866. Ord. Sergt. William Foster reported on July 29, 1870, that the seven graves were not in a very "trim condition." No attention had been paid to the cemetery in the four years since the troops had departed.[30]

30. Foster to Quartermaster General, July 29, 1870, NA, RG 92, Consolidated Correspondence File.

IV. SUBMARINE MINE DEFENSE SYSTEM

A. Endicott Board Makes its Report

1. A Technological Revolution Makes America's Coastal Defenses Obsolete

The freeze on construction funds for the nation's seacoast defenses imposed by Congress beginning in Fiscal Year 1877 resulted in these fortifications falling into disrepair as the defensive posture of the United States shrank "to perhaps its lowest point since 1812." Simultaneously, great advances were being made in the design and manufacture of heavy ordnance.

One important development involved the substitution of steel for iron in the casting of guns. As the technique of forging large masses of steel improved, it enabled the ordnance people to proceed with the manufacture of the compound tube. The founding of cannon tubes in accordance with this new concept--increasing the size and strength of the tube by the successive shrinking on of reinforcing hoops--had been practiced in the years before 1860. Technology, however, had lagged, and it was not until the Civil War that banded and rifled guns of heavy caliber came into general use. Dr. Raymond E. Lewis, an authority on the subject, has written:

> Not until the late 1880s did the combined availability of good quality steel in large amounts, industrial facilities for producing heavy forgings, and machining techniques able to meet the required standards of precision make it possible to produce substantial numbers of these lighter, stronger, and hence, more powerful weapons.[1]

Another important advance was in the perfection of breech-loading. The principle had been common knowledge for centuries, and it had been employed intermittently until 1855, when Lord William Armstrong of Great Britain designed a rifled breech-loading gun that

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1. Lewis, Seacoast Fortifications of the United States, p. 75.

"included so many improvements as to be revolutionary."[2] During the Civil War breech-loading artillery was employed on a limited scale by the belligerents. After 1865 breech-loading field pieces replaced muzzle-loaders in the European armies, as well as those of the United States. Not so rapid was the replacement of the muzzle-loading heavy ordnance mounted in coastal fortifications. The problem of developing a successful breech-loading great gun was technological. To be acceptable, a breech-loading mechanism had to withstand the great heat given off by the detonation of the propellent and be capable of containing the gasses and machined to be opened and closed rapidly. It was not until the mid-1880s that the ordnance technology was sufficiently advanced to produce the well-machined block mechanisms required by the big rifled guns needed for coastal defense.[3]

Three other developments helped spark the emergence of modern coastal artillery: (a) methods of rifling tubes were improved, which made possible the introduction of more efficient projectiles; (b) development of disappearing carriages that utilize the firing recoil energy to return the gun to its position in battery behind a parapet, where it could be reloaded and serviced without unduly exposing its crew; and (c) introduction of improved propellents, nitrocellulose- and nitroglycerin-based powders, to replace black powder.[4]

The effect on heavy ordnance of this technological revolution cannot be exaggerated, because it represented the greatest advance to be made in artillery from the time of its appearance in the fourteenth century until the development of the atomic cannon in the 1950s. As Dr. Lewis has written:

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2. Albert Manucy, Artillery Through the Ages: A Short Illustrated History of Cannon, Emphasizing Types Used in America (Washington, 1948), p. 4.

3. Lewis, Seacoast Fortifications of the United States, p. 75.

4. Ibid., p. 76; Manucy, Artillery Through the Ages, p. 28.

> Compared to the best of the smoothbore muzzle-loading cannon of the post-Civil War period, the new weapons which began to emerge from the developmental stage around 1890 could fire projectiles that, caliber for caliber, were four times as heavy as to effective ranges two to three times as great; and they could do so with remarkably increased armor-penetration ability and accuracy.[5]

During these years, the European naval powers had embarked on ambitious and expensive construction programs--the battleship had made her appearance. News of the development of what was considered to be the ultimate weapon afloat caused ranking Army and Navy officers, as well as much of the public dwelling on the Atlantic and Pacific coasts, to become alarmed over the failure of Congress to authorize appropriations for coastal defense since the mid-1870s. Pressure mounted for Congress to take action to correct a situation which had allowed the Second and Third System forts to deteriorate to a point where the nation's security was jeopardized, and it would be "helpless against the attack of any third-rate power possessing modern iron-clad vessels armed with heavy rifled cannon."[6]

2. President Cleveland Forms the Endicott Board

Accordingly, in 1885 President Grover Cleveland appointed a board headed by Secretary of War William C. Endicott to review the coastal defenses of the United States and to submit recommendations for a program to update them to take advantage of the technological revolution in weaponry. The board was composed of officers of the Army and Navy, as well as civilians. Not since 1816, when the four-man board headed by Bvt. Brig. Gen. Simon Bernard had made the study leading to construction of the Third System forts, had the subject of fortifications,

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5. Lewis, Seacoast Fortifications of the United States, p. 76.

6. Executive Documents of the House of Representatives for the 1st Session of the 51st Congress, 1889-90 (Washington, 1889), Ser. 2716, pp. 4-6.

types of armament, etc., been subjected to such an exhaustive study. The Endicott Board made its report in 1886.[7]

The Board called for fortifications at 27 coastal points, plus three on the Great Lakes. Batteries emplacing guns and mortars would be supplemented by floating batteries, submarine minefields, and torpedo boats. Cost of the undertaking, including the manufacture of 577 big rifled guns, 724 giant mortars, and their carriages, was estimated at $126,377,800.[8] As Dr. Lewis has written:

> In terms of the cost estimate alone, the overall proposal was grossly unrealistic. Moreover, the detailed provisions concerning the types and quantities of weapons, drafted while the new ordnance was still at a fairly early stage of development, were necessarily set forth long before precise information was available regarding the actual performance of the production models.9

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7. Lewis, Seacoast Fortifications of the United States, pp. 77-78.

8. Executive Documents of the House of Representatives for the 1st Session of the 49th Congress, 1885-86 (Washington, 1886), Ser. 2395, p. 18. The consolidated estimates provided:

for construction of masonry and earthwork batteries	$31,863,000
for armor of batteries	20,300,000
for structural metal for batteries	3,320,000
subtotal for emplacements	$55,483,000
for manufacture of 577 heavy steel rifled guns and 724 mortars	$28,554,000
for manufacture of 1,301 gun and mortar carriages	18,875,000
subtotal for guns, mortars & carriages	$47,429,000
for submarine mines	$ 1,659,000
for mining casemates	635,000
for electric lights, etc.	1,200,000
subtotal for mining operations	$ 3,494,000
for floating batteries	4,334,000
for torpedo boats	9,720,000
Grand Total	$126,377,800

9. Lewis, Seacoast Fortifications of the United States, p. 77.

Nevertheless, on March 29, 1887, the Board of Engineers for Fortifications was directed by Secretary of War Endicott to prepare plans for the defense of the nation's more important harbors, in accordance with recommendations of the Endicott Board. Operating within these guidelines, the Board "undertook a thorough revision of plans for defense of our chief ports by submarine mines and a study of the precise location of the new armaments rendered necessary by modern modes of attack."[10]

During the years, 1887-96, detailed plans for defense of 23 key harbors, including New York, were prepared by the Board of Engineers and approved by the Secretary of War.[11] Besides these major undertakings, partial projects were programmed and approved for defense of the Lake Ports; Cumberland Sound, Georgia and Florida; Kennebec and Penobscot Rivers, Maine; New Bedford, Massachusetts; and New Haven and New London, Connecticut. Under consideration in 1896 were projects for defense of Port Royal, South Carolina, and Dry Tortugas, Florida.[12]

3. Congress Acts

The first session of the 50th Congress resumed making appropriations for coastal defense. On September 22, 1888, President

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10. Craighill to Lamont, Sept. 29, 1896, in Report of the Secretary of War; being part of the Message and Documents Communicated to the Two Houses of Congress at the Beginning of the Second Session of the Fifty-Fourth Congress (3 vols., Washington, 1896), Ser. 3479, II, 7. Brig. Gen. W. P. Craighill was Chief Engineer and Daniel S. Lamont was Secretary of War in 1896.

11. In addition to New York, these harbors were: Portland, Me.; Portsmouth, N. H.; Boston, Mass.; Narragansett Bay, R. I.; eastern entrance to Long Island Sound, N. Y.; Philadelphia, Pa.; Baltimore, Md.; Washington, D. C. ; Hampton Roads, Va.; Wilmington, N. C.; Charleston, S. C.; Savannah, Ga.; Key West and Pensacola, Fla.; Mobile, Ala.; New Orleans, La.; Galveston, Tex.; San Diego and San Francisco, Calif.; mouth of the Columbia River, Ore. & Wash.; and Puget Sound, Wash. Report of the Secretary of War, Ser. 3479, II, 7.

12. Ibid.

Cleveland signed into law an act implementing several of the Endicott Board's recommendations. This legislation, besides establishing a Board of Ordnance and Fortifications to oversee the development of armament for the projected Endicott System of defense, made an appropriation for beginning the manufacture of modern seacoast guns and mortars and made available $200,000 for inauguration of the submarine mine defense scheme.[13]

Employing these funds, the Corps of Engineers commenced construction of three mining casemates at Forts Wadsworth and Schuyler, New York, and at Fort Warren, Massachusetts. A second appropriation voted by Congress on March 2, 1889, funded five more casemates, one each for the forts at Willetts Point (subsequently Fort Totten) and Fort Lafayette, New York, the fort at Sandy Hook, and at Alcatraz and Point San Jose, California.[14]

Beginning in 1890, Congress resumed making annual appropriations for seacoast fortifications. During the previous 15 years, as has been noted, great advances had been made in the manufacture of great guns, and their increased power made mandatory the construction of fortifications with increased resistance to projectiles. At sea, the British and Italians had launched ships mounting rifled cannon weighing more than 100 tons. The existence of such weapons afloat necessitated "a certain corresponding resistance of works of defense, a corresponding thickness of cover." The situation was therefore propitious for the United States to program the construction of modern fortifications. General projects for the defense of Portland, Maine; Boston, Massachusetts; New York City, New York; Washington, D. C.; Hampton Roads, Virginia; and San Francisco, California, had been prepared and approved by the Chief of Engineers and the Secretary of War.

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13. Executive Documents, Ser. 2716, pp. 5-7.

14. Ibid., p. 7.

The Fortifications Act of August 17, 1890, which appropriated $1,221,000, required that this sum be applied as follows: Boston, $235,000; New York, $736,000; and San Francisco $260,000. On February 24, 1891, expenditures of $750,000 were authorized, with major allotments made for the defense of San Francisco, New York, Hampton Roads, and Washington, D.C.

The approved projects for defense of the southern and eastern entrances to New York Harbor contemplated an armament of 19 12-inch guns on lifts, 17 10-inch and 9 8-inch guns on disappearing carriages, 176 12-inch mortars, and submarine mines operated from five mining casemates.[15]

B. System's Components are Installed and Activated

1. Construction of the Southwest Bastion Mining Casemate

Sixty thousand dollars of the March 1889 appropriation for "Torpedoes for Harbor Defenses" were allotted by the Chief Engineer to Colonel Gillespie for construction of the Sandy Hook mining casemate. Work on the casemate and its cable gallery commenced in August 1889.

Plans for the casemate had been prepared by the Board of Engineers and submitted to the Chief Engineer in October 1887. They called for conversion of loopholed casemates nos. 104-05 in the west face of the southwest bastion into a mining casemate. Twenty-five feet of masonry was to be added to the west front of the bastion. The adjoining salient magazine and loopholed and gun casemates in the subject bastion would be filled with masonry. Access to the mining casemate, the arches of which were to be lowered, would be through a vaulted 40-foot passage. The loophole embrasures would be sealed. The cable gallery (3 feet in diameter) would pass under the foundation of the bastion in a southwesterly direction 600 feet to enter the bay. A vertical shaft,

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15. Executive Documents of the House of Representatives for the 1st Session of the 52d Congress, 1891-92 (Washington, 1892), Ser. 2922, III, 5-7.

extending down 15 feet from the floor level of the south casemate room, would afford access to the gallery.[16]

By the end of Fiscal Year 1890, a labor force working under the immediate supervision of Lt. Harry Taylor had "essentially completed" the casemate and its entrance gallery, while the cable gallery was nearly finished. More than 6,400 cubic yards of masonry were positioned at a cost of $16.93 per cubic yard. Colonel Gillespie attributed the high unit cost of the concrete work to the "necessity of purchasing all new plant and of repairs to old buildings to provide shelter for the working parties."[17]

The cable gallery was finished in October 1890, and the mining casemate, one of the first five in the system, completed and declared ready to be turned over to the troops. Colonel Gillespie informed the Chief Engineer that in constructing the casemate and cable gallery 6,411 cubic yards of masonry had been positioned at a cost of $48,590.99 for an average of $7.58 per cubic yard.[18]

2. Construction of a Brick Torpedo Shed

On February 24, 1891, Chief Engineer T. L. Casey made an allotment of $9,000 from the appropriation for "Torpedoes for Harbor Defenses" for construction of a fireproof brick shed for storage of torpedoes and their assessories. These items were required for the defense by submarine mines of the channels near Sandy Hook.

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16. "Submarine Mine Defenses, Mining Casemate at Fort Sandy Hook, Tracing No. 3, Proposed by the Board of Engineers in Report dated, October 24th, 1887," NA, RG 77.

17. Gillespie to Chief Engneer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1890, NA, RG 77, Ltrs. Recd., Chief Engineer.

18. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1891, NA, RG 77, Ltrs. Recd., Chief Engineer; Executive Documents, Ser. 2922, III, 7.

It took Colonel Gillespie about five weeks to prepare and submit to the department for approval plans and specifications of this second element in the Sandy Hook submarine mine defense system. A site for the shed was selected by Colonel Gillespie parallel to and adjacent to the south face of the old fort's southwest bastion. The plans called for a brick structure, 40 by 90 feet (inside measurement), with walls 1 foot thick and 10 feet high under the eaves. The roof was to be of slate, supported by eight iron trusses. The floor was to be concrete, with an extension of the construction railroad from the Engineer wharf running through the structure from west to east. On each side of the track would be racks of 10- by 8-inch timber, arranged for storage of the buoyant torpedo cases in two tiers. In the southeast corner would be a suitable storeroom, 12 by 12 feet, for storage on shelves of the smaller parts of the torpedo system. There would also be an overhead "hoisting and conveying appliance" at the east end of the building for handling heavy anchors and ground mines.

By June 30, 1891, the foundations had been positioned, the brick and slate purchased, and a contract signed with Continental Iron Works for fabrication of the iron roof trusses.[19]

By June 30, 1892, Colonel Gillespie reported the torpedo shed was nearly completed. The only work remaining to be accomplished was positioning the shelving in the storeroom, which had been purposely delayed, and construction of the overhead crane for which plans were in preparation.

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19. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1891, NA, RG 77, Ltrs. Recd., Chief Engineer; "Torpedo Shed, Sandy Hook, N.J., constructed under the direction of Lieut. Col. G. L. Gillespie, Corps of Engineers, U.S.A., 1891-1893"; "Torpedo Shed proposed to be erected at Sandy Hook, New Jersey, New York Harbor, prepared under the direction of Lieut. Col. Gillespie, Corps of Engineers, U.S.A." Copies of these plans, as well as all others cited, are on file at the Sandy Hook Unit, Gateway National Recreation Area.

During the winter of 1891-92, the interior of the structure had been purposely left unfinished, so it could be utilized as a shelter for the stone cutters shaping granite for the lift battery.[20]

As of June 30, there were stored in the shed all the torpedo cases required for the submarine mine defense to be operated from Sandy Hook, along with a large portion of the other "more bulky articles of the system." Stored and receipted for were: 20 ground mines; 478 steel torpedo cases, No. 32; 12 ground junction boxes; 84 triple junction boxes; 50 single large junction boxes; 50 single small junction boxes; and 370 1,000-pound anchors.[21]

Although another 12 months had passed, Colonel Gillespie could not file a completion report for the torpedo shed. An overhead trolley, with a 3,000-pound capacity, had been ordered in Fiscal Year 1893, but delivery had not been effected.[22] The trolley was received and installed in Fiscal Year 1894, and the torpedo shed declared finished.[23] In Fiscal Year 1895 the roof of the shed was repaired and the ironwork painted at a cost of $240.97.[24]

3. Construction of the Cable Tanks

In Fiscal Year 1897 a third structural element was added to the Sandy Hook submarine mine defense system. Two storage tanks for

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20. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1892, NA, RG 77, Ltrs. Recd., Chief Engineer.

21. Ibid.

22. Executive Documents of the House of Representatives for the 2d Session of the 53d Congress, 1893-94 (Washington, 1896), Ser. 3199, p. 617.

23. Executive Documents of the House of Representatives for the 3d Session of the 53d Congress, 1894-95 (Washington, 1895), Ser. 3296, p. 456.

24. Executive Documents of the House of Representatives for the 2d Session of the 55th Congress, 1897-98 (Washington, 1897), Ser. 3631, p. 623.

immersion of the mine cables were constructed by remodeling the two cisterns under casemates nos. 91 and 92 in the northwest curtain of the old masonry fort.

To do so, the flooring of the casemates was removed, along with the arches, to ground level fronting the scarp's superior slope, and the bottoms of the cisterns reinforced with two feet of masonry. A 39' 4" by 40' 8" shed, with two large sliding doors in the southeast elevation, was erected to shelter the tanks. The shed's framing timbers were 8 by 8s, which were sheathed by 7/8-inch boards. The old fort's scarp was left standing to protect the shed and cable tanks from fire of enemy warships which might succeed in passing the batteries and gaining Sandy Hook Bay.[25]

4. Activation of the Submarine Mine Defense System

The war with Spain, which was declared on April 25, 1898, gave the Army an opportunity to deploy and place in operation its new submarine mine defense system. Personnel from the Engineer Depot at Willetts Point, New York, reported at Sandy Hook early in April. As a precautionary measure, the mines to be operated from the Fort Hancock mining casemate for defense of the southern entrance to New York Harbor were "planted" in the hectic days before the nation went to war. To illuminate hostile minesweepers and torpedo boats attempting to penetrate the minefield, the engineer in charge had his men position two searchlights with independent power plants on the northeast shore of the Hook. Three cannon (a 5-inch siege rifle, a 7-inch siege howitzer, and a 4.7-inch Armstrong rapid-fire gun) were mounted in temporary emplacements from where the artillerists could direct their fire at Spanish warships pinpointed by the searchlights.[26]

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25. Executive Documents of the House of Representatives for the 3d Session of the 55th Congress, 1898-99 (Washington, 1898), Ser. 3746, p. 632; Plan of "Cable Tanks and Shed for Torpedo Station at Fort Hancock, Sandy Hook, N. J.," NA, RG 77.

26. Executive Documents, Ser. 3746, p. 632.

The mines planted in April were removed in August, and by the 16th had been disarmed. The cables were taken up, the mining casemate dismantled, and the materiel cleaned and stored in the torpedo shed and cable tanks.[27]

5. Two More Cable Tanks are Added to the System

To facilitate this work, two additional cable tanks were built in casemates nos. 89 and 90 and provided with a covering shed. Overhead cranes were installed to service the four tanks. The construction was similar to the two adjoining tanks and shed.[28]

6. Repairs and Maintenance In Fiscal Years 1899-1901

A number of repairs and maintenance activities were carried out on the submarine mine defense system during Fiscal Years 1899-1901. In Fiscal Year 1899 the mining casemate was waterproofed and provided with a wooden lining.[29] Funds were allotted and spent in Fiscal Year 1900 to overhaul the submarine mine cable; to remove the oil engines from the mining casemate and store them in the torpedo shed; and to repair instruments.[30] Two years after the Treaty of Paris was signed ending the Spanish-American War, two of the three guns (the 5-inch siege rifle and the 7-inch siege howitzer) were dismounted and removed from the temporary emplacements.[31] On May 14, 1901, the Corps of

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27. Executive Documents of the House of Representatives for the 1st Session of the 56th Congress, 1899-1900 (Washington, 1899), Ser. 3905, p. 780.

28. Ibid.

29. Ibid.

30. Executive Documents of the House of Representatives for the 2d Session of the 56th Congress, 1900-01 (Washington, 1900), Ser. 4080, p. 840.

31. Ibid.

Engineers finally transferred to the Fort Hancock garrison responsibility for care of the submarine mining materiel.[32]

C. Expansion and Maintenance of the Facilities, 1901-1929

1. Construction of a Loading Room and New Mining Casemate

A storm on November 24, 1901, put nearly four feet of water into the torpedo shed, ruining hundreds of dollars worth of equipment. When asked to report on the loss, Maj. William L. Marshall of the Engineers noted that the torpedo materiel, when turned over to the artillery, had been carefully inspected and was in good condition. With respect to this materiel, as well as all other electrical installations, it called for strict attention on the part of skilled technicians to keep it in serviceable condition. Such care was not available at Sandy Hook, because there were too few electrician sergeants on post.

So far as Major Marshall could learn, the only repairs needed to the $60,000 torpedo plant at Fort Hancock would cost $152, principally for instruments damaged by the storm. One hundred and twenty-five dollars worth of perishable materiel destroyed by the storm had been replaced, as it was "continually deteriorating, and some of it never first class."[33]

This was the second time that the torpedo shed had been flooded: the reason being that its floor was only 7 feet 1 inch above mean low water. Moreover, it was too small for its mission. The shed was so full of materiel that it could not be "sorted and properly handled."

To do as suggested by the post mine defense personnel--remove and replace the roof, raise the walls and floors five

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32. Executive Documents of the House of Representatives for the 1st Session of the 57th Congress, 1901-02 (Washington, 1901), Ser. 4279, p. 768.

33. Marshall to Chief Engineer, Jan. 13, Feb. 6, 1902, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

feet, reconstruct window and door openings, and build a 60- by 40-foot addition--Major Marshall argued, would be as costly as a new structure and result in one of "patch work" construction. Accordingly, he recommended that the shed be turned over to the Engineer Department as a storehouse and that a new torpedo shed be built. The new shed was to be 140 by 40 feet, with a second story, 60 by 40 feet, at one end for storage of implements and materiel that dampness could damage. The cost of such a structure was estimated to be $23,500 by Major Marshall.[34]

Turning to the mining casemate, Major Marshall observed that, when constructed, use of engines, generators, and accumulators in them had not been contemplated. When turned over to the artillery, he had reported, the casemate unserviceable. It would cost $7,000 to remove one side of the casemate and rebuild it with proper ventilation. In his opinion, generators and storage batteries should never be in the operating room of a mining casemate. This was especially true at posts like Fort Hancock, where there was a central power plant and several storage batteries to supply electricity.[35]

No action was taken by the department at this time to provide funds to implement Major Marshall's proposals. But by Fiscal Year 1904 money was available to fund construction of a properly ventilated mining casemate to replace the one in the southwest bastion. On May 4, 1904, Major Marshall informed Chief Engineer Gillespie that to refit the magazine of the abandoned Dynamite Gun Battery as a mining casemate would cost about $1,500. This sum would fund these changes: (a) cutting out of a doorway or ventilating and lighting the opening; (b) excavation of about 800 cubic yards of sand in front of this opening; (c) building a mining gallery; and (d) erecting partitions.

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34. Ibid., Jan. 14, 1902, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

35. Ibid., Jan. 13, 1902, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

Major Marshall cautioned, however, that this alternative would result in a pit near the subject opening into which sand would drift. This sand could be removed only through the rooms of the casemate or by a derrick. Consequently, this solution would provide the mine defense system with "an unsatisfactory make-shift, poorly ventilated and cramped" casemate.

He recommended construction of a new structure, "substantially in accord with the latest typical design for the interior rooms of a mining casemate." This building should be erected within the enclosure of the Dynamite Gun Battery, where it would be protected against direct fire by the battery's parapet. It should be positioned so that the bombproof cover could be added whenever funds became available. Marshall estimated the cost of such a building, without overhead protection, and a mining gallery leading to a manhole on the beach at $3,000. In addition, he urged construction of a new torpedo storehouse within the same enclosure. Meanwhile, a loading room similar to the one at Willetts Point, costing about $2,000, should be erected near the 1894 brick torpedo storehouse or the wharf.[36]

After reviewing the correspondence, Chief Engineer Alexander Mackenzie allotted $3,000 for construction of a mining casemate within the Dynamite Gun Battery enclosure and $2,000 for building a loading room near the wharf.[37] The structure housing the loading room would be sited with its "end doorway toward the torpedo storehouse." An independent railroad spur, connecting the loading room with the wharf and storehouse, was to be built.[38]

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36. Marshall to Mackenzie, May 4, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

37. Marshall to Horn, Aug. 23, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock. Capt. T. N. Horn was the post submarine mine defense officer.

38. Marshall to Hurlbut, Sept. 14, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

Work commenced on the new mining casemate in the winter of 1904-05. The frame structure (52' 4" by 22' 11") had a concrete floor with a wood roof sheeted with felt paper and copper. From east to west the rooms were: storage battery room, engine room, closets and latrine, operating room, and bedroom.[39]

By May 1905 the casemate and loading room had been completed. Assistant Engineer P. P. Hurlbut was directed to provide the labor for moving the mining plant (oil engine, Wagner generator, and storage battery) from the old casemate in the southwest bastion into the new casemate. The work was done under the supervision of the post submarine mine defense officer.[40] On August 29, 1905, all the equipment having been installed, Marshall made his final inspection of the casemate and loading room and transferred them to the post commander.[41]

2. Maintenance of the Mining Casemate, 1906-1918

A howling gale out of the northeast on January 14, 1906, sent surf crashing over the seawall, severely damaging the parapet of the former Dynamite Gun Battery. If repaired with stone, Marshall (now a lieutenant colonel) reported, the cost would be $4,200 and if with concrete $3,500.[42]

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39. "Plan and Details for Mining Casemate at Fort Hancock, New Jersey, prepared under direction of Lieut. Col. W. L. Marshall, Corps of Engineers, U.S.A., September 1904," NA, RG 77.

40. Marshall to Hurlbut, May 1, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

41. Marshall to Chief Engineer, Sept. 25, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

42. Marshall to Mackenzie, Feb. 13, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

It was May 1907 before the department was able to allot $3,500 for the repair of the parapet, which, besides shielding the mining casemate, supported the platform for a 36-inch searchlight.[43]

On September 10, 1907, Capt. W. W. Hamilton, the officer commanding the mine company, asked that the casemate be painted the same color as the 36-inch searchlight traverse. Colonel Marshall was agreeable. Within a few days, a crew had been turned out by Assistant Engineer Hurlbut, and the structure painted a light khaki.[44]

The new paint on the outside doors to the casemate's main entrance was scorched and blistered on May 11, 1909, by a fire which destroyed the post laundry. The laundry had been housed in an old frame building "outside the walls of the old Dynamite Battery."[45]

3. Improvements to the Submarine Mine Defense Facilities, 1905-1925

a) Colonel Marshall's Program

In March 1905 Colonel Marshall submitted estimates for perfecting the submarine mine defenses of the southern entrance to New York Harbor. At Fort Hancock there was needed:

1. For old torpedo storehouse and cable tanks

a.	Extension of traveller track . . .	$ 2,000.00
b.	Extension of cable tanks . . .	7,000.00
c.	Roof and shed over tanks . . .	2,000.00
	Total	$11,000.00

43. Marshall to Hurlbut, May 13, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

44. Hamilton to Post Adj., Sept. 10, 1907, and Hurlbut to Marshall, Oct. 7, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

45. Hurlbut to Roessler, May 10, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

2. For construction of a new torpedo storehouse three alternatives were proposed:

	Storehouse:	
	a. One-story frame structure 60 x 80 feet .	$ 9,500.00
	b. One-story steel frame structure, covered with corrugated iron, 160 x 30 feet .	10,300.00
	c. Two-story brick or concrete building, 100 x 30 feet, with office and storage for precision parts	15,000.00
3.	Range and position-finding stations	
	1 Primary	2,500.00
	1 Secondary	1,300.00
4.	Tramway and trucks	3,500.00
5.	Proper portion repairs to Engineer wharf .	3,000.00
	Total	$29,000.00
		to $34,500.00

The total cost was dependent on the type of storehouse built. Because of the frequent gales, Colonel Marshall opposed construction of a two-story storehouse, unless it was brick or concrete.[46]

The department in Fiscal Year 1906 allotted funds to enable Colonel Marshall to implement this project. The new torpedo storehouse would be 160 by 30 feet, built of galvanized metal with a concrete floor.

b) Construction of Two More Cable Tanks

First to be completed were two large cable tanks. They adjoined on the southeast the four tanks previously built in casemates nos. 89-92 of the old fort. The shed sheltering the new tanks

46. Marshall to Mackenzie, March 14, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

was erected as an extension of the ones already standing. On January 31, 1906, Colonel Marshall inspected and turned over to the Coast Artillery the new tanks.[47]

c) Maintenance, Additions, and Repairs to Cable Tanks, 1908-1921

In 1908 beams were positioned in all the cable tanks, both old and new.[48] The following year a cable testing house was erected at a cost of $136.[49]

In 1911 the cable tanks were connected with the Proving Ground's "saltwater fire hydrant," near the northwest corner of the ordnance carpenter shop. Heretofore, the tanks had been filled with fresh water, and salt added to make the desired six percent solution. This would result in considerable savings for the United States, as it required 1-1/8 pounds of salt per cubic foot of water, and the tanks had a total capacity of 42,321 cubic feet.[50]

The cable shed was reroofed and new gutters hung during the winter of 1913-14.[51] In the winter of 1914-15 six wooden beams were removed from the cable tank floors and replaced with "iron girders."[52] Two 10-ton bridge cranes were installed during the winter of

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47. Ibid., Feb. 7, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

48. Chief Engineer to Marshall, May 6, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

49. Roessler to Chief Engineer, Jan. 12, 1909, NA, RG 77, Ltrs. Sent & Recd., Chief Engineer.

50. White to Adj. Gen., Dept. of the East, Dec. 13, 1910, and Chief Engineer to Roessler, Feb. 8, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Col. John V. White was post commander in December 1910.

51. Roessler to Chief Engineer, Oct. 10, 1913, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

52. Ibid., Nov. 30, 1914, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

1915-16 to service tanks nos. 1-6 and 2-3.[53] In Fiscal Year 1920 a 100-foot concrete trough was constructed from the north side of the cable tanks. This trough was to be used for testing cables.[54]

d) Construction of the Steel Torpedo Storehouse

It was decided to invite proposals for construction of the steel frame torpedo storehouse. The successful bidder was J. Edward Ogden & Co.[55]

On October 27, 1906, Colonel Marshall advised the post commander that the torpedo storehouse was completed and ready for transfer. He, however, would like to retain possession of the portion of the structure nearest the wharf for temporary storage of cement for construction of the primary stations and modernizing Battery Halleck and for storage of all mine cases from the old brick storehouse while it was being rehabilitated. He did not plan to employ the small rooms for storage of Signal Service instruments.[56]

The post commander was agreeable and the transfer was postponed. Meanwhile, in accordance with instructions from the Torpedo Board, shelves and drawers were built in two rooms. In the office were positioned one set of four open shelves, surmounting the sets of drawers. While in the small storeroom Hurlbut's men built open shelves to the ceiling on two sides of the room, surmounting drawers on one side and cupboards on the other.[57]

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53. District Engineer to Chief Engineer, Dec. 15, 1915, and March 16, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

54. Ibid., July 1, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

55. Marshall to Mackenzie, Sept. 27, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

56. Marshall to Harris, Oct. 27, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

57. Marshall to Hurlbut, Jan. 11, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

On January 11, 1907, Assistant Engineer Hurlbut notified Colonel Marshall that the torpedo shed was ready to be turned over to the Coast Artillery. Installed in the shed were a travelling crane, ten sets of "Wontsag" steel shelving, seven steel lockers, and 40 mine racks.[58] Two weeks later, Colonel Marshall directed Hurlbut to have his men build and position six tables, twelve benches, and a pole in the instruction room. Before the end of the month the storehouse was given its final inspection and transferred.[59]

e) Maintenance and Repair of the Steel Torpedo Storehouse, 1912-1925

In Fiscal Year 1912 the new torpedo storehouse was wired for electricity.[60] Thirteen years later, in 1925, the structure was reroofed.[61]

f) Improvements to Brick Torpedo Shed

In Fiscal Year 1908 the overhead trolley in the 1894 brick torpedo shed was extended the length of the building.[62]

g) Improvements to Loading Room

The loading room in Fiscal Year 1912 was wired for electricity.[63] In Fiscal Year 1915 the east doorway to the structure was

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58. Hurlbut to Marshall, Jan. 11, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

59. Marshall to Hurlbut, Jan. 23, 1907, and Marshall to Chief Engineer, Feb. 12, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

60. Hurlbut to Roessler, Oct. 4, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

61. Chief Engineer to District Engineer, June 9, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

62. Hurlbut to Marshall, April 2, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

63. Hurlbut to Roessler, Oct. 4, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

enlarged to permit housing the D.B. boat for its annual winter repairs.[64]

h) Expanding the Submarine Mine Railway System

In Fiscal Year 1906 the narrow gauge submarine mine defense railway was expanded. A spur was extended northwest from the wharf area to the new mining casemate at the Dynamite Battery; a second spur branched off from the mortar shed extension to the cable tanks; and a third provided a bypass with access to the loading room and new torpedo shed.

To assist the men in handling the mines and cables, three flat cars were transferred to Fort Hancock in the winter of 1908.[65] In 1913 three more flat cars were turned over to the submarine mine defense command.[66]

4. Construction of a "Protected Mining Casemate"

a) Getting the Plans Finalized and Approved

In the months following the nation's April 1917 entry into World War I plans were developed for construction of a bombproof mining casemate within the old Dynamite Gun Battery. This site had been selected with a view to "economy both with regard to sand fill for bombproofing and with regard to cables." The site, however, had never been approved, and District Engineer Theodore A. Bingham questioned its desirability on these points: (a) although the casemate would be small and a hit on it unlikely, placing it within the Dynamite Gun Battery would increase the size of the target; and (b) here it would be more likely to be damaged by aerial bombs than if it were in an isolated location.[67]

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64. Roessler to Chief Engineer, Jan. 30, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

65. Harris to Marshall, Feb. 13, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

66. Roessler to Chief Engineer, Dec. 1, 1913, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

67. Bingham to Harris, Jan. 22, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Col. Henry L. Harris, who now commanded the New York Harbor Defenses, questioned the points raised by Colonel Bingham. On January 24, 1918, he approved the Dynamite Gun Battery site.[68]

On January 24 the officer responsible for the area's submarine mine defenses suggested to Colonel Harris that within the proposed bombproof casemate provision he made for an "emergency mine commander station." The station should have room for a plotting board and azimuth instrument, along with necessary telephone, lighting, and searchlight connections. The present mine primary station would be retained. Thus, in event of attack, the primary station could be destroyed, and the foe possibly deceived into believing that the system had been permanently crippled.[69] Colonel Harris was agreeable to these recommendations.

Accordingly, Chief Engineer William M. Black notified Colonel Bingham that the new casemate was to be designed to be built in the "right end" of the old Dynamite Gun Battery emplacement. It was believed that the best arrangement could be secured by placing "the long dimensions of the new structure in the direction of the short dimension of the emplacement." All features of a typical mining casemate were to be included in the design, as well as a plotting room, at least 12-foot square, and a mine commander's telephone booth.

The plan was to provide for an overhead cover, with the long face of the structure so designed as to make completion of protection as convenient as possible whenever attack threatened. It would be kept in mind that, in completing the overhead cover, forced ventilation would become necessary. In addition, two entrances were to be provided, as far apart as practicable.

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68. Harris to Bingham, Jan. 24, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

69. Mine Commander, Sandy Hook, to Harris, Jan. 24, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

General Black directed Colonel Bingham to include a mine commander station of the closed type, 10-feet square. This station should be positioned on the superior slope of the emplacement to merge with the skyline.[70]

It was April 1919, some five months after the end of World War I, before Colonel Bingham transmitted to Washington for approval the plans prepared in his office for "a protected mining casemate in the southeast end" of the old Dynamite Gun Battery. As the plotting room was deemed a necessary adjunct to a mine commander station, it would be positioned above the operations room to provide direct communications between the plotting room and mine commander station and to afford easy access from the mine commander station into the casemate. In addition, there would be direct communication from the mine commander station and plotting room into the operations room, which would eliminate misunderstandings known to occur when instructions were given by telephone.

At present, Colonel Bingham reported, there were two antiaircraft guns emplaced on the superior slope of the Dynamite Gun Battery. One of these was near the proposed casemate site. The commander of the harbor coast defenses had been asked to relocate these guns.[71]

The Chief Engineer found the estimated cost, $38,347, too high. To pare expenses and meet other criticisms, the District Engineer revised the plans. In doing so, the tunnel entrance through the east parapet was eliminated, the mine commander station sited lower on the superior slope, and the operations room positioned on the lower floor. A

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70. Black to Bingham, Feb. 8, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

71. Bingham to Chief Engineer, April 17, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

dormitory for personnel assigned to the casemate would be outfitted in the old Dynamite Gun Battery magazine.[72]

Additional revisions were made in the summer of 1920. These (a reduction in the dimensions of the plotting room, in the number of telephones, and a change in position of the mine commander station) cut the estimated cost to $37,200.[73]

By this time, the site was being re-evaluated, as the coast defense commander had questioned the advisability of relocating the two antiaircraft guns. The choice had been narrowed to two locations--the one at the Dynamite Gun Battery and the other 1,500 feet farther west at the extremity of the Hook. The general commanding the Eastern Department, pronounced the latter site to be undesirable, because of the difficulty of landing cable there, and the resulting exposure of the cable to shell fire if carried along the Hook.

Latest plans called for the removal of the two antiaircraft guns at the Dynamite Gun Battery to new positions. This would eliminate all objections to locating the casemate at the Dynamite Battery raised by the coast defense commander, except the one involving searchlight no. 4. The light, it was believed, could be relocated without seriously interfering with the Sandy Hook defenses. The general accordingly recommended that the mining casemate be located within the Dynamite Gun Battery.[74] On September 15, 1920, Secretary of War Newton D. Baker approved the plan and site.[75]

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72. District Engineer to Chief Engineer, Nov. 25, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

73. Chief Engineer to Adj. Gen., U.S. Army, July 30, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

74. C.O., Eastern Dept., to Adj. Gen., Aug. 27, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

75. Baker to Chief Engineer, Sept. 15, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

b) Change Order Eliminates a Passageway

Col. E. Eveleth Winslow, who had replaced Colonel Bingham as District Engineer, visited the site in December. He saw that the plans called for an ell-shaped passageway, 3 feet wide by 6-1/2 feet high, to connect the dormitory in the northwest corner of the old emplacement with the casemate operations room. To construct this passageway, workmen would have to cut through two concrete walls, one 8 to 9 feet thick on the right flank of the projected casemate, and the other about 4 feet thick at the front of the dormitory. The remainder of the passageway would be through sandfill. This passageway, Colonel Winslow advised the department, would only be used by men going to and from the operations room, when reporting and coming off duty. For such movements, the passageway was unnecessary, as the artillerists could as easily cross the parade of the old battery, a distance of 40 feet.[76] The Chief Engineer agreed with Winslow that the passageway was a needless extravagance, and it was eliminated from the project.

c) Casemate is Built and Transferred

By mid-April 1921 the walls of the new casemate had been completed, and work commenced fitting up the interior.[77] Equipment scheduled to be transferred from the 1905 casemate to the protected casemate included: From engine room--one Hornsby-Akroyd 4-horsepower kerosene engine, and one Wagner Electric Co., Type M.G., 550-watt generator; and from storage battery room--40 Type E-7 lead cells.

Capt. John H. Carruth, the officer in charge of the project, questioned whether this equipment should be transferred. He had been told that since the present storage battery had been installed several years before, it had been necessary to charge it by powerline

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76. Winslow to Chief Engineer, Dec. 9, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

77. Winslow to C.O., Coast Defenses, Sandy Hook, April 22, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

from the Battery Alexander powerhouse. Carruth recommended that the new casemate be equipped with a 3-kilowatt generating set, so it would have a power plant of ample capacity.[78] This was done and the casemate equipped with a gasoline generating set.

The "protected mining casemate and mine commander station" were completed and equipped by mid-October. On December 9, 1921, Colonel Winslow made a final inspection and transferred the facility to the Coast Artillery.[79]

D. Submarine Mine Defense System and Facilities in the 1930s

1. Positioning the 23 Groups

In 1929 the Army and Navy revised and up-dated their submarine mine defense system for the southern entrance to New York Harbor. The revised project called for an inner barrage of 23 groups (19 mines in each) of "controlled mines" for which the Army would be responsible and an outer barrage of 3,000 mines planted in 9 lines by the Navy. The 23 groups of controlled mines would be operated from Fort Hancock, and would consist of 19 groups of mines, planted in three curved lines, "each concave toward and to seaward of the seaward entrance to Gedney and Ambrose Channels." Of these, ten groups would be planted in the outer line, five groups would be planted in a second line, and four groups would be planted in the inner line. These lines were to be about 1,000 yards apart, and each was to extend on either flank to points where the water shoaled to three fathoms. No mines were to be planted in Ambrose Channel. The mission of the outer line of mines was to prevent submerged submarines from entering New York Harbor and was not aimed against surface ships, as were the second and inner lines.

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78. Carruth to Winslow, April 20, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

79. Winslow to Chief Engineer, Dec. 9, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Four groups of mines would be positioned with the object of "closing channels accessible from South Channel."[80]

Ashore expansion from the eight groups of the old mine project to 23 groups called for construction of additional facilities. Involved would be tripling the present storage space for mine cases and related equipment, and making available increased facilities for assembling, loading, and testing of the greater number of mines before planting. Other changes were dictated, because the present plotting boards, base end stations, and group commander station were unable to cover the new minefield at the entrance to Ambrose Channel.

2. Relocation of Commander Station

To accomplish its expanded mission, the command post was relocated from the "protected casemate" into two adjacent buildings in the secondary stations, 1,500 yards south of Battery Gunnison. This station was already equipped with two Swasey Depression Position Finders, Type A-II, with an instrument height of 40 feet. No new construction was required, although rewiring was necessary.

3. Protected Mining Casemate

The 1921 casemate would suffice for the project. Its operations room was equipped with a standard single conductor system through which it was capable of operating 29 mine groups. Electrical energy was supplied from the post system at 110 volts A.C., which could be converted to D.C. by an A.C.-D.C. motor generator installed at the casemate. In addition, the casemate was equipped for emergencies with a gasoline generating set, which could deliver 80 volts D.C. for the apparatus and lights. There was also an 80-volt, 15 amperage storage battery.

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80. Annexes to Harbor Defense Project: Harbor Defenses of Sandy Hook, Records of the Adjutant General's Office, 1917-1939, Record Group 407, National Archives. This entire section on "Positioning the 23 Groups" is based on this source.

4. Plotting Room

A new plotting room was provided in the early 1930s by closing in the gallery at the west entrance to the mining casemate and by equipping and wiring the space provided as a plotting room.

5. Base-Lines and Observation Stations

The stations at M^1 (the extremity of the Hook) and M^3 (near the salient angle of Battery Alexander) were retained for serving the four groups of mines near South Channel. Five base-lines (three at Fort Hancock [including the two already there], one at Fort Tilden, and one inter-fort base) would be provided to permit tracking in the new area to be mined at the entrance to Ambrose Channel. The three new stations, however, had not been built by March 1936.

6. Cable Tanks

The cable tanks, designed to hold 198 reels of 296 miles of single conductor cable, sufficed for the expanded project.

7. Loading Room

To service 23 mine groups another loading room was necessary. The proposed site was north of and at right angles to the 1905 loading room. It was 1940 before this facility was constructed, but at a different site--several hundred feet southeast of the 1894 torpedo storehouse.

8. Explosive Room

The explosive room was to be relocated from near the west elevation of the 1905 loading room to a position adjacent to its east elevation. A second explosive room was to be built adjacent to the new loading room. These rooms were never constructed.

9. Explosive Magazines

Two igloo-type magazines to accomodate the 114,000 pounds of T.N.T. required for the project were programmed and built in 1937-38. They were located near Spermaceti Cove, east of the highway. A

macadam road, 2,800 feet in length and 15 feet wide, was constructed to provide access to the magazines from the north-south highway.

10. Mine Storehouse

The sheet-metal mine storehouse, with a capacity of 250 mine cases, called for in the expanded project in 1929 was constructed in 1940. It was positioned northeast of the new loading room and southeast of the cable tanks. A narrow gauge spur branching off through the loading room and into the new mine storehouse also was constructed.

11. Mine Batteries

Four Fort Hancock batteries (Batteries Morris and Urmston [six 3-inch guns], Battery Peck [two 6-inch guns], and Battery Gunnison [two 6-inch disappearing guns]) were assigned to the mine command for defense of the minefields. In event of an emergency, the guns of Fort Tilden's Batteries East and West could be called upon to support the mine group.

12. Boats

Two mine planters (U.S. Army Mine Planter Ord and the Cable ship Joseph Henry), two D.B. boats, and six mine yawls were assigned to plant and maintain the minefields.

E. Underwater Defense Project in World War II

1. Operating and Servicing 29 Groups

In 1942, after the United States had entered World War II, the Harbor Defenses of Sandy Hook were merged into a new command designated the Harbor Defenses of New York. This resulted in a reorganization of the submarine mine defense project for the inner barrage. It would now consist of 29 mine groups instead of 23. Twelve of these groups would be fired from a mining casemate at Fort Tilden. The Fort Tilden groups were planted in two curved lines between Rockaway and Ambrose Channel. Seven groups, positioned in a curved line below the Narrows, were operated from the Fort Wadsworth mining casemate. Fifteen groups were the responsibility of the Fort Hancock

mining casemate. Groups nos. 5 and 6 were moored in Ambrose Channel, while groups nos. 7-10 covered the area between that channel and the shoals off Sandy Hook, fronting the casemate. A second grouping of mines, nos. 19-24, tied in with the second line of the Fort Tilden barrage north of Ambrose Channel and extended south to the shoals off the northwest extremity of Sandy Hook. In this second curved line, extending from Sandy Hook to Rockaway, no mines were planted in Ambrose Channel.[81] To service the 29 groups called for construction of additional facilities for underwater defense at Fort Hancock.

2. Two New Igloos

The 29 groups required 400 tons of T.N.T. which was more than could be stored in the two igloos erected in 1938. In 1942-43 two new igloos were constructed on the point northwest of Spermaceti Cove, southwest of Battery Mills. To provide access to these igloos, a surfaced road was built passing to the rear of Battery Mills.[82]

3. New Cable Hut

A new cable hut, through which the cables servicing groups nos. 5-10 passed, was built northeast of the mining casemate. The old hut continued to service the cable controlling groups nos. 19-24.[83]

4. Mine Wharf and New Boathouse

A wharf and new boathouse were built to service and maintain the increased number of craft needed for 29 groups of mines. The wharf thrust into the cove parallel to and southeast of the Coast Guard dock. The mine boathouse, with space for five yawls, was erected on the wharf adjacent to its landward approach.[84]

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81. "Supplement to Harbor Defense Project, Harbor Defenses of New York, Aug. 1944," NA, RG 407.

82. Ibid.

83. Ibid.

84. Ibid.

F. Recommendations

For more than half a century and through three wars (the Spanish-American, World War I, and World War II) the submarine mine defense system constituted a necessary element in protecting the nation's vital ports and harbors from penetration by enemy naval forces. Conceived initially as a defense against surface ships (battleships and cruisers), the controlled minefields, along with the navy's contract mines, on the United States' entry into World War I were positioned with the goal of keeping German submarines, which had demonstrated they could cross the Atlantic, from entering New York Harbor. Henceforth, until the underwater defense system, consisting of barrages of controlled mines, was abandoned by the Army following World War II, its principal mission was to prevent penetration of the harbor by enemy submarines.

Key elements of the Army's underwater defense system, which guarded the nation's most important harbor, were at Fort Hancock. Three facilities that were integral parts of the system as established in the 1890s are extant--the mining casemate in the southwest bastion of the masonry fort, the brick torpedo storehouse, and the cable tanks and sheds. These structures form an ensemble, and consideration should be given to redefining the park boundary to include the mining casemate and torpedo shed in Gateway National Recreation Area. At present, they are within the adjacent Coast Guard Reservation.

In the first quarter of the twentieth century, the mining casemate was relocated, and other facilities of the underwater defense system were expanded. The mining casemate was relocated to the old Dynamite Gun Battery, a loading room, explosive room, boathouse, and new torpedo storehouse were built near the wharf, and the cable tanks were enlarged. During the 1930s and World War II additional facilities were constructed: four igloos for storage of T.N.T., a sheet metal mine storehouse, a second loading room, and a wharf and second boathouse. Several of these structures are within the Coast Guard Reservation.

As these structures represent a system, which for years was an important element in the nation's defenses, they merit preservation.

Consideration should be given to modifying the boundary between the National Recreation Area and Coast Guard Reservation to include the mining casemate and cable huts within the National Recreation Area. Those structures associated with the system (the boathouse dating to the first decade of the twentieth century, and the boathouse and wharf built for World War II) on the Coast Guard Reservation should be nominated for inclusion on the National Register of Historic Places.

V. BATTERY POTTER: A STRUCTURAL HISTORY

A. Preparations to Begin Construction are Completed

1. Plans are Approved, a Site Selected, and Allotments Made

When construction commenced on the Endicott System batteries in Fiscal Year 1890, there were emplaced in the old masonry fort nine obsolete muzzle-loading cannon--three 8-inch columbiads, two 8-inch Rodmans, and four 100-pounder Parrotts. All were mounted on iron casemate carriages. On hand but not mounted were six 8-inch columbiads, five 8-inch Rodmans, five 10-inch Rodmans, one 15-inch Rodman, five 200-pounder Parrotts, and three 300-pounder Parrotts. These guns, as well as the fort, would be worse than useless against any modern European navy attempting to fight its way into New York Harbor.[1]

In Fiscal Year 1890 Colonel Gillespie selected a site for the modern battery to be armed with two 12-inch rifles on hydraulic lifts, programmed for Sandy Hook under the Endicott System. The site chosen was 1,100 feet south of the southeast bastion of the old fort. To facilitate planning for development of a modern defense complex at Sandy Hook, Colonel Gillespie had the reservation surveyed and mapped.[2]

Plans for the lift battery had been prepared by Brig. Gen. J.C. Duane and modified by Col. Henry C. Abbot. The estimated cost of this massive battery of masonry and sand was set by the Board of Engineers at $283,000. The anticipated cost of a massive and complicated gun-lift, including the hydraulic ram and fittings, was $61,980, and that for the hydraulic power for two lifts $50,570, making the total estimated cost of the mechanism for a single lift $112,500 or $174,530 for two lifts. The estimated cost for two completed batteries, not including the price of the two 12-inch guns, was established at $457,530.

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1. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1890, NA, RG 77, Ltrs. Recd., Chief Engineer.

2. Ibid.

To begin construction, Colonel Gillespie received from the appropriation of August 18, 1890, an allotment of $154,000 and from the appropriation of February 24, 1891, an additional $129,000. This sum of $283,000 was to cover the cost of the masonry. To fund construction of the lift mechanism he was allotted $112,500 from the appropriation of September 22, 1888, for Armament of Fortifications. When ground was broken only the first allotment of $154,000 was available, and Gillespie's instructions from Chief Engineer Thomas L. Casey, received September 13, 1890, were "to build the northern half of the battery only."[3]

2. Gun-Lift Battery Plant

The "plant" was positioned in the autumn of 1890. The wharf plant consisted of a 30- by 80-foot pier connected with the old crib wharf by a bridge 32 by 170 feet, both supported on piles. The southern end of the pier was covered by a storehouse, where material on arrival from the wharf was stored, the stone in bins and the Rosendale cement in sheds. The bins adjoined the sheds on the west.

The stone bins were provided at suitable intervals with sliding trap doors through which the broken stone was delivered into galleries underneath. A gondola car equipped to contain the materials for one charge of concrete was sent down into the gallery by gravity where it received its charge of broken stone through one of the traps. It was then hauled by the winch head of the hoisting engine (for derricks nos. 1 and 2 at the gun-lift) under the hopper on the mixing platform where it received its cement and sand and then over to the mixer into which its charge was emptied. Water was supplied from a tank containing the requisite volume for the charge through the hollow trunnion of the mixer.

The mixers were cubical boxes, four feet on each edge, constructed of ¼-inch steel and 3-inch angle irons. They were rotated by

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3. Gillespie to Chief Engineer, Annual Reports of Oprations at Fort at Sandy Hook for Fiscal Years 1891 and 1892, NA, RG 77, Ltrs. Recd., Chief Engineer.

3-inch steel shafts, passing through diagonally-opposite corners and securely fastened by iron castings. To each shaft was keyed a worm wheel of 40 teeth, 1½-inch pitch, having five complete turns, and bored to fit the 2½-inch worm shaft.

When the gun-lift battery plant was first set up, difficulty was experienced in starting the mixers, and the lidgerwood horizontal 15-horsepower engine suffered from the great strain thrown upon it when both mixers were put into gear. This trouble was alleviated by employing a counter-shaft with two heavy fly wheels taken with a capacity of 1,500 barrels of cement (one barge load). During wet weather or when hoists were unavailable, cement was stored in this structure. The south side of the bridge mounted one derrick for unloading cement from barges and placing it onto cars, and the north side two derricks for handling broken stone. Steam power for the derricks was provided by a lidgerwood hoisting engine with a double friction drum and one no. 4 hoisting engine.

All the cement and broken stone, as well as other building materials, were transported between the wharf and the battery site on the construction railroad. The railway, one spur of which led to the site of the gun-lift battery and the other to the mortar battery, separated into three parallel tracks near the head of the bridge, any one of which could be reached by the derricks. The railroad rolling stock included: one H.K. Porter & Co. locomotive no. 1222; eighteen rotary side dump cars of three cubic yards capacity; two rotary side dump cars of 1½ yards capacity; and 21 flat cars.[4]

The plants at the lift-gun battery and the mortar battery were similar, except that the capacity of the former was double to that of the latter. The mixers were turned at a rate of eight turns per minute,

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4. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1892, NA, RG 77, Ltrs. Recd., Chief Engineer; "Map of Sandy Hook, N.d., . . . to Accompany Report, U. S. Engineer Office, New York, N.Y., June 30, 1892," NA, RG 77.

and the average number of turns given each charge was 18. The concrete was discharged from the mixer into concrete boxes, and these were hauled by steam under the derricks for deposit in the place desired. There were six derricks positioned at key points around the lift-gun battery. These derricks were powered by two steam engines.[5]

B. Work Accomplished in Fiscal Year 1891

Ground was broken for the lift-gun battery in January 1891. By June 30 all excavation for the foundations of the north one-half of the battery and nearly all that for the south one-half were finished. About 3,500 cubic yards of concrete and rough stone were positioned, principally in the north one-half. The foundation for the accumulator pit, five feet below the water table, had been successfully laid for the north gun position, and the curb for the shot lift nearly adjusted. The latter penetrated the sand to a depth of 22 feet below the water table.[6]

The masonry was built by day labor, while the materials were delivered by contracts which were awarded after the receipt of sealed proposals. Lawrence Cement Co. had been awarded the contract for supplying Hoffman brand Rosendale cement at $1.02 per barrel; John A. Bouker for supplying broken granite for concrete at $1.63 per cubic yard; and John Satterlee for delivery of large stone at 79 cents per ton.[7]

In response to his call for bids for the manufacture of and erection of a hydraulic gun-lift, Colonel Gillespie received five proposals.

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5. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1892, NA, RG 77, Ltrs. Recd., Chief Engineer; "Lift-Gun Battery No. 1 at Sandy Hook, n.d., General plan showing arrangement of working plant in use . . . U.S. Engineer Office, New York, N.Y., June 30, 1892," NA, RG 77.

6. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1891, NA, RG 77, Ltrs. Recd., Chief Engineer. Chief Engineer Casey had authorized Gillespie on April 3, 1891, to begin work on the south half of the battery.

7. Ibid.

On February 20, 1891, with the approval of the Chief Engineer, Gillespie contracted with Continental Iron Works of Brooklyn to construct and position the ironwork necessary to operate one lift for $93,750. By June 30 the firm had delivered the curbs for the lift, and by June 30, 1891, Colonel Gillespie had expended $41,156.08 on the project.[8]

C. Work Accomplished in Fiscal Year 1892

1. Battery Takes Shape

During Fiscal Year 1892 excavation for the foundations of the south one-half of the battery were completed. Construction of concrete masonry was pushed, except during the period December 23, 1891-April 13, 1892, when the cement plant was shut down because of cold weather. By June 30, 1892, the masonry of the battery had been carried to an average height of 32 feet above the bed of the foundations, or to reference (39'); the sandcore between the exterior 20-foot wall and the interior 10-foot wall had been filled and compacted. The settlement was done by use of water and averaged about 15 percent.

The amount of masonry constructed during the year was 29,875.5 cubic yards; that previously accomplished amounted to 3,055 cubic yards, thus raising the total to 32,930.5 cubic yards. Although 76 percent of the masonry had been completed, there remained to be built 10,167.5 cubic yards. The masonry consisted of 23,815 cubic yards of concrete, mixed and placed at $4.13 per cubic yard, and 5,512 cubic yards of large stone, delivered and placed at $3.31 per cubic yard. The average cost of the two combined during the year was $3.91, and the average cost of all masonry laid from the beginning was $5.51 inclusive of superintendence, purchase and manufacture of plant, repairs to buildings, office expenses, and general work.[9]

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8. Ibid. The unsuccessful bidders were: South Boston Iron Works, $119,500; Morgan Engineering Co., $148,050; Robert J. Gray, $103,000; and N. F. Palmer, Jr., & Co., $110,000.

9. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1892, NA, RG 77, Ltrs. Recd., Chief Engineer; Executive Documents of the House of Representatives for the 2d Session of the 52d Congress, 1892-93 (Washington, 1893), Ser. 3078, III, 5-6.

At the beginning of the fiscal year, there had been four contracts in force: (a) with the Lawrence Cement Co. for delivery of 31,000 barrels of Rosendale cement at $1.02 per barrel; (b) with John A. Bouker for delivery of 21,000 cubic yards of broken granite at $1.63 per cubic yard; (c) with John Satterlee for delivery of 5,000 tons of large stone at 79 cents per ton; and (d) with Continental Iron Works for construction of the mechanism for one hydraulic gun-lift.

On August 17, 1891, the Continental contract was revised to allow for certain changes in the mechanism to cost an extra $9,350. Then on May 17, 1892, another supplemental agreement was negotiated with the iron company for additional parts of the mechanism: tanks for the accumulator pit, supply of the hydraulic system with water, and parts for the south lift, which were to be built into the masonry and would not be subject to modification.

Under the materials contracts, 23,695 cubic yards of broken stone and 34,055 barrels of Rosendale cement had been delivered by June 30.[10]

During the year Gillespie computed statistics relative to the average cost of materials for the project as follows:

	Cement, per bbl.	Broken Stone per cb. yd.	Large Stone, per ton	Sand per cb. yd.
On scows or canal boats alongside of dock	$1.02	$1.63	$0.79	...
Unloading into cars	.0227	.1211	.396	...
Hauling to yard or shed . . .	.0032	.0193	.101	...
Storing in yard or shed . . .	.0183	.0425	...	...
Testing cement	.0094	....	...	...
Placing large stone in wall . .	....	....	.197	...
Hauling sand	....	....	...	$0.103
Total cost	$1.0736	$1.8129	$1.484	$0.103

10. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1892, NA, RG 77, Ltrs. Recd., Chief Engineer.

Cost per cubic yard large stone in wall, $3,305.

Colonel Gillespie computed the cost of the "manufacture of one cubic yard of concrete" (1 part cement, 2 parts sand, and 5 parts broken stone) at:

	Material	Manufacture	Total cost
Broken stone, 0.92 cubic yard	$1.6785	....	....
Cement, 1.43 barrels	1.5337	....	....
Sand, .37 cubic yard	.0382	....	....
Charging and running mixer	....	$0.2538	....
Delivering under derrick	....	.08554	....
Hoisting	....	.13687	....
Placing and tamping	....	.17109	....
Making and setting up forms	....	.16431	....
Lumber and nails	....	.06460	....
Cost per cubic yard	$3.2504	$0.8762	$4.1266

Note.--One charge of the mixer is equal to 1.05 cubic yards of masonry in place, machine mixed and placed by derrick.

He placed the cost per cubic yard of masonry--concrete and large double space stones combined--at:

Concrete masonry; 23,815 cubic yards, at $4.1266 . .	$ 98,174.979
Large stone; 5,512 cubic yards, at $3.305	18,217.16
Total	$116,392.139

Masonry, concrete and large stone combined, 29,766.80 cubic yards, at $3.9101	$116,392.139

The cost per unit of concrete and of concrete with large stones was the cost per unit for the project in Fiscal Year 1892, inclusive of the proportion of the total cost of the plant corresponding to the proportion of the battery completed. These figures, Gillespie observed, had been checked and rechecked so that they would be of value in making estimates for similar construction in other areas. A review of the statistics satisfied Gillespie that the cost of the services of carpenters, lumber, etc., for building forms, centres for concrete arches, etc., had been relatively expensive. Experience had demonstrated that for these purposes white pine, dressed on both sides, was superior. At first, spruce had been used on the project, but it could only be employed once,

as the moisture in the concrete caused it to warp badly. Thus, while the initial cost of spruce was much less than pine, its final expense was greater. Gillespie had found also that the cost of mixing and placing the concrete was higher than anticipated, because the isolation of Sandy Hook made it difficult to gauge the shipments and "necessitated the constant maintenance of a full working force, under all conditions of construction or weather."[11]

Colonel Gillespie placed the total cost per cubic yard of masonry, including superintendence, granite masonry, purchase and maintenance of plant, repairs to buildings, clerk hire, office expenses, and general work at:

Concrete masonry;	23,815	cub. yds., at $4.1266.	$ 98,174.979
Masonry of large stones;	5,512	cub. yds., at $3.305.	18,217.16
Granite masonry, setting;	108.7	cub. yds., at $7.46.	810.94
Granite, for cutting only;	270.4	cub. yds., at $32.67.	8,889.75
Excavation for foundations;	5,127	cub. yds., at $0.251.	1,284.66
For purchase and maintenance of plant and repairs to buildings;	29,875	cub. yds., at $0.7452.	22,263.40
For work of plasterer finishing walls of casemates and galleries			391.47
For purchase and maintenance of public animals			1,131.45
For general work			8,555.57
For office expenses, etc.,			2,700.51
For superintendence			2,046.00
Total cost			$164,465.289

Masonry constructed during the year	cub. yds.	29,875.5
Total cost of masonry constructed		$164,465.289
Cost per one cubic yard		$5.505

The cost for one cubic yard of masonry, including all the work done since the beginning of construction in Fiscal Year 1891, was:

Masonry constructed	cub. yds.	32,950
Total cost of same		$196,664.99
Cost per one cubic yard		$5.9685

11. Ibid.

The average daily number of employees in each category for the year were:

Overseers	1.2	Laborers, monthly	.75
Clerks	1	Blacksmiths	1.60
Draftsmen	.83	Plasterers	.17
Recorders	.75	Painters	.70
Cooks	.75	Riggers	.08
Locomotive engineers	.7	Carpenters	6.08
Engineers	3	Bricklayers	0.0108
Firemen	1.2	Stone cutters	9.25
Master laborers	3	Laborers, daily	66.40
Watchmen	.17		

During the year, Colonel Gillespie placed in daily use at the average plant the following:

Locomotives	1	Dump cars	9.25
Hoisting engines	3.6	Flat cars	8.40
Stationary engines	1.5	Derricks	5.25
Concrete mixers	1.5	Horses	2.25[12]

2. Change Orders

As this was the first battery of this type constructed in the United States, the plans had to be changed from time to time as work progressed. These modifications, while they involved no radical alterations in the general design, resulted from experience. There were four of these changes, three of which effected the battery and one the machinery.

At the suggestion of Chief Engineer Casey, on his September 16, 1891, inspection of the project, it was decided to cap the piers containing the seats for the locking bolts of the cage with granite blocks and to construct of granite the coping around the gun pit at the level of the terreplein which housed the buffer cylinders. As this type of material was carried 15 feet to the rear wall of the pit, and 10 feet on the sides and toward the front, its use involved the substitution of

12. Ibid.

granite for concrete in the soffit and walls of the leading gallery for nearly one-half its length. The granite so used was salvaged from the old masonry fort. A force of 18 stone cutters was hired to cut and set the granite.

As of June 30, 1892, the condition of the stonework was: (a) the walls and arch of the leading gallery set; (b) the coping above the arch and the piers for seats of the locking bolts set; (c) the stone for the coping of the north lift finished; and (d) one-third of the granite for the south lift cut. The total quantity of granite cut and set during the year was 270.4 cubic yards, at a cost per yard, including moving the stone, of $33.65. There remained to be cut and set 121.5 cubic yards of granite.[13]

The pit for the accumulator well, although sunk 4½ feet below the water table in the sand, failed to exclude water. Numerous remedies having failed to correct the situation, the pit was lined with a steel tank, 20 feet by 10 feet by 5 feet.

Colonel Gillespie on January 19, 1892, submitted to the department plans and estimates for a "defensible entrance to the battery." Chief Engineer Casey approved the concept, but directed that further study of the project be made with a view of providing a flank defense for the entire battery.

Gillespie and his young assistant, Lt. James G. Warren, found that the trace of the battery did not lend itself to a flanking defense of a simple character. But it seemed to them that all the conditions requisite to a defense of the work by its garrison would be fulfilled "sufficiently" by placing a chemin de ronde at the foot of the superior slope on the curved face of the battery, supplemented by wire entanglements surrounding the battery and placed at the foot of the sand

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13. Ibid.

slope. To insure that small-arms fire from the chemin de ronde would be effective, it was found necessary to remove a portion of the sand slope covering the exterior scarp. To compensate for loss of the cover involved, the vertical portion of the exterior scarp was raised four feet from reference 30.0 to 34.0, thereby throwing forward the sloping portion of the scarp and increasing the thickness proportionately.[14]

On May 28, 1892, a special report, with plans and estimates for a modification of the loading gallery of the south lift was submitted by Colonel Gillespie to the Chief Engineer, who promptly approved it. This change substituted a horizontal iron cover of I beams and plates for the full center arch of the original plan and gave additional head room, with equal strength and protection, at a reduced cost.[15]

3. Positioning the North Gun-Lift Mechanism

Continental Iron Works commenced delivery of parts for the gun-lift mechanism at Sandy Hook on October 22, 1891, and during November positioned and adjusted the locking-bolt seats and their attachments (the stanchion guide rails; wedge blocks and bases; and the hollow guide rails of the lower section of the gun pit). During the winter the work of constructing, assembling, and testing the several parts of the mechanism was carried on as expeditiously as possible at the company's Brooklyn plant.

On February 23, 1892, work was resumed at Sandy Hook. The accumulators were set and adjusted. On March 10 the cage, with locking-bolt mechanism, was inspected by Colonel Gillespie at the

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14. Ibid.; "Proposed Main Entrance to the Lift Gun Battery at Sandy Hook, N.J., . . . U.S. Engineer Office, Sandy Hook, N.J., January 14th, 1892," Sheets 2 and 3, NA, RG 77.

15. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1892, NA, RG 77, Ltrs. Recd., Chief Engineer.

Brooklyn works. After being tested satisfactorily, it was then taken apart and on March 25 shipped to Sandy Hook. By June 30 all parts of the mechanism had been completed and delivered at the battery, and all parts of the lift "mechanism proper" had been positioned. A small amount of work remained to be done in making final adjustments to various parts of the ammunition lift and hydraulic rammer. Continental Iron Works, however, had fulfilled its contract so far as the condition of the masonry would permit.

On June 27 the accumulators were successfully raised and lowered. Power was provided by one of the pumps and one boiler with 72 pounds steam pressure. This trial demonstrated the verticality of the accumulator rams and cylinders, the proper adjustment of the guides and packing, the sufficiency of the boilers and pumps, and the perfect action of the appliance for regulating the velocity of fall of the accumulators when approaching the lowest point.

The principal cause of delay had been the difficulty in making the connection between the platform of the cage and the pintle-plate of the gun carriage, which had been designed and manufactured by Schneider-Creusot for use in connection with the lift. The under surface of the pintle-plate was very irregular and probably had been intended by the manufacturer to be bedded in concrete. More than two weeks had been required to chip a bed for it on the upper surface of the platform. By June 30 all parts of the north gun carriage were on the battery's terreplein and would be assembled with the assistance of the Ordnance Detachment by or before July 15. Preparations had been completed for mounting the huge 12-inch rifle upon its carriage as soon as it was ready to receive it.

Continental Iron Works, Colonel Gillespie wrote, had "displayed most creditable zeal, and have furnished workmanship and material of the highest character, and have spared no effort to insure the success of this first American mounting for a modern high power gun."[16]

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16. Ibid.

D. Fiscal Year 1893 Finds the Battery Partially Armed

1. Masonry and Embankment are Completed

At the beginning of Fiscal Year 1893 there remained in force the following contracts for materials for the Sandy Hook batteries: (a) with Lawrence Cement, dated December 29, 1891, for delivery of 38,000 barrels of Rosendale cement at $1.02 per barrel (contract completed July 25, 1892); (b) with John A. Bouker, dated December 29, 1890, for delivery of 21,000 cubic yards of broken granite at $1.63 per cubic yard (contract declared fulfilled on July 29, 1892).

On July 20, 1892, Colonel Gillespie opened the sealed proposals submitted in response to his advertisements for supplying the government with cement and broken stone. Calvin Tompkins of New York was the lowest responsible bidder. Two days later, on the 22d, Colonel Gillespie contracted with Tompkins for delivery of 25,000 barrels of "Old Newark" Rosendale cement at 93.9 cents per barrel, and 20,000 cubic yards of broken stone at $1.28-3/4 per cubic yard.

Delivered under the Tompkins agreement to June 30, 1893, were 12,102 cubic yards of broken stone and 23,410 barrels of cement. Of these, 102 cubic yards of stone and 3,637 barrels of cement were used in construction of the gun-lift battery.[17]

An unseasonably severe winter compelled Colonel Gillespie to suspend construction of the masonry for five months, from December 1, 1892, to May 1, 1893. Despite this action, the battery, with the exception of the mechanism for the south lift, was "practically completed" by June 30.

The hoisting and overhead carrying apparatus for the ammunition service had not been positioned, while the large doors for the

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17. Executive Documents of the House of Representatives for the 2d Session of the 53d Congress, 1893-94 (Washington, 1895), Ser. 3199, III, 607-08.

main entrance still needed to be built and hung. Materials for these, if not on hand, had been ordered for early delivery.[18]

To provide a water supply for the boilers and hydraulic system and for the purpose of cleanliness, a "Ryder" hot-air pumping engine was positioned in a bombproof room (7½ by 9 feet) under the sand embankment adjoining the "defensible entrance" on the right and communicating with it by a doorway cut through the concrete wall. This pump had a capacity of 1,000 gallons per hour, which was an ample supply as the boilers of the lift mechanism evaporated only 500 gallons per hour, and the 1,300-gallon tank supplying the hydraulic system required only occasional refilling. The pump was connected by a galvanized-iron pipe to a group of four 1½-inch well points about 175 feet behind the battery.

On the left of the "defensible entrance," covered by sand and opposite the pump room, was a second bombproof room (7½ by 16½ feet) which could be used as a "sanitary water-closet." Flagstone taken from the old stone fort was employed by Colonel Gillespie to pave the battery's terreplein, the floors of the boiler and accumulator rooms, the space between the tracks for the ammunition service, and the exterior court between the wing walls of the "defensible entrance."[19]

During the fiscal year 8,292.9 cubic yards of masonry had been built at a cost of $4.706 per cubic yard. This included 1,512 cubic yards of large stone bedded in the concrete and designed by "rendering the masonry nonhomogenous" to deflect enemy shells; 538.3 cubic yards of cut granite; and 895.25 cubic yards of pavement for the interior and exterior of the battery. A sand embankment, resting against the exterior 20-foot wall and surrounding the battery (except at the main entrance)

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18. Ibid., p. 608.

19. Ibid., pp. 612-13; "Gun-Lift Battery No. 1 at Sandy Hook, n.d., Progress Sheet showing Total Masonry and the Masonry Constructed each month during the Fiscal Year ending June 30, 1893," NA, RG 77.

had been erected. The quantity of sand excavated, hauled, and deposited for the embankment was 5,185 cubic yards. All this work--masonry and earth construction--had been done by hired labor.[20]

The cost of completing the battery's masonry, amounting to 42,410.45 cubic yards, was divided as follows:

cubic yards concrete masonry, at $4.13618 per cubic yard	$161,363.34
cubic yards large broken stone, bedded in concrete at $3.333 per cubic yard	5,082.82
cubic yards cut granite masonry at $36.1711 per cubic yard	19,470.94
487 cubic yards in finished pavement of superior slope (Alsen's Portland cement), comprising an area of 1,096 square yards, at $3.11814 per square yard	3,417.48
411.25 cubic yards in finished pavement of exterior and interior slopes (Duryea's American Portland cement), comprising an area of 1,645 square yards, at $2.3757 per square yard	3,908.02
128.75 cubic yards in finished floors of galleries and rooms (with Rosendale cement), comprising an area of 965.5 square yrds, at $1.41 per square yard	1,361.35
977.50 cubic yards bluestone pavement of terreplein, entrance passage, and boiler room, comprising an area of 1,845 square yards, at $2.70572 per square yard	4,992.07
Total cost	$199,596.02[21]

Colonel Gillespie broke down the total expenditures on the project:

42,410.45 cubic yards masonry, at $4.706293	$199,596.02
Purchase and maintenance of plant, etc.	23,850.34
Excavation for foundations, 5,177 cubic yards, at $0.251	1,299.43
Work of plasterers, finishing interior walls and arches	1,453.87
Repairs to buildings	3,881.93

20. Executive Documents, Ser. 3199, III, 608.

21. Ibid., p. 609.

Purchase and maintenance of public animals	1,231.93
Sand filling in exterior slope, 5,185 cubic yards, at $0.22235	1,152.03
Material and labor finishing pavement of superior slope with Duryea's American Portland cement, 1,096 square yards, at $1.7924	1,964.45
Removing pavement of Duryea's American Portland cement from superior slopes	258.75
Grading exterior sand slope and adjacent grounds	100.82
Track and derrick work	1,513.85
Building and hanging doors for magazines and casemates	1,241.33
Tearing out stone bins, cement sheds, etc., and clearing up refuse	1,545.06
Whitewashing interior walls and arches	411.21
Materials and labor, laying drain pipe	172.11
Materials and labor, putting in plant for permanent water supply	720.40
Materials and labor, ammunition service, cars track, and turntables	1,212.38
Materials and labor, operating and maintaining gun-lift mechanism	2,083.31
Materials and labor, mounting 12-inch rifle	1,073.31
Fastening pintle-plate to platform and assembling Creusot carriage	381.25
Materials and labor outfitting dynamo room and making steam connections for electric light plant	266.16
Installation of electric light plant	3,788.00
Three iron stairways, interior of battery	710.00
Iron cover of south lift loading gallery	250.00
Iron beams in floor of caponniere	180.49
Applying waterproofing process, 2,686 square yards, at $0.25	671.50
Iron-cover plates of pipe conduits	66.32
Purchse of materials for operating purposes	752.38
General work, etc., consisting of items not susceptible of classification, and including time allowed employees for legal holidays	9,832.89
Office expenses	2,714.82
Superintendance and clerk hire	6,648.50
Total expenditures to June 30, 1893	$270,985.73[22]

22. Ibid., p. 610.

During the 12 months the average daily number of employees in various categories had been:

Overseers	1.54	Watchmen	.29
Clerk	.91	Teamsters	.79
Draftsman	.75	Blacksmith	1.35
Recorder	.804	Plasterers	2.42
Locomotive engineer	.17	Carpenters	3.70
Engineers	3.25	Stone cutters	6.35
Rigger	.17	Stone setters	1.91
Master laborers	2.58	Laborers, daily	39.55
Monthly laborers	.83	Firemen	2.40[23]

The average plant equipment in daily use during Fiscal Year 1893 included:

Locomotive	.25	Dump cars	3.50
Hoisting engine	1.50	Flat cars	5.33
Stationary engine	.83	Derricks	3.45
Concrete mixers	.75	Horses	1.58[24]

2. Change Orders Proposed and Implemented

a. Introducing Mechanical Power for Ammunition Storage

No special arrangements had been provided for the handling, either for storage of or use in battle, of ammunition. Knowing that the projectiles for the giant 12-inch rifles weighed more than 1,000 pounds each, Colonel Gillespie realized there was a need to utilize some form of mechanical power for "their economical and speedy handling." In addition, the quantity of powder required to fill the magazines (45 short tons) could not "be well transported without special facilities."

Thus, he prepared a plan for "furnishing the necessary conveniences while making use of a portion of the plant acquired for construction purposes." His plan, as modified by the Board of Engineers, was approved by Chief Engineer Casey on October 15, 1892.

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23. Ibid.

24. Ibid.

The construction track (36-inch gauge) from the Engineer wharf, which ran through the entrance of the battery to the transverse gallery connecting the magazine passageways, was retained. Where it entered the transverse gallery, a turntable was positioned from which tracks led, right and left, to points opposite the entrances to the magazine passage. These tracks were of steel girder rails, 72 pounds to the yard, built into the concrete floor. Through the magazine passageway, crossing the tracks at right angles and extending to the ram of the ammunition hoists, ran a second set of tracks of the same gauge, but with gun metal strap rails, 2½-inch, screwed with brass screws to creosoted yellow pine stringers bedded on the concrete floor. A turntable was placed in the line of this track opposite the magazine entrances.

By employing this system of tracks and turntables, ammunition, unloaded onto flat cars from a lighter at the wharf, could be delivered at the entrances to the magazine passages. There it was transferred to the ammunition car by an overhead trolley and a 2,000-pound hoist attached to the crown of the arch of the transverse gallery. When the transfer was completed, the car was run directly into the magazine. The magazines, designed for storage of shells, were provided with an overhead traveling bridge, trolley, and hoist, which enabled one man to handle a load of 2,000 pounds at any point in the magazine. The powder cylinders, which weighed 150 pounds each, were stacked by hand.

The combined ammunition carriage lift and loading tray, constituting part of the mechanism of the lift, could be integrated into this system. This was done by running it from its place over the ram of the ammunition hoist into the magazines, where it received the powder and projectile and conveyed them to their final position in the gun by mechanical power.[25]

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25. Ibid., pp. 610-11; "Lift Gun Battery No. 1 at Sandy Hook, n.d., Plans and Sections showing arrangement of Track and Turntables for Ammunition Services," NA, RG 77.

b) Lighting the Battery With Electricity

As planned, the battery was to be lighted by oil lamps placed in suitable recesses constructed in the walls. Colonel Gillespie was satisfied that "the magnitude of the work" with "its many passages and casemates," would make this system useful as an auxiliary. He felt, however, that it could not provide a good working light. He received authority from Chief Engineer Casey to provide a suitable electric light plant.

The plant that was selected consisted of a direct-coupled Thomson-Houston engine and dynamo, having a capacity, with 80 pounds of steam and running at 550 revolutions per minute, of 100 volts and 40 amperes, equivalent to that of about 80 candlepower lamps. This plant was similar to those in use on the nation's modern warships.

On November 23, 1892, Colonel Gillespie contracted with the General Electric Company for installation of the electric light plant. The plant, which cost $3,788, was accepted March 10, 1893. Connected with the plant were four 24-candlepower lamps, one in each magazine, and 54 16-candlepower lamps. Excess power was employed to run electric fans for ventilation purposes. The lead-covered conductors ran in moldings attached to the concrete walls and arches by brass expansion bolts. Every lamp was covered with steam and vapor-proof globes, protected with metal guards. The steam for the plant was taken from the battery's main boilers.[26]

c) Raising the Interior Crest and Adding Blast Aprons

When the north gun was test fired in September 1892, the concrete of the superior slope was only four days old. Thus, it had barely had time to "begin settling under a freezing temperature before it was subjected to severe gun blasts, which materially injured it." This experimental firing of the 12-inch rifle demonstrated to Colonel Gillespie

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26. Executive Documents, Ser. 3199, III, 611-12.

the practicability of raising the interior crest of the battery 18 inches without impairing its fire over the channel, for the protection of which it was designed. As this would materially increase the cover, not only for the gun crew but to the loading galleries, Colonel Gillespie determined to make this change.

The interior crest was raised by the addition of a wedge-shaped mass of masonry, having a depth of 18 inches at the interior crest and extending out to zero at the exterior crest. The effects of the muzzle blasts upon this masonry demonstrated that certain improvements in the composition and laying of the concrete should be adopted when the superior slope was reconstructed.

Like all concrete structures the parapet of the battery was composed of successive layers of masonry from 4 to 8 inches thick, and as such there were weak points in the bond between the layers. The blasts of the gun had destroyed first the bond between the upper layers of concrete, and succeeding shots broke these layers into smaller pieces, and finally, when fragmented, displaced them.

In reconstructing the slope, all concrete masonry displaying signs of weakness was removed. Then the masonry was built up in sectors, "the successive layers of which were superimposed before the underlying ones had time to set." This method had as its goal the making of blocks of equal strength throughout and the substitution of vertical for horizontal joints. The materials employed were Alsen's Portland cement and fine crushed granite, mixed by machine in the proportion of two parts cement to three parts of stone, and carefully rammed into place. Precautions were taken while the cement was still fresh to float the upper surface with dry cement and sand. The thickness of this new masonry apron was varied in proportion to its exposure to blast--from 12 inches directly under the gun to about 2 inches at the exterior crest.[27]

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27. Ibid., pp. 612-13.

3. America's First Modern Big Gun is Emplaced and Tested

a) Assembling the North Carriage and Mounting the Gun

It was July 30, 1892, before the pintle-plate of the gun carriage was finally attached to the platform of the lift. The lower surface of the plate was irregular. It had been necessary to do a great amount of chipping upon the upper surface of the platform before it was practicable to adjust the pintle-plate to bring its limiting lines, the circles bounding the lower roller path, into horizontal planes. After this was effected the remainder of the Schneider-Creusot carriage was assembled. Employees of the Engineer Department handled this task, except for insertion and adjustment of the rams in the recoil and reservoir cylinders and the adjustment of the obturating bars and pump, which were done by the Ordnance Detachment. By August 15 the carriage was assembled and ready to receive its gun.[28]

On August 12 a 12-inch breech-loading rifle (Model 1888, No. 11), recently received from the Army Gun Factory, was placed on a cradle about 1,200 feet from the battery. It took ten working days for the Ordnance Department to deliver the gun under the wall of the battery at the point indicated by Colonel Gillespie. By this time (August 23), a working party led by Lieutenant Warren had erected the "appliance" for mounting the 52-ton gun. Final arrangements were completed for positioning the huge rifle on the 25th, and it was "successfully delivered on the wall of the battery, immediately in front of the north platform, at noon on August 26. On Monday, the 29th, the rifle was finally placed upon its carriage and raised to firing position by the hydraulic lift.[29]

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28. Ibid., p. 615.

29. Ibid. The device for raising the gun was a frame of timbers, having a width between uprights slightly greater than that of the gun, measured from end to end of the trunnions. It was positioned parallel to the wall of the battery and 13 feet from it. From the cap of the frame a steel bar, about 4 inches in diameter, was suspended by three wrought-iron bands, from which were hung two blocks, one with four and

b) Testing the Gun and Lift Mechanism

With the 12-inch rifle in position, the Sandy Hook lift battery gained the distinction of being the first Endicott emplacement to be partially armed.

Before the test firings, preliminary trials of several parts of the lift mechanism had been made as progress permitted. The cage and platform were raised and lowered for the first time on July 7, 1892. The first trial of the mechanism--gun-lift, ammunition hoist, and hydraulic rammer--occurred on August 31.

On September 12, in the presence of a Special Board of Engineers, the official test began and was continued periodically until May 31, 1893. Twenty-four rounds were fired. Many of these, notably the 21st, subjected the structure to stresses far in excess of any probable under battle conditions. Notwithstanding these pressures, the

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29. (continued) the other with three sheaves. Through the sheaves and their falls was led about 750 feet of 7½-inch manila rope, the standing part being made fast to the cap of the frame and the running part passing first through a single block secured to the bottom of one of the timber uprights and then to a secure anchorage. The gun, without preponderance, the breech-block having been removed, was slung to falls by a 1-3/4-inch chain, the breech to the wall.

Parallel to this frame were four smaller frames, so arranged that when capped they would form a platform at the elevation to which the gun was to be delivered. These frames were braced together and to the large frame, and the entire structure tied and braced to the masonry of the battery. Leads were taken from two nearby hoisting engines, which formed part of the plant, to the running section of the 7½-inch manila, employing two parts of half-inch steel-wire hoisting rope. The gun was raised vertically above the level of the auxiliary platform, the caps promptly put upon the frames, stringers laid over the caps, and a cradle run out upon these from the wall. The big rifle was lowered upon the cradle, which was then hauled in upon the masonry by means of a lead from one of the hoisting engines.

It took one hour and 43 minutes to hoist the 52-ton gun, with the time in motion 12 minutes and 25 seconds--a rate of 1 foot in 39 seconds. The operation was carried out in a driving rain. Ibid., p. 616. A series of photographs was made of the gun mounting operation. Copies of these are on file at the Sandy Hook Unit, Gateway NRA.

mechanism functioned smoothly and satisfactorily, and demonstrated no signs of weakness in any of its parts.

These trials showed the desirability of some minor changes, principally in the loading apparatus. These involved increasing the speed of travel of the hydraulic rammer; modifying the combined ammunition carriage and loading tray; and lengthening the throttling bar. Continental Iron Works made these changes at no additional cost to the United States.[30]

4. Gillespie Contracts for the Lift Mechanism for the South Emplacement

On January 26, 1893, Chief Engineer Casey made an allotment of $63,000 from the appropriations of February 24, 1891, and July 23, 1892, for Gun and Mortar Batteries, for construction of the mechanism of the south lift.[31] The mechanism for the south emplacement was to be similar in all respects to that on the north emplacement. On November 21, 1892, Colonel Gillespie called for sealed proposals for its manufacture. The bids were opened on January 24, 1893, and the contract awarded to Continental Iron Works, the lowest responsbile bidder, for $63,000.

As of June no carriage had been procured for the platform of the south lift. It was decided, however, that it should be a duplicate of the one in position on the north lift. Colonel Gillespie made arrangements with the Ordnance Department to have the pintle-plate of the carriage delivered by September 1, 1893. As soon as it was attached to the platform of the south lift, the top carriage and gun mounted on the north lift would be shifted to the south lift for a test of its mechanism and for other Ordnance Department trials.[32]

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30. Ibid., pp. 613-15.

31. Ibid., p. 607.

32. Ibid., pp. 616-17.

E. Fiscal Year 1894 Finds the Battery Nearly Ready to be Turned Over to the Troops

1. Chief Engineer Gives an Overview

When he filed his annual report for Fiscal Year 1894, Chief Engineer Casey informed Congress that, in the four years since ground had been broken for the first Endicott System emplacements, projects had been formulated and approved for the defense of 15 harbors. Construction was well underway at six of these points (New York, Boston, Washington, San Francisco, Hampton Roads, and Portland, Maine) and had been recently initiated at two more (Narragansett Bay and Pensacola). One 12-inch rifle at Sandy Hook had been mounted and it was expected that a second would be mounted in a completed battery for the defense of New York Harbor during the fall of 1894. These guns were mounted on lifts by which they "may be completely lowered for loading out of sight of the enemy in 26 seconds, and the loaded gun raised for firing in 21 seconds." The ammunition could be raised by another lift in 17 seconds. The weight of gun and carriage thus lowered and raised was about 108 tons.

A battery of 16 mortars, also at Sandy Hook, was nearly ready for the defense of New York Harbor, and another for the protection of San Francisco Harbor. Before the close of the present fiscal year, General Casey predicted, these batteries would be entirely ready, along with one for the defense of Boston Harbor. Three 12-inch rifles would probably be mounted en barbette on "high sites" at San Francisco Harbor.

The completion of emplacements for 17 10-inch and 8-inch guns, to be mounted on disappearing carriages, had been delayed by lack of carriages on which to mount the guns, and that of seven emplacements for 12-inch and 10-inch guns was likely to be delayed for the same reason. General Casey urged that appropriations be made for the manufacture of the disappearing carriage recently developed by the Ordnance Department. The Buffington-Crozier self-depressing carriage,

Casey pointed out, had proved itself in tests at the Sandy Hook Proving Ground equal to all requirements that a carriage must fulfill.[33]

2. South Lift Mechanism is Positioned and Tested

During the year Continental Iron Works completed, delivered, and installed the mechanism for the south lift. Pending receipt of the carriage from the Watertown Arsenal, the north carriage and gun were transferred temporarily to the south lift. Before being returned, nine rounds were fired from the south lift to test the mechanism.

Bullet-proof entrance doors were fashioned and hung. With the caponniere over the entrance arranged for flank defense, they provided an adequate defense for the entrance to the battery. The arrangements for ammunition service were completed, and the mechanism of the lifts were serviced and operated from time to time. The battery with its hydraulic mechanism was now complete, and as soon as the second gun was mounted, it would be ready to be turned over to the troops.[34]

F. Battery is Declared Ready to be Turned over to the Troops

1. Colonel Gillespie Submits His Completion Drawings and Final Cost Figures

Completion drawings of the battery, along with a description and specifications, were forwarded by Colonel Gillespie to Chief Engineer Casey on January 4, 1895.[35] As of March 1 there had been expended on Gun-Lift Battery No. 1:

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33. Executive Documents of the House of Representatives for the 3d Session of the 53d Congress, 1894-95 (Washington, 1895), Ser. 3296, V, 5-9.

34. Ibid., p. 456.

35. Executive Documents of the House of Representatives for the 1st Session of the 54th Congress, 1894-95 (Washington, 1895), Ser. 3371, IV, 506; "Defenses of New York Harbor, New York, 1894, Gun-Lift Battery No. 1, Sandy Hook, N.J., Constructed under the Direction of Lieut. Col. C. L. Gillespie . . . in 10 sheets," NA, RG 77.

Installation of construction plant	$ 25,473.00
Battery construction	
42,410 cubic yards concrete and masonry, including materials for forms, superintendence, and all incidentals appertaining to concrete and stone construction, at $5.70	241,628.84
Sand filling in core and glacis	4,326.74
Drainage system	322.92
Doors and interior fittings	3,650.77
Ammunition service	1,770.52
Water supply plant	833.66
Electric plant	4,661.55
	257,196.
Mechanism and power for two lifts	172,360.
Cost of battery without armament	$455,028.23
Armament (estimated)	
2 carriages, 12-inch, Le Creusot pattern	38,000.00
2 breech-loading rifles, 12-inch, Model 1888M	100,000.00
Cost of assembling and mounting	3,958.93
	$141,458.93
Total cost of battery, complete	$596,487.16[36]

2. November 1894 Tests

Pending the mounting of the south carriage and gun, when a speed test could be made, experiments were begun and completed in November 1894 to determine the rate at which the existing power would permit operation of the lifts. As the carriage for the south mount had not been received from the Ordnance Department, the gun was placed on its lift on blocking, together with enough deadweight to represent its carriage.

The program called for starting with the full accumulator head and both lifts down. One lift was sent up and the time noted. The lift was then lowered as soon as the locking bolts had locked, and a

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36. Executive Documents, Ser. 3371, IV, 506.

record kept of the time of ascent and descent. The ammunition hoist and rammer were also operated, and the time of ascent and descent of the ammunition hoist logged, after which the time was noted when the accumulator head was restored ready for a second lift.

The operation was repeated with the other lift, again keeping a record of the time consumed in each stage. Operating the lifts alternately, the test continued. A record was kept of the steam pressure at the beginning and end of each operation, as well as of the amount of water in the boilers during the tests.

The amount of friction on the lift rams varied with the condition of the surfaces of the ram and stuffing box as to lubrication. Records showed that this friction varied from 15 to 30 pounds per square inch of cross section, or from 95 to 189 pounds per square inch of circumference of ram. On the accumulators, the difference in friction was occasionally sufficient to cause both accumulators, differing in weight by 7 tons, to descend together, indicating a difference of 230 pounds per inch of circumference of accumulator ram.

It was found that the rate of ascent and descent of the gun and ammunition lifts depended on the alacrity with which the operators opened the valves, as the lifts were operated by constant water pressure and were not affected by the capacity of the plant. The tests established these times:

Gun-lift:

Time of ascent, 15 to 17 seconds.
Time of descent, 17 to 20 seconds.

Ammunition-lift:

Time of ascent, 7 seconds.
Time of descent, 10 seconds.

Time required for the power to furnish head for single lift, 1 minute 40 seconds.

The two lifts, moving alternately, could be worked at the rate of 2 minutes between lifts.

It was possible to send the gun-lift either up or down in 15 seconds, including time for operation of the locking bolts.

If it were determined to increase the steam capacity of the boilers, this could be done at slight expense by: (a) covering with asbestos all steam pipes and exposed boiler surfaces, to retain the heat; (b) lengthening the grate surface by moving the bridge wall of each furnace back about 1 foot; and (c) supplying a feed-water heater which could heat the feed-water--500 gallons which were now introduced cold--by exhaust steam before entering.[37]

3. South Lift is Armed and Both Guns Speed Tested

On May 17, 1895, the Ordnance Department finally delivered the carriage for the south lift. The gun Model 1888, No. 12, was mounted on June 5, and, two days later, Colonel Gillespie notified Chief Engineer William P. Craighill that the battery was completed.[38]

On August 7 a test for rapidity of fire was made under direction of the Board of Ordnance and Fortification. Five shots were fired from each lift by personnel from the Proving Ground Ordnance Detachment. These shots were fired alternately from the two guns. All time consumed in traversing the guns and in delays not incidental to the carriages or mechanisms was noted. A record was also kept of the time of ascent and descent, and also of the steam pressure and quantity of water in the boilers. The mechanism performed satisfactorily, and the power was ample to meet all demands.

The south lift, being of newer and more efficient construction, proved as expected to be much more efficient. This gun, which fired the second shot of the series, discharged its fifth shot before

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37. Ibid., p. 507; Executive Documents of the House of Representatives for the 2d Session of the 55th Congress, 1897-98 (Washington, 1897), Ser. 3631, p. 619.

38. Executive Documents, Ser. 3371, IV, 507.

the fourth shot from the north lift, although subjected to delays while waiting for the north gun to fire. The average corrected interval between shots, both lifts considered, was 3 minutes, 23.7 seconds, corresponding to a lapse of 6 minutes, 47.4 seconds between shots from a single cannon. The corrected time of firing five shots from the south lift was 17 minutes, 10 seconds, corresponding to an interval of 3 minutes, 26 seconds, between shots from a single gun. The quickest time for the full cycle-loading--ascent, firing, and descent--was 2 minutes, 12 seconds, made on the second round from the south lift. As this lift was of a later pattern, it represented the "adopted construction."[39]

G. Battery as a Key Unit in the New York Harbor Defenses

1. Maintenance of the Battery in Fiscal Years 1897 and 1898

On September 23, 1896, an allotment of $700 was made by the Chief Engineer from the Fortifications Act of June 6, 1896, for preservation and repair of the Sandy Hook works. With this sum and a small balance remaining from the appropriation for construction, the lift battery was maintained until June 3, 1897, when an allotment of $90 was made by the Chief Engineer from the appropriation of the Preservation and Repair Act of March 3, 1897, for maintenance. This money was used to pay the salaries of the civilian engineers needed to fire the boilers and service the lift mechanism.

On December 26, 1896, two privates of artillery had reported for duty to learn the care and operation of the lift battery. They were continued on duty, which enabled Colonel Gillespie to lay off all but one civilian attendant.

Besides being used for annual target practice, the battery provided light for two other works--the mortar battery and the recently completed 10-inch battery (soon to be designated Battery Granger).[40]

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39. Executive Documents, Ser. 3631, pp. 619-20.

40. Ibid., pp. 623-24.

In Fiscal Year 1897 the flagstone pavement of the terreplein was repointed, and the exposed surfaces of the boilers and steam pipes covered with a magnesia block covering 1½ inches thick.[41] During Fiscal Year 1898 a condenser for disposing of exhaust steam was installed and the boiler tubing renewed.[42]

2. Battery is Turned over to the Troops

Troops had been ordered to Fort Hancock, as the Sandy Hook post had been designated, in February 1898. On March 22 of that year, one month before the United States declared war on Spain, Colonel Gillespie transferred the battery to the artillery.[43] Later, in July 1898, three Gatling guns were mounted for defense of the battery's gorge.[44]

3. Maintenance and Repairs in Fiscal Years 1899-1903

In February 1897 Colonel Gillespie was transferred to Boston, and in March Lt. Col. William Ludlow reported for duty as Engineer responsibile for the defenses of Sandy Hook and Governor's Island. Ludlow, a New Yorker, was graduated from the U.S. Military Academy as no. 8 in the Class of 1864. Commissioned a 1st lieutenant in the Corps of Engineers, Ludlow reported for duty as Chief Engineer of the XX Army Corps. He served with that Corps from the battle of Peachtree Creek until the surrender of Gen. Joseph E. Johnston's army at Durham Station, North Carolina. During those months, Ludlow received three brevets for gallantry and meritorious conduct.

Ludlow's first assignment at the close of the Civil War was as commander of the Engineer Depot and Company at Jefferson Barracks,

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41. Ibid.

42. Executive Documents of the House of Representatives for the 3d Session of the 55th Congress, 1898-99 (Washington, 1898), Ser. 3746, IV, 631-32.

43. Ibid.

44. Executive Documents of the House of Representatives for the 1st Session of the 56th Congress, 1899-1900 (Washington, 1899), Ser. 3905, VIII, 778.

Missouri. He was promoted captain in March 1867, and from November 1872 to May 1876 was Chief Engineer of the Department of Dakota. In June 1882 he was promoted major and in August became Engineer Secretary of the Lighthouse Board. From February 1883 to April 1886 Ludlow was on leave, serving as Chief Engineer of the Philadephia Water Department. Ludlow was Engineer Commissioner of the District of Columbia from April 1886 to January 1888. On August 13, 1895, he was promoted lieutenant colonel, while serving as the military attache to the U.S. Embassy in London.[45]

Utilizing a $200 allotment from the "National Defense Act" of March 9, 1898, Colonel Ludlow positioned at Sandy Hook two emergency range-finder piers for portable instruments.[46] In Fiscal Year 1899 alterations were made in the range-finder pillars.[47] With a $5,000 allotment, a crew was turned out in April 1901, taking up the flagstone pavement from the terreplein and replacing it with "a waterproof course."[48]

To combat seepage in Fiscal Year 1902, cracks in the pavement around the carriages were cut out and the joints filled with waterproof cement. This, for the time being, stopped the leakage into the magazines and galleries.[49] At the same time new fire bricks were put in the fire boxes of the gun-lift boilers.[50]

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45. Cullum, Biographical Register, III, 19-20; IV, 144.

46. Executive Documents, Ser. 3746, IV, 631, 635.

47. Executive Documents, Ser. 3905, VIII, 778.

48. Executive Documents of the House of Representatives for the 1st Session of the 57th Congress, 1901-02 (Washington, 1901), Ser. 4279, XII, 768.

49. Executive Documents of the House of Representatives for the 2d Session of the 57th Congress, 1902-03 (Washington, 1902), Ser. 4444, V, 692.

50. Ibid.

4. War Department Names the Battery

On May 25, 1903, the Army finally named the lift battery. As customary, the emplacement was given the name of a deceased Army officer. Henceforth, it would be known as Battery Potter, in honor of Brig. Gen. Joseph H. Potter, who had died at Columbus, Ohio, in April 1892.[51]

Joseph H. Potter of New Hampshire and a classmate of U.S. Grant had graduated from the U.S. Military Academy as no. 23 in the Class of 1843. Commissioned a brevet 2d lieutenant, Potter was assigned to the 1st U.S. Infantry, and posted to Fort Des Moines. Potter transferred to the 7th U.S. Infantry in the autumn of 1845 and served with that unit in the Mexican War. He was severely wounded at Monterrey in September 1846. Brevetted 1st lieutenant for gallantry in that battle, Potter, on returning to duty, was stationed at Jefferson Barracks. Potter spent the next twelve years in various posts on the Arkansas-Indian Territory frontier and in New Mexico and as a member of the Mormon expedition. The outbreak of the Civil War found Potter, now a captain, at Fort McLane, New Mexico.

Captain Potter was captured by Rebel forces at San Augustin Springs, Texas, on July 27, 1861, and was not exchanged until August 1862. Commissioned colonel of the 12th New Hampshire Infantry, Potter led his regiment at Fredericksburg and Chancellorsville. He was captured at the latter battle. After being exchanged he returned to duty, and in 1864-65 commanded a brigade in the XVIII Corps, Army of the James. On May 1, 1865, Potter was promoted brigadier general of Volunteers. Eight months later, he was mustered out of the Volunteer Service.

As a lieutenant colonel of regulars, he was assigned to the 30th U.S. Infantry, which was serving in the Department of the Platte.

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51. General Order 78, War Department, May 28, 1903.

On March 15, 1869, Potter was transferred to the 4th U.S. Infantry. In December 1873 he was promoted to colonel of the 24th U.S. Infantry, one of the Army's two black infantry regiments. He was named a brigadier general on April 1, 1886, and, having passed his 64th birthday, was retired on October 12, 1886.[52]

By this time Maj. William L. Marshall, as Engineer in charge of the defenses guarding the southern and eastern approaches to New York Harbor, was responsible for maintenance and repair of the Fort Hancock defenses. A Kentuckian, Marshall had graduated no. 7 in the Class of 1868 from the U.S. Military Academy. Commissioned a brevet 2d lieutenant in the Corps of Engneers, Marshall joined the Engineer Battalion at Willetts Point. In August 1870 he was ordered to West Point as Assistant Professor of Natural and Experimental Philosophy. He rejoined the Engineer Battalion after one year. His next three assignments found him exploring and mapping the West, posted in northwest Georgia, and attached to the Mississippi River Commission.

On August 30, 1882, Marshall, now a captain, was placed in charge of harbor and river improvements in Michigan, Illinois, and Wisconsin. He was promoted major in 1895 and in January 1900 was placed in charge of the New York Harbor defenses.[53]

In Fiscal Year 1904 Major Marshall ordered from Greenlie, Wyatt & Co. a sign board for the battery. The letters, reading "BATTERY POTTER," were to be cast of heavy bronze.[54]

H. Battery Becomes Obsolete and is Disarmed

1. Appropriations Zoom and Construction Accelerates

By the end of Fiscal Year 1904 the lift mechanism of America's first modern battery was obsolete. In the fourteen years that

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52. Cullum, Biographical Register, II, 179-80.

53. Ibid., III, 119; V, 148.

54. Marshall to Greenlie, Wyatt & Co., undated, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

had passed since Congress had made its first appropriation for construction of the Endicott System of reinforced concrete emplacements, the Ordnance Department had developed a far superior and less costly type of disappearing carriage--the Buffington-Crozier--on which to mount its big seacoast defense guns. Plans for a second lift battery at Sandy Hook, along with those for similar emplacements at other points, were scrapped. They were replaced in the construction program with less expensive batteries mounting their guns on self-depressing disappearing carriages.

On July 6, 1898, eleven weeks after the nation declared war on Spain, Congress appropriated another $2,562,000 for construction of permanent gun and mortar batteries. This followed by eight weeks a $3,000,000 appropriation for the same purpose. These appropriations increased to $19,110,333 the aggregate sum voted by Congress for the Endicott System's gun and mortar emplacements in the eight years since the inauguration of the program.[55]

Existing projects for seacoast defenses then contemplated the emplacement of about 500 heavy guns of 8-, 10-, 12-, and 16-inch caliber, about 700 rapid-fire guns of various calibers, and some 1,000 mortars. These figures were subject to slight changes as minor revisions were made and additional localities added to the system.

The estimated cost of the Engineer work connected with the installation of this armament was $55,000,000. Thus, by the summer of 1898, Congress, discounting the inflation factor, had funded more than one-third of the program's estimated cost.

As of June 30, 1898, the Chief of Ordnance had provided the following types of gun and carriages for the system:

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55. These appropriations were: Act of August 18, 1890, $1,221,000; Act of February 24, 1891, $750,000; Act of July 23, 1892, $500,000; Act of February 18, 1893, $50,000; Act of August 1, 1894, $500,000; Act of March 2, 1895, $500,000; Act of June 6, 1896, $2,400,000; Act of March 3, 1897, $3,826,000; Act of May 7, 1898, $3,000,000; and Act of July 6, 1898, $2,562,000.

Type of gun or carriage	Total Guns & Carriages Provided	Total Emplacements Provided
12-inch mortar carriages, Model 1896	227	228
12-inch mortar carriages, Model 1891	85	84
12-inch disappearing carriages, L. F., Model 1897	22	22
12-inch disappearing carriages, L. F., Model 1896	27	27
10-inch disappearing carriages, A. R. F., Model 1896	3	3
10-inch disappearing carriages, L. F., Model 1896	70	70
10-inch disappearing carriages, L. F., Model 1894	35	35
8-inch disappearing carriages, L. F., Model 1896	35	35
8-inch disappearing carriages, L. F., Model 1894	26	26
12-inch gun-lift carriages, altered to barbette	3	3
12-inch gun-lift carriages, Model 1891, Battery Potter	2	2
12-inch barbette carriages, Model 1892	26	26
10-inch barbette carriages, Model 1893	10	10
15-inch smoothbore carriages, altered for 8-inch rifle	21	21
8-inch barbette carriages, Model 1892	8	9
6-inch barbette disappearing carriages, Model 1897	15	15
15-pounder rapid-fire carriages	80	80
6-pounder rapid-fire field carriages and rampart mount	30	30
6-inch rapid-fire carriages (naval pattern for Brown wire gun)	25	25
6-inch rapid-fire (Vickers Son & Maxim) pedestal mount	8	8
5-inch barbette carriages, on pillar mount, Model 1896	32	32
5-inch rapid-fire (naval pattern, Brown wire gun)	25	25
4.7-inch rapid-fire (Armstrong pattern) pedestal mount	35	35
4-inch Driggs-Schroeder rapid-fire	4	4

56. Executive Documents, Ser. 2756, IV, 9-10.

Provision also had been made for mounting 288 heavy seacoast guns, 254 rapid-fire guns, and 312 mortars, or about 57 percent of the projected total of heavy guns, 36 percent of the rapid-fire guns, and 31 percent of the mortars. This armament was positioned at 71 "localities" in 29 harbors.

The total number of emplacements completed or under construction as of July 1, 1897, had been 24 12-inch, 82 10-inch, 33 8-inch, 16 rapid-fire, and 232 12-inch mortar. Under the Act of May 7, 1898, construction was commenced upon 19 emplacements for 12-inch guns, 2 emplacements for 10-inch rifles, 6 emplacements for 8-inch guns, and emplacements for 80 12-inch mortars. Under the allotments made by President William McKinley from the appropriation for "National Defense" in the Act of March 9, 1898, construction was commenced on emplacements for 31 12-inch guns, 18 10-inch guns, 41 8-inch guns (including 21 8-inch rifles temporarily mounted on 15-inch Rodman carriages), and 46 rapid-fire guns.

When relations with Spain assumed a threatening character, orders were given to accelerate construction and to mount every available gun upon delivery. Operations were carried on with double, and in some cases triple, shifts and were pushed, regardless of weather and climate conditions. The extraordinary efforts made resulted in mounting 6 12-inch, 52 10-inch, 30 8-inch, 26 rapid-fire, and 71 12-inch mortars in Fiscal Year 1898. Twelve months before on June 30, 1897, there had been emplaced 10 12-inch, 18 10-inch, 5 8-inch, and 73 12-inch mortars. On June 30, 1898, the following emplacements were ready for armament: 27 12-inch, 28 10-inch, 7 8-inch, 16 rapid-fire, and 64 12-inch mortar. Under construction were emplacements for 31 12-inch, 4 10-inch, 38 8-inch, 20 rapid-fire, and 104 12-inch mortars.[57]

On March 3, 1899, Congress appropriated another $1,000,000 to fund construction of the Endicott batteries. In addition to

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57. Ibid., pp. 10-11.

the $10,150,923 that had been appropriated, there had been allotted and expended $306,805 from the appropriation for "National Defense" for temporary batteries "of old-type guns and emergency work" during the Spanish-American War.

By June 30, 1899, provision had been made for emplacement of 297 heavy guns, 308 rapid-fire guns, and 344 mortars. This armament was mounted in 77 "localities" in 30 harbors. The total number of emplacements now provided for was 85 12-inch, 118 10-inch, 94 8-inch, 308 rapid-fire, and 344 12-inch mortars. Not included were 70 6-pounder rapid-fire guns on mobile mounts not requiring permanent emplacements, temporary emplacements for 21 8-inch breech-loading rifles on modified 15-inch Rodman carriages, one temporary emplacement for a 10-inch gun on barbette carriage, and five temporary emplacements for 8-inch guns on barbette carriages. These temporary emplacements, including several at Sandy Hook, had been constructed during the Spanish-American War with "National Defense" funds. Their armament would be transferred as permanent emplacements were completed. While it was proposed to disarm these temporary emplacements, they could be used in case of an emergency.[58]

When Chief Engineer John M. Wilson submitted his annual report for 1900, he informed Congress that it was not until 1896 and thereafter that appropriations commensurate with the magnitude of the program were made. Stimulated by the larger appropriations of recent years and the war with Spain, the nation's coastal defenses were by 1900, ten years after the commencement of work, about 50 percent completed. Twenty-five of the principal harbors now had a sufficient number of heavy guns and mortars mounted to provide an effective defense against naval attack. Existing approved projects contemplated the mounting of about 480 8-, 10-, 12-, and 16-inch guns, some 850 rapid-fire guns from 6-pounders to 6-inch caliber, and some 900 mortars at a cost of

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58. Executive Documents, Ser. 3905, pp. 10-13.

approximately $50,000,000 for the engineering work. On May 25, 1900, Congress had appropriated another $2,000,000 for the system.[59]

On March 1, 1901, Congress appropriated $1,615,000 to fund the program in Fiscal Year 1902. For the first time no money was allotted for construction of mortar batteries. While the number of mortars in the earlier projects had been greatly reduced, it was believed by the Chief Engineer that there were a number of points at which batteries should be constructed.

As of June 30, 1901, there were mounted in the Endicott emplacements 72 12-inch, 112 10-inch, 86 8-inch rifles, 88 rapid-fire guns, and 203 12-inch mortars. This was an increase during the fiscal year of 15 12-inch, 7 10-inch, 11 8-inch, 35 rapid-fire, and 23 12-inch mortars.[60]

A series of tests were held in the summer of 1901 at Fort Preble, Maine, in a successful effort to get Congress to reverse itself on funding the construction of additional mortar batteries. The results were satisfactory and "conclusively proved" the usefulness of mortars even against moving warships at ranges between 3,000 and 9,000 yards. Subsequent target practice had shown them "to be accurate and effective up to 11,000 yards, and extreme ranges of 12,000 yards" had been successfully developed.

The mortar, the Chief Engineer reported, "possesses the advantage that it can be directed to hit any point within its limits of range. Intervening high or wooden land does not affect its searching fire if outlying range-finding stations are provided as to permit the water areas to be seen. If an advance gun battery is captured it can be

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59. Executive Documents of the House of Representatives for the 2d Session of the 56th Congress, 1900-01 (Washington, 1900), Ser. 4089, XV, 7-11.

60. Executive Documents, Ser. 4279, pp. 5-11.

instantly made untenable by mortar fire." At most of the harbors all the mortars that were needed had been emplaced, "but at a few localities additional mortar batteries" were essential.

On June 6, 1902, Congress appropriated $2,000,000 for continuation of the program. In Fiscal Year 1902 eight 12-inch, three 8-inch, 24 rapid-fire guns, and 34 mortars had been added to the system.[61]

On March 3, 1903, Congress appropriated $2,236,424 for construction of gun and mortar batteries. During Fiscal Year 1903, 12 12-inch, 3 10-inch, and 4 8-inch heavy guns, 70 rapid-fire guns, and 31 mortars were mounted.[62]

2. Taft Board Makes its Recommendations

The United States, as a result of the war with Spain, became a world power. The support of its growing navy and recently-acquired possessions in the Pacific called for the establishment of fortified bases as coaling and naval repair stations. Chief Engineer George Gillespie, who had been in charge of the Sandy Hook defenses for more than 15 years, reminded Congress in 1903 that the "degree of defense" to be provided for coaling and other naval stations scattered over the world; for the larger naval bases that must be promptly established for which the Secretary of the Navy had already requested large appropriations; for Manila, Pearl Harbor, and Honolulu; and the lake ports and the St. Lawrence, should be determined by a tribunal similar to the Endicott Board.

This tribunal, Gillespie noted, should be constituted by Congress and, like the Endicott Board, should include the Secretary of

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61. Executive Documents, Ser. 4444, pp. 8-12.

62. Executive Documents of the House of Representatives for the 2d Session of the 58th Congress, 1903-04 (Washington, 1903), Ser. 4636, X, 8-12.

War, the Chiefs of Engineers, Ordnance, and Artillery, one ranking officer from each of these branches of the service, two senior naval officers, and two civilian experts on foreign commercial relations. In the absence of legislation on the subject of insular defenses, a mixed board of engineer and artillery officers, organized by authority of the Secretary of War, had already partially considered and reported on plans for emergency defense of several of the most important harbors in the insular possessions. Valuable data had been collected regarding the physical character of the proposed sites, and when money became available, construction could be started. Before preliminary plans were drawn up and implemented, it would be well to invite the cooperation of the Navy. Meanwhile, projects for the defense of San Juan, Puerto Rico; Pearl Harbor and Honolulu Harbor, Hawaiian Islands; Guam; and Manila and Subic Bays, Philippine Islands, had been approved by the Secretary of War, and construction would commence as soon as funds become available.[63]

Acting on Chief Engineer Gillespie's recommendation which had been endorsed by the Secretary of War, President Theodore Roosevelt on January 31, 1905, by executive order constituted a board, headed by Secretary of War William Howard Taft, to prepare and submit for congressional action a "well-studied and comprehensive scheme of coast defense" for the nation's insular possessions. The National Defense Board, or the Taft Board as it was popularly known, was to: (a) indicate the areas where seacoast defenses were most urgently required; (b) determine the character and general extent of the defenses; and (c) estimate their cost. The Taft Board made its final report to Congress on February 1, 1906.

The Board called for coastal defenses at Guantanamo Bay, Cuba; Honolulu and Pearl Harbors, Hawaiian Islands; and Manila and Subic Bays, Philippine Islands. Beginning with the Fortification Act of

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63. Ibid.

April 21, 1904, passed some nine months before the Taft Board was organized, Congress made liberal apprpriations for construction of defenses at these points during the ensuing years.

Taking a hard look at approved projects for defense of continental ports and harbors, the Taft Board found that plans had been approved for 31 localities:

1. Penobscot River, Maine,
2. Kennebec River, Maine,
3. Portland, Maine,
4. Portsmouth, New Hampshire,
5. Boston, Massachusetts,
6. New Bedford, Massachusetts,
7. Narragansett Bay, Rhode Island,
8. Eastern Entrance to Long Island Sound
9. New York, New York,
10. Delaware River,
11. Baltimore, Maryland,
12. Washington, D. C.,
13. Hampton Roads, Virginia,
14. Entrance to Chesapeake Bay at Cape Henry
15. Wilmington, North Carolina,
16. Charleston, South Carolina,
17. Port Royal, South Carolina.
18. Savannah, Georgia,
19. St. Johns River, Florida,
20. Key West, Florida,
21. Tampa Bay, Florida,
22. Pensacola, Florida,
23. Mobile, Alabama,
24. New Orleans, Louisiana,
25. Sabine Pass, Texas,
26. Galveston, Texas,
27. San Diego, California,
28. San Francisco, California,
29. Columbia River, Oregon & Washington,
30. Puget Sound, Washington, and
31. Lake Champlain, New York & Vermont

While recommending that additional fortifications be programmed for some of these points, the Board deleted from the approved projects those installations proposed for the Penobscot and St. Johns Rivers, Sabine Pass, and Lake Champlain.[64]

3. Lift Mechanism Becomes Obsolete

At the end of Fiscal Year 1904, Chief Engineer Gillespie reported to Congress that continued and significant progress on construction and armament of the Endicott System emplacements was

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64. Executive Documents for the House of Representatives for the 1st Session of the 59th Congress 1905-06 (Washington, 1905), Ser. 4946, VI, 6-9; Executive Documents of the House of Representatives for the 3d Session of the 58th Congress, 1904-05 (Washington, 1904), Ser. 4785, VI, 5-10.

underway. During the past twelve months, one 12-inch, four 10-inch, seven rapid-fire guns, and twenty-two 12-inch mortars had been mounted.

The 8-, 10-, and 12-inch guns, Gillespie observed, afforded an effective defense for the harbors, and it was not contemplated to construct many more of these emplacements until an adequate rapid-fire armament had been installed to supplement the heavier guns. All the emplacements permitted a reasonable effective service of their guns, but when the earlier batteries had been built, he admitted, little was known about the rapidity at which modern high-powered guns could be safely fired and less as to the "actual" artillery methods of handling them. With experience, improved methods of construction had been developed, and target practice with smokeless powder, invented after many of the batteries were completed, had shown the desirability of certain additions and modifications.

As rapidly as these needs were identified, they were being met by changes which were incorporated into the plans for all subsequent emplacements. The latest batteries left little to be desired. The majority of the emplacements required only moderate additions to bring them up to "full efficiency;" but a few of the very earliest would require extensive changes and additions. The principal proposed improvements consisted of: (a) widening the loading platforms to avoid accidents to the gunners and confusion in ammunition service, as well as to furnish additional storage rooms for projectiles where they were less exposed to condensation and dampness; (b) providing latrines in the vicinity of the emplacements; and (c) providing additional means of lighting gun platforms, carriages, and sights for night practice. For these improvements, divided among 1,297 emplacements, General Gillespie asked for an appropriation of $942,500.[65]

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65. Executive Documents, Ser. 4785, VI, 5-10.

The lift mechanism of "America's first modern battery" did not lend itself to the modifications called for by Chief Engineer Gillespie. It was hopelessly obsolete.

On May 13, 1904, Colonel Marshall discussed with the Fort Hancock commander, Lt. Col. Peter Leary, a proposal to disarm Battery Potter because of the slow rate of fire with the two 12-inch guns being raised, lowered, and loaded with hydraulic machinery. To operate the battery, fire always had to be kept under one of the boilers, and a steam engineer retained on the Corps' payroll to operate the mechanism. Even with banked fires, about 130 tons of coal were burned annually.

At this time the only man on the post who understood and could operate the machinery was the civilian engineer, whereas the operation of the guns in the Endicott System should be understood by all the artillerists stationed at Fort Hancock. This constituted a serious objection to the lift-battery. While the guns could be loaded and fired more rapidly than a 15-inch Rodman smoothbore, they were not nearly as efficient in this respect as the 10- and 12-inch guns mounted on disappearing carriages.

Battery Potter, however, was the only Fort Hancock emplacement having an unlimited field of fire. Without it, an enemy naval force might occupy Sandy Hook Bay. In addition, the lift mechanisms had only been out of order once, for a period of 15 minutes, in more than eleven years. These two factors were the only ones that Colonel Marshall could advance for its retention.

If it were determined to disarm Battery Potter, Colonel Marshall recommended that an emplacement mounting either two 12- or two 10-inch rifles and two 6-inch rifles, on disappearing carriages, be constructed at Camp Low to cover Sandy Hook Bay. To underscore this need, he warned that penetration of the bay by enemy battleships, covered by a fog, would make Fort Hancock untenable.

The disarmament of Battery Potter would make its emplacement, Colonel Marshall noted, available for the recently authorized primary range and position finding stations. The lower rooms and boilers therein could house the central powerhouse.[66]

I. War Department Adopts and Installs the Horizontal Base System of Fire-Control

1. Groping for a Solution

When construction commenced on the Endicott emplacements, fire control was simple and the guns were sighted directly. By the late 1890s this situation was changing rapidly. To provide for improved fire control and promptly registering on targets, the Secretary of War charged the Corps of Engineers with the mission of constructing instrument stations for range- and position-finders and underground conduits for communications in the approved system of fire control. The deficiency act of July 7, 1898, appropriated $150,000 for installing range- and position-finders. This sum was all but exhausted in Fiscal Year 1899 in providing instrument stations for depression position-finders on high sites, in construction of one experimental tower on a low site, and in installation of an experimental system of underground conduits at one artillery post.

Considerable difficulty was experienced in ascertaining the views of the artillerists respecting desired features of the proposed fire control system. When he filed his annual report for Fiscal Year 1899, Chief Engineer Wilson informed Congress that the question as to the type of range-finder best adapted for employment on level sites had not been resolved. The use of towers for depression instruments at sites such as Sandy Hook presented the Corps with difficult structural problems as well as grave "tactical objections." At the same time, underground conduits, because of terrain factors, could not be provided at all seacoast defenses.

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66. Marshall to Leary, May 31, 1904, and Marshall to Stickney, June 1, 1904 NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock. Col. Amos Stickney was Engineer Officer, Atlantic Division.

If the Engineers implemented the fire-control system called for by the artillery, General Wilson warned, the cost would be more than $1,000,000. So far it had been his policy to limit expenditures for the range-finder system to those features which had been well established and to which all arms of the service were in agreement, "leaving other matters until the artillery shall have formulated definitely and conclusively its views."[67]

In Fiscal Year 1900 operations continued on the installation of range- and position-finders as required by the approved plans for fire-control prepared by the Artillery Board. The Act of May 25, 1900, had appropriated another $150,000 for this purpose. With this sum it was proposed to construct about 25 additional range-finder stations, for which plans and estimates had been ordered before June 30, 1900. With stations previously constructed, there would be about 55 main stations available for use out of a projected total of 177 required for batteries still being manufactured or already completed.

Once again, as he had twelve months before, Chief Engineer Wilson cautioned Congress that many details of the fire-control system had not been resolved. Still plaguing all concerned was the use of depression position-finders upon "artificial elevations on low sites, as contemplated by the present plans of fire-control."[68]

3. Construction of Three Range-Finder Towers

In May 1898 Colonel Ludlow was called to Washington to become Chief Engineer of the Armies in the Field. His replacement as Engineer in charge of the Sandy Hook Defenses was Maj. Henry W. Adams. A native of Massachusetts, Adams was graduated no. 1 in the Class of 1866 from the U.S. Military Academy. Commissioned a 2d lieutenant in the Corps of Engineers, he was assigned to the Engineer

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67. Executive Documents, Ser. 3905, VIII, 13.

68. Executive Documents, Ser. 4089, IV, 10-11.

Company at West Point. From August 1867 until August 1869, Adams was assistant engineer in charge of repair of Forts Jackson and St. Philip, Louisiana. The next five years found him making surveys of rivers and harbors in Mississippi, Louisiana, and Texas.

On June 6, 1874, Adams was assigned to the survey of the Northern Lakes and Mississippi River. From June 1878 to June 1895 he was on duty in Washington, D. C., as Assistant to the Chief Engineer. Adams, who had been promoted major in January 1887, was ordered to New York City in October 1895 where he was placed in charge of a number of projects.[69]

In August 1898 Major Adams, utilizing an allotment from the appropriation for "Gun and Mortar Batteries," began construction of a shelter house for a 60-foot range-finder tower for the lift-battery. By June 30, 1899, it had been completed, except for the galvanized iron sheathing on the shelter house.[70] In Fiscal Year 1900 the instrument room was fitted up, and the key turned over to the Fort Hancock commander.[71]

Construction of two additional 60-foot range-finder towers was authorized by Chief Engineer Wilson on August 8, 1900. The towers were to be of steel on concrete foundations with a frame instrument room covered with galvanized steel. By June 30, 1901, the tower for the seven-gun battery had been completed, while the tower at the mortar battery had been finished except for its instrument room. These steel structures had been built by contract.[72]

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69. Cullum, Biographical Register, III, 163; IV, 157-58.

70. Executive Documents, Ser. 3905, p. 780. The tower was about 200 feet behind the battery.

71. Executive Documents, Ser. 4089, XV, 840.

72. Executive Documets, Ser. 4279, p. 768.

The second instrument room was completed in July. Ladders were placed to the roofs of the range-finders, and the projecting flanges removed. On September 3 they were turned over to the post commander.[73] Shortly thereafter, it became necessary to install larger plates on the concrete pedestals as the original plates were too small for the most up-to-date range-finders.[74]

When he filed his annual report for Fiscal Year 1901, the Chief Engineer noted that during the past twelve months additional range- and position-finders had been constructed. The controversy among the experts on the practicality and efficiency of high towers on low sites had continued. After a number of towers, which were patterned after the experimental lift-battery tower that had been approved by a mixed board of Artillery, Ordnance, and Engineer officers, had been built, objection was made to the size of the observation room. Work on all new towers was now suspended.[75]

In the summer of 1907 the range-finder tower behind Battery Halleck was remodeled and outfitted as a secondary mine defense station.[76] Five years later, in 1912, the three towers were repainted.[77] The towers, having been declared obsolete, were demolished in 1915.[78]

3. Adoption of the Horizontal-Base System of Position-Finding

When Chief Engineer Gillespie submitted his annual report for Fiscal Year 1902, he informed Congress that satisfactory progress had

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73. Marshall to Gillespie, July 24, 1901, and Marshall to Chief Engineer, Sept. 10, 1901, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

74. Executive Documents, Ser. 4444, p. 691.

75. Executive Documents, Ser. 4279, pp. 10-11.

76. Hurlbut to Marshall, Sept. 26, 1907, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

77. Hurlbut to Roessler, June 14, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

78. Roessler to Chief Engineer, March 19, 1915, NA, RG 77, Ltrs. Sent, & Recd., Fort Hancock.

been made in systematizing "the whole matter of fire control." The "Gordian Knot" which had heretofore plagued the project had been cut. Bickering had finally ceased, and harmony prevailed among the four Departments involved--the Engineers, the Coast Artillery, the Ordnance personnel, and the Chief Signal Officer.

It had been agreed that as fire control was a tactical problem, the space required in the observation rooms, the height and degree of protection against projectiles, and the relative order in which the various forts and batteries should be equipped were subjects for the Artillery Corps to determine. The province of the Engineer Department would continue to be construction of the shelters, towers, electric ducts, etc. That of the Signal Corps would be the installation of telephones, telautographs, and other means of electrical communication, as well as the power and lighting currents used in connection with the telautographs being supplied from the engineer plants installed in the batteries. The Chief of Ordnance, by law, would provide the range-finding instruments.

Where the stations were on high ground, there had been no delay in completion of the Engineer work, but where high steel towers were called for, "the condition of the steel market" had been such to prevent rapid progress. In most cases the towers had to be at inaccessible localities, and the cost of each was so small that large firms would not bid for their construction, while smaller companies could not secure the rolled steel shapes from the mills without long delays.

By June 30, 1902, nine fire commanders' and 45 battery commanders' stations had been completed and turned over to the troops; and twelve fire commanders' and 30 battery commanders stations were under construction. An extensive experimental system of position-finding, using long horizontal bases, was being installed at Pensacola.[79]

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79. Executive Documents, Ser. 4444, pp. 11-12.

The Pensacola experiment employing a horizontal-base system of position-finding was a success, and it was adopted by the Coast Artillery. The horizontal-base system of position-finding was based upon the trigonometric solutions of plane triangles. This sytem called for two observing stations, designated the primary (B') and supplementary (B') stations, at the end of an accurately measured base line. Each station would be equipped with a carefully oriented instrument or other device for measuring horizontal angles or directions. In a centrally located station, called a primary station, would be a plotting board, so constructed as to represent to scale the field of fire of the particular battery, with the two base-end stations and the directing point of the battery accurately located thereon. These two stations, the directing point, and the target would form a series of triangles from which the distance and direction to the target from the directing point could be determined trigonometrically or graphically.[80]

In Fiscal Year 1904 boards, including two traveling artillery officers, in association with local artillery commanders and the District Engineer at each fortified harbor on the Atlantic and Gulf coasts, prepared plans for the necessary base-end stations.

Chief Engineer Gillespie estimated the cost to his department of implementing the plans of these boards to be $500,000. Involved would be the construction of fire-control stations and the supply of necessary electric light and power plants.[81]

The Fortifications Act approved March 3, 1905, included $1,000,000 for fire-control to be distributed at the discretion of the Secretary of War among the Engineer and Ordnance departments and Signal Corps. The goal was to insure an early and systematic installation

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80. Advanced Coast Artillery, prepared by the Coast Artillery Journal, Fort Monroe, Va. (Annapolis, 1928), p. 10.

81. Executive Documents, Ser. 4785, VI, 8.

of a horizontal-base system of position-finding. The Engineers were allotted $590,000 of this sum for the construction of permanent fire-control systems for up to six selected harbors as funds would permit.[82] Installation of the new system was commenced in Fiscal Year 1906 at the harbors of New York, Boston, and Portland, Maine.

4. Colonel Marshall Submits a Program

In 1904, at the time he had broached the subject of disarming Battery Potter, Colonel Marshall had mailed to his civilian assistant at Fort Hancock, P. P. Hurlbut, a map of the northern section of Sandy Hook. On it he had marked three sites at which construction of position-finding stations were contemplated. Hurlbut was to have the sites surveyed to determine: (a) their elevations above mean low-water; (b) the layout of the roads near the first; (c) the location of the second in relation to adjacent targets of the Proving Ground; and (d) the position of the shore line in the vicinity of the third with a view to placing stations at the base end and as far as practicable toward the northwest.[83]

Before any decision was reached on this subject, Colonel Marshall was contacted by Chief of Artillery John P. Story, who called for construction of a primary fire commander's station at Fort Hancock. The station was to be used in connection with the three existing battery commanders' stations at Batteries Potter and Reynolds and the three 10-inch emplacements at Battery Halleck.

Colonel Marshall found that a primary fire commander's station, similar to the one recently completed at Fort Totten, would cost $3,000. This type of structure would mount an instrument 40 feet above the plane of mean low-water, high enough to "look over the crest of

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82. Executive Documents, Ser. 4946, p. 9.

83. Marshall to Hurlbut, May 13, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

Battery Halleck." If Battery Potter were disarmed, Marshall estimated that the cost of the subject station, if built on the battery's terreplein, would be reduced to $1,500.[84]

On August 24, 1904, Colonel Marshall submitted cost figures for the structures needed for the Fort Hancock fire control system. If site "A" were selected by the Chief of Artillery as a position-finding station, twelve primary stations (in groups of two, five, and five, for the first, second, and third fire commands) would be needed. In addition, there would be twelve secondary stations at "B" and twelve supplementary stations at "C." These would be grouped in the same manner as the primary stations. Marshall estimated the cost of these structures, which would differ very little from those at Fort Totten, as:

one two-primary-station building	$ 4,800
two five-primary-station buildings	21,600
one two-secondary-station building	2,000
one two-supplementary-station building	2,000
two five-secondary-station buildings	9,000
two five-supplementary-station buildings	9,000
Total	$48,400

If Battery Potter were disarmed, fire command no. 2 would require four position-finding stations of each class instead of five, but the cost of removing the big 12-inch guns and mounts would have to be considered. Assuming that the primary-stations were built on the Battery Potter terreplein, Marshall placed the cost at:

one two-primary-station building	$ 2,400
one four-primary-station building	4,600
one five-primary-station building	5,400
one two-secondary-station building	2,000
one four-secondary-station building	3,800
one five-secondary-station building	4,500

84. Marshall to Mackenzie, Aug. 20, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock. Alexander Mackenzie had replaced General Gillespie as Chief Engineer in January 1904.

one two-supplementary-station building	2,000
one four-supplementary-station building	3,800
one five-supplementary-station building	4,500
Total	$33,000

These figures did not provide for "building cover" for the stations, which would be a large and expensive item, nor for the cost of electrical equipment.[85]

Marshall calculated the expense of removing the 12-inch rifles and their carriages from Battery Potter and placing them on cars at $2,300. When this was added to the estimate it raised the figure to $35,300. This represented a saving to the government of more than $13,000, if Battery Potter were used as a primary fire commander's station.[86]

On October 4 Chief Engineer Alexander Mackenzie allotted $3,000 for the construction of a fire commander's station. As the question of removing the guns from Battery Potter would not be decided until the impending 3d Session of the 58th Congress acted on legislation affecting the coastal fortifications, Colonel Marshall directed Assistant Engineer Hurlbut to construct the station at "A" for drill purposes. This would defer selection of the final location until such time as a decision was made regarding Battery Potter's future.[87]

A week later Marshall mailed to Hurlbut plans for the primary fire commander's and primary stations. A pier was to be built to mount the instrument at an elevation of 40 feet.[88]

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85. Ibid., Aug. 24, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

86. Ibid., Aug. 20, 23, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

87. Marshall to Hurlbut and Marshall to Harris, Oct. 4, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

88. Marshall to Hurlbut, Oct. 10, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

Maj. Henry L. Harris, the Fort Hancock commander, disagreed with the decision to construct the fire commander's station behind Battery Halleck. He questioned the wisdom of building it anywhere except on the superior slope of Battery Potter. While he sought to have Chief of Artillery Story reconsider his order, Colonel Marshall had Assistant Engineer Hurlbut suspend work on the station.[89]

On November 9 Colonel Marshall learned from General Story that a temporary fire commander's station would be built on Battery Potter, and be so sited as not to prevent its guns from bearing on Sandy Hook Bay should a naval attack occur. If the big 12-inch rifles had to open fire, "the station must disappear" from the Fort Hancock fire-control system.

Marshall also questioned whether a station could be maintained at "A," if the guns of Battery Potter and the 12-inch rifles in emplacements Nos. 1 and 2 of Battery Halleck were booming away at an attacking fleet. It seemed essential to him to either employ Battery Potter as a site for range-finder stations or to limit the fields of fire of these four 12-inch rifles in the present fire-control system.[90]

5. Construction of the Primary Stations for Batteries Reynolds and McCook

On February 16, 1905, Colonel Marshall mailed to the department a tracing of the proposed location of a primary fire commander's station on the Battery Potter terreplein. Also depicted were the rear elevations of "several groups of primary stations." To afford the greatest possible protection by the battery's parapet, he planned to have the nine stations present a low silhouette. As indicated, the

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89. Ibid., Oct. 19, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

90. Ibid., Nov. 9, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

differences in levels between floors of observation and plotting rooms was about 2 feet, 5 inches, while the ceilings of these rooms were all on the same level. To provide the two Battery Reynolds stations with 360 degrees coverage, Marshall proposed to mount their instruments 4½ feet higher than those in the other stations.[91] The department replied that if the two stations (for the fire commander and the battery commander of Battery Reynolds) could be housed in one structure at a cost of less than the allotted $3,000, he could proceed.[92]

On March 22 Colonel Marshall informed the Chief Engineer that the difference in elevation between the floors of the plotting and instrument rooms was sufficient to make the space under the latter available as an extension of the plotting room. Consequently, the length of the structure from front to rear was reduced from 32 to 29 feet, and additional windows were provided. Those in the side of the station were of sufficient height above the floor to permit use of the wall space under them for mounting necessary instruments. To enable the department to understand what was proposed, Marshall enclosed a drawing of "Plans and Sections of Primary Stations for Battery Reynolds Located on the Platform of Battery Potter." It was believed that this two-station structure could be built for $3,000, although this sum would not fund the necessary electrical system.[93]

The two-primary-station frame structure was built during the late spring and summer and accepted by the post commander on October 9. It was positioned on the southeast corner of the Battery

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91. Marshall to Mackenzie, Feb. 16, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

92. Abbot to Marshall, Feb. 18, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

93. Marshall to Mackenzie, March 22, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock; "Fort Hancock, n.d., Plans and Sections of Primary Stations for Battery Reynolds Located on the Platform of Battery Potter," NA, RG 77.

Potter terreplein. When the southeast and southwest pits of Battery Reynolds were designated Battery Alexander McCook, the south rooms served Battery Reynolds and the north rooms Battery McCook.[94] Three years later, in August 1908, awnings were positioned to shade the observation windows of the two stations.[95]

6. Battery Potter is Disarmed

On May 10, 1906, Colonel Marshall again reviewed the situation at Sandy Hook. Several boards had made studies and had selected stations that were subsequently found to be impracticable because of the Proving Ground. Marshall had never understood why the Proving Ground had been allowed to remain at Sandy Hook, "where it seriously interferes with and controls the location of works of defense."

In view of the limitations imposed on the defenses by the Proving Ground, Marshall agreed with the Fort Hancock commander that Battery Potter was the best site for primary range- and position-finding stations. His reasons were: (a) the stations could not be advanced or withdrawn to a safe site without interfering either with the fields of fire of guns, "located in positions determined not by the requirement of the defense but by the existence of the Proving Ground," or be directly obstructed by the Ordnance facility; (b) the guns of Battery Potter, even when fired with service charges, damaged Proving Ground buildings, particularly the "Brick House"; (c) if the stations were positioned to the west (rear) of Battery Potter, numerous Proving Ground structures would obstruct the seaward view; and (d) if sited far enough forward to escape the effects of the concussion from the big guns, the stations would encroach upon the Proving Ground's beach range and thus be thrust within the field of fire of the coast defense guns.

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94. Ibid., Oct. 13, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

95. Chief Engineer to Roessler, Aug. 31, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Colonel Marshall recommended that, if it were impossible to relocate the Proving Ground, Battery Potter be disarmed and its two 12-inch rifles and their carriages delivered to the Ordnance Department. The battery would then be assigned as a site for the primary range- and position-finding stations for Fort Hancock. The three 8-inch rifles in Battery Duane at Fort Wadsworth would be dismounted and transferred to Sandy Hook for emplacement at Camp Low.[96]

In mid-July 1906 the Board of Ordnance and Fortifications sanctioned the proposal to disarm Battery Potter and transfer the three 8-inch Battery Duane rifles to Sandy Hook for mounting in the new emplacements, authorized for construction at Camp Low. On July 29 Colonel Marshall notified Assistant Engineer Hurlbut that Battery Potter would be used for range- and position-finding stations. It would be rewired in conjunction with the construction of these stations. Inasmuch as Battery Potter was not presently in use and there was great pressure on the electricians to complete projects connected with the batteries (installation of electric hoists, searchlights, generating plants, etc.), Hurlbut would give this work low priority. Because of these priorities, it was mid-August 1906 before the two 12-inch rifles and their carriages were dismounted and turned over to the commanding officer of the Sandy Hook Proving Ground.[97]

7. Construction of Necessary Structures

a. Marshall Submits a Program

On June 5, 1905, Colonel Marshall had submitted an estimate of funds needed to complete all fire-control installations, provided that the primary stations were on the Battery Potter terreplein. The items in the estimate included:

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96. Marshall to Mackenzie, May 10, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

97. Marshall to Hurlbut, July 29, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock; Ltr., Lander Radford to Tom Hoffman, Aug. 6, 1978, files, Sandy Hook Unit, Gateway NRA. Mr. Radford, who was stationed at Fort Hancock, recalled that he was assigned to the detail that dismounted the guns, and never worked as hard in his life.

Seven additional primaries at $2,000 each	$14,000.00
Nine secondaries at $1,800 each	16,200.00
Five supplementary stations at $1,800 each	9,000.00
Three dormitories, latrines, etc.	7,500.00
Two switchboard rooms	4,000.00
One 52-cell, type F9 accumulator for lighting secondary stations	2,400.00
One switchboard	650.00
Water supply and lighting	6,000.00
One hundred and five thousand duct feet conduit, laid at 10 cents per duct foot	10,500.00
One hundred manholes at $45 each	4,500.00
Labor pulling cables, etc.	5,000.00
One tide observation station	600.00
One meteorological station	500.00
One battle commander's station	500.00
Earth cover for secondary and supplementary stations	6,000.00
Cutting out concrete, installing signal service boxes, etc.	1,100.00
Total cost	$88,454.00

If the proposal to locate the primaries on Battery Potter was approved the estimated cost would be increased to $14,500 for the construction of stations and $6,500 for cover, making the estimate $109,450.[98]

b. Construction of the Two Switchboard Rooms

Nine months later, in mid-March 1907, Colonel Marshall advised the post commander that the two switchboard rooms should be sited on or near Battery Potter. The plan for the smaller called for two rooms--one 4½ by 15 feet and the other 15 by 19 feet, while the plan for the larger called for rooms that would be 15 by 19 feet and 19 by 23½ feet. The small room in the former and the large room in the latter were for storage batteries. Nearby a dormitory would be erected for accommodation of personnel assigned to the primary stations.[99]

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98. Marshall to Mackenzie, June 5, 1905, NA, RG 77, Press Copies, Ltrs. Sent, New York Defenses.

99. Marshall to C.O., Fort Hancock, March 14, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

On June 13 Colonel Marshall notified the department that plans for the reinforced concrete switchboard rooms, types A and C, were being finalized. He planned to locate these structures in a protected area behind the right flank of the Battery Potter gorge.[100]

On October 8 Marshall contacted Assistant Engineer Hurlbut. With the $4,000 allotted by Chief Engineer Mackenzie, Hurlbut was to begin construction of the two switchboard rooms.[101]

The work on the rooms dragged. A year passed before Hurlbut reported that the two structures were completed. On October 25, 1907, Colonel Marshall spent the day at Sandy Hook, and the switchboard rooms were inspected and transferred to the Coast Artillery.[102]

c. Construction of Seven Primary Stations

On June 13, 1906, Colonel Marshall informed the department that he planned to construct seven concrete primary stations on the terreplein of Battery Potter. These stations, which would present low profiles, could be built of "steel-concrete almost as cheaply as of timber, and with advantages as to permanence and fire-resistance." In programming the work, Marshall proposed to complete the new 8-inch battery (William Arrowsmith) at Camp Low before dismounting the Battery Potter guns. This would defer construction of the primary stations until the second half of Fiscal Year 1907.[103]

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100. Marshall to Mackenzie, June 13, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

101. Marshall to Hurlbut, Oct. 8, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

102. Hurlbut to Marshall, Oct. 14, 1907, and Marshall to Chief Engineer, Oct. 23, 1907, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

103. Marshall to Mackenzie, June 13, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

That autumn Colonel Marshall submitted for approval by Chief Engineer Mackenzie, "Plans for Primary Fire Control Stations," to be built on the terreplein of Battery Potter with the $14,000 allotted on August 15, 1905. In explanation, Marshall pointed out that there was no way to give the stations for Batteries Richardson, Granger, and Gunnison "a complete view" of the front swept by their right flank guns without relocating the stations recently erected for Batteries Reynolds and McCook. The fire commander's station suffered from similar limitations. Accordingly, it was proposed to erect one two-station building and one five-station building, the latter to have its left flank constructed en echelon. The walls were to be reinforced concrete, with the roofs supported by timber rafters. Before beginning construction, Marshall would have the gun pits from which the 12-inch rifles and their carriages had been removed covered with a slab of reinforced concrete, leaving space for a stairway up through the north gun pit.[104]

Assistant Engineer Hurlbut turned a crew to begin on the construction work in the spring of 1907. Although plans had been approved, a number of change orders were written and sanctioned. Hoods were placed over the stairway between the primary fire-control stations.[105] A proposal to position mosquito screens on the windows and doors of the stations was vetoed by the Chief of Artillery.[106] Plans and details for the slot awnings were provided in late August.[107]

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104. Ibid., Nov. 16, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock; "Fort Hancock, N.J., Plans for Primary Fire Control Stations, drawn under direction of Lieut. Col. W. L. Marshall, Corps of Engineers, U.S.A., November 1906," NA, RG 77.

105. Marshall to Chief Engineer, April 22, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

106. Ibid., July 2, 1907, and Hurlbut to Marshall June 26, July 5, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

107. Marshall to Hurlbut, and Hurlbut to Marshall, Aug. 23, 28, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

By November 16 Colonel Marshall was able to advise Chief Engineer Mackenzie that Hurlbut and his workmen had completed the seven primary fire-control stations and one secondary station on the Battery Potter terreplein. These vital elements of the Fort Hancock fire-control system were transferred to the Coast Artillery on December 12, 1907.[108]

d. Construction of Nine Secondary and Three Supplementary Stations

On November 24, 1905, Colonel Marshall wrote Assistant Engineer Hurlbut that nine secondary stations were to be built. These would be housed in three structures, containing two, three, and four stations. The intervals between piers under one roof had been established at 12 feet, 6½ inches, and between adjacent piers of two buildings 40 feet, center to center.[109] Hurlbut was to stake out the sites and make surveys to connect the pier locations with established triangulation points, so they could be accurately plotted on harbor charts.[110]

In mid-November 1905 Colonel Marshall notified Assistant Engineer Hurlbut that he was to construct three supplementary fire-control stations. They were to be housed in one structure. Hurlbut was to identify the site at his earliest convenience, make measurements from established points, and forward to Marshall data locating the instrument piers to permit accurate plotting of the sites on a harbor chart. A line through the three instrument piers was to pass through

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108. Marshall to Chief Engineer, Nov. 16, Dec. 26, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

109. Marshall to Hurlbut, Nov. 24, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

110. Ibid., Nov. 4, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

Battery Potter. Chief Engineer Mackenzie had allotted $7,500 for this project.[111]

The plans and the necessary allotments were approved and construction commenced in the spring of 1907. The nine secondary stations were sited about 1,500 yards southwest of Battery Gunnison, and the three supplementary stations were located midway between the new mining casemate and the northwest point of Sandy Hook. By early August, Assistant Engineer Hurlbut reported that nine secondary and three supplementary stations had been completed. On August 20 they were given a final inspection and transferred by Colonel Marshall to the Fort Hancock garrison.[112]

Because of beach erosion at the point of the Hook authority was requested in August 1912 to relocate the three supplementary stations some 260 yards farther east.[113] The project was approved and funds allotted for its accomplishment in Fiscal Year 1915. The new stations were completed, inspected, and turned over to the post commander in June 1915. Each of the stations was equipped with an azimuth instrument, Model 1910, with a circular seat. The old stations were demolished in the summer of 1915.[114]

e. Maintenance of the Primary Stations: 1910-1913

On March 4, 1910, Assistant Engineer Hurlbut reported that the roofs of the primary stations needed repairs.[115] Before

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111. Marshall to Mackenzie, Nov. 15, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

112. Hurlbut to Marshall, Aug. 7, 1907, and Marshall to Chief Engineer, Aug. 16, 1907, NA, RG 77, Ltrs. Sent, & Recd., Fort Hancock.

113. Roessler to Chief Engineer, Aug. 27, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

114. Ibid., March 19, June 11, and July 9, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

115. Hurlbut to Roessler, March 4, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

the end of the month, the window frames and sash bars of the primary stations for Batteries McCook and Reynolds had been broken and the weatherboarding loosened by the discharge of the 12-inch rifles in nearby Battery Bloomfield.[116]

Some seventeen months later, on October 5, 1912, Hurlbut called Colonel Roessler's attention to the "bad condition" of the doors and sills of the fire-control buildings. Such conditions had resulted from air pressure caused by shock waves from the guns and the failure to keep them painted. He suggested that the badly rusted parts be removed, after which the remaining sections would be brushed and painted.[117] Colonel Roessler suggested that in repainting the woodwork and steel doors they mix one pound of lampblack with ten gallons of oil.[118]

f. Camp Low Fire-Control Stations

On March 9, 1906, Colonel Marshall sent for approval to the department tracings that provided details for a range-finder shelter to be erected near Camp Low. It would serve as a combined primary fire commander's and primary station for the 8-inch battery (William Arrowsmith) under construction there and as a supplementary station for Batteries Reynolds and McCook. These functions were distinct, appertaining as they did to separate fire commands.

The primary station was to have an observing room of usual size and a plotting room enlarged by inclusion of space behind the observing room of the secondary station. The secondary station would include a 12- by 14-foot observing room, with available space reduced 3

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116. Ibid., March 23, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

117. Ibid., Oct. 5, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

118. Roessler to Hurlbut, April 8, 1913, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

feet by a stairway. The first floor would be divided proportionately between the two stations.[119]

In January 1907 Colonel Marshall forwarded to the department for approval plans and sections for the secondary position-finding and fire commander's stations to be constructed to complement Battery Alexander, along with those for the secondary position-finding station for the Camp Low battery.[120]

The primary, secondary, and supplementary stations for the Camp Low battery were completed and transferred to the Coast Artillery in April 1908.[121] Because of the isolation factor, a latrine was built in the vicinity of the Camp Low primary station.[122]

g. Construction of the Mine Defense Primary Station

On February 6, 1906, Colonel Marshall mailed to the department tracings of plans and details for a primary station for submarine mine defense. The plan allowed mounting instruments at 40 feet above the plane of mean low-water. The observation slot would afford the required instrument depression. There would be an interior stairway.[123]

This station, positioned near the left flank of Battery Alexander, was built in the spring and summer of 1907. On August 20 it

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119. Marshall to Mackenzie, March 9, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

120. Marshall to Chief Engineer, Jan. 6, 1907, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

121. Ibid., March 19, 1908, and Hurlbut to Roessler, April 9, 17, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

122. Hurlbut to Marshall, Oct. 15, 1907, and Chief Engineer to Marshall, Oct. 16, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

123. Marshall to Mackenzie, Feb. 5, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

was given its final inspection and transferred by Marshall to the post commander.[124]

In March 1908 changes in the slotways of the mine command station were called for. To finance this project, the Chief Engineer allotted $600.[125]

h. Construction of the Tide and Meteorological Stations

In August and September 1907 a tide station was erected at the head of the Engineer wharf. On October 10 Colonel Marshall transferred it to the post commander.[126]

The meterological station, sited between the mortar battery and the Sandy Hook Lighthouse, was completed and turned over to the troops on March 1, 1908.[127]

Construction of Two Dormitories

On August 13, 1908, the Chief Engineer allotted an additional $3,000 to fund construction of two dormitories, one for officers and the other for enlistment men assigned to man the nine Battery Potter primary stations and two switchboard rooms.[128] On January 4, 1909, the department approved a request to provide the dormitories with window

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124. Chief Engineer to Marshall, Aug. 7, 15, 1907, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

125. Hurlbut to Roessler, March 20, 1908, and Chief Engineer to Roessler, May 15, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

126. Marshall to Chief Engineer, Nov. 1, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

127. Hurlbut to Marshall, Feb. 27, 1908, and Marshall to Chief Engineer, March 1, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

128. Roessler to Chief Engineer, Aug. 10, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

screens.[129] The dormitories were completed in mid-February 1909 and soon thereafter turned over to the troops.[130]

j. Marshall Lists the Room Dimensions

In May 1906 Colonel Marshall listed the dimensions of the rooms in the position-finding stations:

Station	Observing Room	Third Floor	Second Floor	First Floor	Remarks
B"-Reynolds	12' x 16'		16' x 24.5'	16' x 24.5'	Two-station Bldg.
B"-McCook	12' x 16'				
B"-Gunnison	12' x 16'		16' x 37'		Three-sta. Bldg.
B"-Granger	12' x 16'				
B"-Richardson	12' x 16'				
B"-Bloomfield	12' x 16'				
B"-Halleck	12' x 16'			16' x 49.5'	Four-sta. Bldg.
F"-No. 2	12' x 16'				
B"-Alexander	12' x 16'				
F'"-No. 1	12' x 16'				
F'"-No. 2	15' x 16'	16' x 27.5'	16' x 40'	16' x 40'	Three-sta. Bldg.
B'"-Alexander	12' x 16'				
M'	14' x 16'	Plotting room 15' x 16', with extension 14' x 16'; first floor room 15' x 16', with extension 7½ x 14'; and room 8' x 11'.			
F'-No. 3 (8-inch)	14' x 16'		Plotting room 15' x 16', with extension 11½' x 12½'; first floor room 15' x 16', with extension 14' x 16'.		
B'" for mortars	12' x 14'	Two first floor rooms, 10½' x 12'; and 11½' x 12'.			

The last two stations listed are in one building.

Available floor spaces are less than those given, where encroached upon by stairways and instrument piers.[131]

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129. Hurlbut to Roessler, Jan. 4, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

130. Ibid., Feb. 10, 24, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

131. Marshall to Mackenzie, undated, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock. In the nomenclature of the Coast Artillery and Engineers, the secondary stations were designated B", the fire commander's stations F' and F", the primary station for mine defense M', and the supplementary station B'".

J. Maintenance and Improvements to the Battery: 1909-1914

1. Condemnation and Removal of the Lift Mechanism

When Battery Potter was disarmed in the summer of 1906, the lift machinery consisted of: two scotch marine boilers, 90-horsepower, each 9- by 9-foot, with breeching; two heavy duty Worthington pressure pumps, 20 by 4-3/4 by 15 inches; one Smith & Vail boiler feed pump; one hot air Ryder engine, one-eighth horsepower; one 8-kilowatt Thompson-Houston dynamo and 10-horsepower lease engine; two hydraulic lifts, with cages, each weighing about 125 tons; two accumulators, estimated weight 375 tons; two loading rammers with platforms and fixtures; one 200-horsepower Wheeler high pressure condenser, with circulating pump attached, and hot well; one 1,500-gallon capacity iron cylinder tank; one 250-gallon semi-cylindrical boiler feed tank; and two 1½-inch Metropolitan injectors.[132]

In December 1908 Assistant Engineer Hurlbut had the engine and rod dynamo inspected. They were found to be in bad condition. The inspector recommended that they be broken down and cleaned. The scotch marine boilers also needed cleaning and oiling.[133]

Lt. Col. Solomon W. Roessler, who had been on duty as Engineer officer responsible for the defenses guarding the Eastern and Southern entrances to New York Harbor since July 20, 1908, determined to bring this situation to the department's attention. Roessler, a native of Illinois, was a veteran of many years' service in the Corps of Engineers. He had graduated no. 3 in the Class of 1877 from the U.S. Military Academy. Commissioned a 2d lieutenant in the Corps of Engineers, Roessler reported for duty with the Engineer Battalion at Willetts Point, New York. In December 1879 Lieutenant Roessler was

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132. Inventory prepared by Hurlbut, Jan. 23, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

133. Hurlbut to Roessler, Dec. 8, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

attached to the Board of Engineers, collecting data on low-water navigation of the Mississippi and Missouri Rivers. From August 1880 until August 1883 he was posted at West Point as Assistant Professor of Civil and Military Engineering. After service as assistant engineer at several posts, Roessler on April 6, 1885, rejoined the Engineer Battalion at Willetts Point. Roessler, now a captain, was in charge of river and harbor improvements on the Mississippi River between Cairo and the mouth of White River from June 1890 to January 1895. He served his third tour of duty at Willetts Point from November 1895 to October 1898, when he was placed in charge of the defenses of Portsmouth, New Hampshire, and river and harbor works from Portsmouth to Portland, Maine. After being promoted major in 1898, Roessler was ordered in 1905 to the Pacific Northwest, where he was in charge of the fortifications at the mouth of the Columbia River. There he remaned until ordered to New York City to replace Colonel Marshall, who on July 8, 1908, had been promoted brigadier general and named Chief Engineer.[134]

The lift battery machinery, according to Colonel Roessler, was neither on his returns nor those of the artillery. From what he had seen he did not know of "any use to which this property could be advantageously applied in this district." It was all old, some of it obsolete, and the "condition of all of it doubtful." He desired authority to take the subject property up on his returns, preparatory to submitting it to an inspector as a preliminary step to its condemnation and sale.[135] On December 30 Chief Engineer Marshall approved Roessler's proposal.[136]

No difficulty was experienced in having the machinery surveyed as obsolete. A contract for its removal was awarded to Marine

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134. Cullum, Biographical Register, III, 271-72; IV, 276; V, 252-53.

135. Roessler to Chief Engineer, Dec. 26, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

136. Barden to Roessler, Dec. 30, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Metal & Supply. The salvage people ran into difficulty. On October 30, 1909, they complained to Colonel Roessler that it was impossible to remove the remainder of the gun-lift. After dismantling the upper plates, they found that the heavy bottom plates, cylinders, and piston rods, besides being rusted together, were imbeded in concrete. The only way they could separate these massive parts was with dynamite. If Colonel Roessler would give permission to employ explosives, they would hire a demolition expert licensed by the New York Bureau of Combustibles.[137]

Before making a decision, Colonel Roessler contacted post commander Harris. If Harris had no objection, Roessler would permit the salvage firm to employ dynamite under Hurlbut's supervision. At the same time, he trusted that Harris would post a man in the primary fire control stations for the first two or three shots to see if there was any disarrangement of instruments. If any was observed the dynamiting would be stopped.[138]

After Chief Engineer Marshall approved the use of dynamite, Colonel Roessler wrote Marine Metal & Supply. But, he warned, if Hurlbut observed any damage being done to the emplacement by the explosives, they would be compelled to stop using dynamite.[139]

There were no further problems. By mid-December, Marine Metal had removed all the condemned machinery, except the pistons. These, too, were gone by the end of the year.

Although the heavy machinery had been broken up, Marine Metal failed to remove all the iron. On June 2, 1910, Colonel Roessler

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137. Elfenbien to Roessler, Oct. 30, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. S. E. Elfenbien was an employee of Marine Metal & Supply.

138. Roessler to Harris, Nov. 2, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

139. Roessler to Marine Metal & Supply, Nov. 17, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

called on the company to remove it immediately, as it was in the way of the troops.[140]

Marine Metal informed the military that during the last week of May they had removed by hand all the scrap metal that they could. Two flat cars had been kept standing by on the track waiting for use of the Ordnance Department's locomotive crane. It was mid-June before the Ordnance personnel released the crane, and the salvage company loaded the heavy pieces of scrap iron, some of which weighed more than a ton.[141]

2. Rehabilitating and Rewiring the Electrical System

On May 9, 1910, the Post Ordnance Officer complained that the Battery Potter rooms were unsafe. They were currently used for the storage of powder and ordnance supplies, and, as the stone flooring had been removed, it was dangerous to enter when no lights were available. In addition, its interior was damp, musty, and unsightly, and water stood in puddles. These rooms were unfit for the men assigned to make up cartridges; yet it was the only place available.[142]

When no action was taken by the Engineer Department to correct the situation, Col. John White, the post commander, called on Colonel Roessler in mid-January 1911 to have the lighting system in Battery Potter placed in serviceable condition. There was an air of urgency caused by news that several siege guns and ammunition were en route to Sandy Hook and would be stored in the battery, along with small arms, fuses, and saluting charges. When he had inspected the battery,

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140. Roessler to McArdle, June 2, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Stephen McArdle was an employee of Marine Metal & Supply.

141. McArdle to Roessler, June 2, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

142. Ordnance Officer, Ft. Hancock, to Post Adj., May 9, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

White had observed that many of the cables were badly grounded and that a number had been cut, "leaving only the good parts in circuit."[143]

After checking the system, Hurlbut found that 76 lights had been in position, but most of them had been removed. To reduce the cost of a new system, the number of lighting outlets was reduced to 44, although they would "hardly illuminate the various rooms and galleries sufficiently for one to see where he is walking." Plug boxes and hand lamps could be employed for close-up work, such as reading numbers, markings on ammunition cases, etc.[144]

Assistant Engineer Hurlbut accordingly prepared estimates for modernizing the Battery Potter lighting system. Needed were:

44 marine electric lighting fixtures to replace the old brass lamp fixtures, at $4.50 each	$154.00
2 hand lamps with 30 feet of flexible cable, each	40.00
10 plug boxes for hand lamps	25.00
800 feet type 1 cable	96.00
500 cable hangers	60.00
500 lead plugs for cable hangers	25.00
Gasoline, tape, rubber, solder, etc.	15.00
One 6-circuit panel box	30.00
Electrician for two months	220.00
Laborer, 75 days' work	168.75
Total cost	$833.75

If the four lights in the second-floor rooms at the left were added to this circuit, it would save 100 feet of cable. The new panel box was to be installed in the long gallery, because the large

143. White to Roessler, Jan. 13, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

144. Kennedy to Roessler, Feb. 15, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Freeman Kennedy was an electrical engineer.

wheels of the siege train might damage it if it were located elsewhere on the ground level.[145]

The estimate for lighting the battery was pared in accordance with Colonel Roessler's suggestion to $500. To do so, Colonel White agreed to permit the Engineers to utilize lead cable on hand at the post. Hand lamps would be employed in the magazines instead of reserve lanterns.[146]

On August 19, 1911, Colonel Roessler, having received the necessary allotment, directed Hurlbut to proceed with the project. He would be guided by his plan, dated March 1911, and a set of blueprints illustrating standard fixtures.[147]

The project was completed before winter. There were problems with the new wiring in the summer of 1912. With the coming of hot weather, the old Rosendale concrete reeked with "condensation." Moisture seeped through the leather gaskets in the plug boxes causing shorts. To rectify this situation, Hurlbut replaced the leather gaskets with ones made of rubber and dried out the fixtures with a blow torch.[148]

3. Maintenance and Construction of Stairways

In January 1911 Assistant Engineer Hurlbut observed that the iron stairways between the battery's first and second floors were in poor condition and needed to be scraped and painted. If this were not

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145. Hurlbut to Roessler, Feb. 4, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

146. White to Roessler, July 31, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

147. Roessler to Hurlbut, Aug. 19, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

148. Hurlbut to Roessler, July 10, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

attended to in the near future, they would rust out. In addition, the exterior ironwork around the doors and windows of the primary stations required attention. The troops, however, repainted only the interior portions of the station.[149]

It was determined that the remaining maintenance projects could be accomplished by the artillery, as soon as the weather permitted. The Corps of Engineers would provide the necessary metal paint and replace a broken iron manhole cover for a cable conduit at the head of the stairs.[150]

Three years later, in January 1914, Lt. Col. Samuel E. Allen of the Coast Artillery inquired into the possibility of having exterior stairways constructed at Battery Potter to afford direct access to the primary fire-control stations on the terreplein and to permit the interior galleries to be used for storage of ordnance and ordnance stores. At this time, he observed, there was need at the fort for additional storage facilities for target materials currently exposed to the elements: towlines, buoys, anchors, siege gun platforms, spare parts for coast defense guns, rammers, stores, sponges, oil tanks, blocks, explosive "D" loading outfits, powder crates, empty powder cases, etc.[151]

District Engineer Roessler cautioned Colonel Allen that the stairways would be expensive. He inquired if a stairway at the gorge with its foot next to the powerhouse would be sufficient? Colonel Allen did not believe it would.[152] Allen argued that a second stairway at the

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149. Ibid., Jan. 11, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

150. Roessler to C.O., Southern Artillery District, Jan. 27, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

151. Allen to District Engineer, Jan. 14, 1914, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

152. Roessler to Allen, April 2, 1914 NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

southeast corner was "deemed sufficiently advantageous" to justify the cost.[153]

Colonel Roessler successfully maintained his position.[154] On May 25 he asked Colonel Allen to designate the point at which he wished a single stairway built. Allen called for its construction near the battery's southeast angle.[155]

The iron stairway (47 feet long with 47 steps) was constructed of 12-inch steel channel strings and cast iron treads, 4 feet wide, with a 1¼-inch pipe handrail on each side. It had concrete footings 4 feet by 6 feet and 3 feet deep.[156]

K. Battery in the 1930s and 1940s

By the late 1930s Batteries McCook and Reynolds had been disarmed and Batteries Alexander, Granger, and Halleck had been relegated to reserve status. Other changes to the fire-control system had been dictated by an increasing sophistication in the system and the construction and assignment to key roles of Batteries Kingman and Mills at Fort Hancock and Battery Harris at Fort Tilden. This had resulted in altering the activities housed in the structures on the Battery Potter terreplein. Two of the structures had been converted into signal and meterological stations.

Two of the structures sheltered the primary stations for Batteries Peck and Gunnison. The former, positioned at a height of 56.73 feet, was equipped with a depressing range finder and an azimuth

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153. Allen to Roessler, April 29, 1914, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

154. Roessler to Allen, May 25, 1914, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

155. Allen to Roessler, June 25, 1914, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

156. G.W.K. to E.D.A., May 5, 1914, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

instrument. The Battery Gunnison station was 52.13 feet above mean low-water and was equipped with similar instruments.

The primary stations for Batteries Richardson and Bloomfield, formerly on the Battery Potter terreplein, had been relocated to the steel tower in the 52d Coast Artillery Gun Park, 300 yards to the southeast.[157]

During World War II there were more changes. By late summer of 1943 the primary stations for Batteries Peck and Gunnison had been phased out and the signal station relocated. The meteorological station, however, continued to occupy the two-station structure on the north. An advanced Harbor Entrance Control Post (HECP) was now housed in the frame structures built in 1905 as primary stations for Batteries McCook and Reynolds. The Group Command Post and Observation Post for Group Four occupied the center structures which had been built in 1907 to shelter five primary stations.[158]

L. Recommendations

Battery Potter was the first Endicott System emplacement completed and armed. It thus ushered in an era, lasting more than half a century, during which the United States relied on massive reinforced concrete emplacements mounting high-powered rifled guns and mortars and minefields covered by rapid-fire batteries to guard its principal harbors and naval bases. It was during these years that the United States became a world power.

As the "first" Endicott emplacement, Battery Potter, like the Second and Third System forts, had a "defensible entrance." To guard the sally port and gorge against an attack from the rear by an enemy landing force, there were caponieres mounting Gatling guns and a chemin

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157. "Annexes to Harbor Defense Project: Harbor Defenses at Sandy Hook, March 1938," NA, RG 407.

158. "Supplement to Harbor Defense Project: Harbor Defenses of New York, August 1943," NA, RG 407.

de ronde. These features, which were costly anachronisms, were quickly eliminated from other Endicott projects. The battery's plans had been approved and the construction commenced before the Ordnance Department developed and successfully tested its depressing carriage. Its two 12-inch rifles were therefore mounted on gun-lifts. Besides being expensive, the lift mechanisms lacked the efficiency and ease of handling of the depressing carriages. Consequently, the mechanisms were declared obsolete, and Battery Potter disarmed in 1906.

Even before the battery was disarmed, primary fire-control stations for Batteries McCook and Reynolds had been built on the southeast extremity of the Battery Potter terreplein. In 1907 seven additional primary stations for various Fort Hancock batteries were constructed on the terreplein. The interior galleries and magazines of the emplacement were employed for storage. In the 1920s and 30s all of these primary stations, except two, were either phased out or transferred, as other uses were found for these structures.

Because of its importance in the evolution of the Endicott System, Battery Potter merits inclusion on the List of Classified Structures as a structure possessing the First Order of Significance. It should be stabilized and restored to its appearance, circa 1915. The restoration will not include reconstruction of the primary stations for Batteries McCook and Reynolds. At least one of the extant primary stations (the one serving Battery Gunnison) should be refurnished to interpret the fire-control system.

VI. BATTERIES REYNOLDS AND McCOOK: A STRUCTURAL HISTORY

A. United States Builds and Arms its First Modern Mortar Battery

1. Battery is Located and Ground Broken

Chief Engineer Casey allotted $201,000 from the appropriation of August 18, 1890, for construction of a 16-gun mortar battery with ditch defense. The plans and specifications to be followed were those approved by the Board of Engineers and dated September 20, 1888.

Colonel Gillespie and his capable assistant, 1st Lt. Harry Taylor, had previously staked out the site designated by the Board of Engineers, adjacent to and southeast of the Sandy Hook Lighthouse. Under orders from the Chief Engineer, dated August 6 and September 13, 1890, construction was commenced in November. The work, like that at the lift-gun battery, was done by hired labor with the materials purchased under contract.

By June 30, 1891, 30,000 cubic yards of sand had been removed, completing the excavation of the four gun pits, galleries, and magazines. No masonry had been positioned, but everything was in readiness for it. The "plant" was set up and prepared "for the rapid and economical manufacture and deposit of concrete." During Fiscal Year 1891 Colonel Gillespie had expended $16,406.05 on the project.[1]

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1. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1891, NA, RG 77, Ltrs. Recd., Chief Engineer; "Plan and Sections of a Half Sunk Mortar Battery near Sandy Hook Light, Sandy Hook, New Jersey, New York Harbor, prepared under the direction of Lieut. Col. G. L. Gillespie, Corps of Engineers, U.S.A. . . . October 1890," NA, RG 77. Northeast of the site of the battery was the old post cemetery, established during the Civil War. Headstones identified graves of four Civil War soldiers (John Moore, Bernard Dunn, Michael Wymbo, and P. E. Scott); Pvt. Peter Wolf, Ordnance Detachment, died Sept. 16, 1891; Nellie S. Alevin, an infant, died Aug. 12, 1897; William E. L. De LaMotte, died March 20, 1889; Thomas Kent died aboard ship and was buried at Sandy Hook, May 2, 1828; and Capt. James Swain and three other sailors shipwrecked and drowned, Jan. 23, 1808.

2. Construction in Fiscal Year 1892

a. Mortar Battery Plant

The plant was positioned several hundred feet northeast of the lighthouse and was similar in concept to the one at the lift-gun battery. Stone, cement, and metal parts were brought to the site by cars operating over a narrow gauge railroad, which connected with the track leading to the lift battery at a Y southwest of the "Brick House." As it approached the site, the railway divided into parallel spurs. Positioned on the south side of the righthand spur was a frame cement shed. This spur ended at a bumper a few feet beyond the shed's south elevation. Adjacent to the cement shed's south elevation was the plant's water tank.

Between the two spurs was the stone bin with a tunnel beneath and parallel to its east elevation. Cars arriving from the wharf dumped broken stone into the bin. Tracks were positioned in the tunnel for gondola cars into which the crushed stone was discharged through overhead hoppers. The cars then moved down the track to where they received their charges of cement and sand and up an incline to a position above the mixer into which the charge was released. Water was led into the mixer from the tank through a pipe. On the ground level below the mixer was a track which separated into spurs entering the construction site by way of the future bombproof galleries giving access to the gun pits. Another spur connected the rail system with the sand pits and converged at the stone bin with the tracks over which dump cars hauled broken stone from the wharf. These tracks continued into the construction site, where they merged into the rails entering the battery via the northeast gallery.[2]

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2. "Mortar Battery at Sandy Hook, N.J., Plan showing general arrangement of working plant in use . . ."; Map of Sandy Hook, N.J., Tracing made from survey map of Jany. 30, 1892, showing location of Gun Lift Battery and Mortar Battery and Track connecting them for hauling material," NA, RG 77.

b. Battery Takes Shape

On July 13, 1891, Lieutenant Taylor directed the laborers to commence mixing and pouring concrete. They began on the retaining walls of the northeast pit. Upon completion of these walls, they constructed the retaining walls of the northwest part and a portion of those of the north entrance. In September, when Lt. J. G. Warren reported for duty, the labor force was transferred to the south one-half of the battery, where it was continued until December 23 when the plant operations were stopped because of cold weather and most of the men laid off. During the winter a small force was employed excavating and filling in the embankment around the mortar pits in the southern end of the battery.

On April 11, 1892, the work force was reinforced and the concrete plant operations restarted. By June 30 the concrete masonry of the battery had been completed, except for the floors of the magazines and galleries, the sloping surfaces for restricting blast damage, the retaining walls, and the counterscarp wall and galleries.[3] During the year 13,028 cubic yards of concrete had been poured. As the total cubic yards of masonry in the completed battery would be 23,886.30 cubic yards, 55 percent of the masonry work had been completed. The ditch line had been cleared of undergrowth and stumps and graded, and was ready for the workmen to begin the counterscarp foundations.[4]

c. Allotting the Costs

Rosendale cement for the project had been purchased from the Lawrence Cement Co. for $1.02 per barrel under the contract of

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3. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1892, NA, RG 77, Ltrs. Recd., Chief Engineer; "Progress Sheet: Half Sunk Mortar Battery, near Sandy Hook Light, Sandy Hook, N.J., . . . to accompany annual report" for Fiscal Year 1892, NA, RG 77.

4. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1892, NA, RG 77, Ltrs. Recd., Chief Engineer.

December 29, 1890, extended to August 1, 1892, and broken granite had been acquired from John A. Bouker for $1.63 per cubic yard under the contract of December 29, 1890, extended to November 1, 1892. Under these contracts, 18,626 barrels of cement and 11,983 cubic yards of broken granite had been delivered up to June 30, 1892.[5]

On reviewing his books, Colonel Gillespie found that the cost of materials charged to the project in Fiscal Year 1892 were:

	Cement, per bbl.	Broken stone per cb. yd.	Sand per cb. yd.
On scows or canal boats alongside of dock	$1.02	$1.63	---
Unloading into cars	.0227	.1211	---
Hauling to yard or shed	.0032	.0193	---
Storing in yard or shed	.0161	.0273	---
Hauling sand	---	---	$0.1181
Cost of material delivered at works	$1.0620	$1.7977	$0.1181

He placed the cost of "manufacture of one cubic yard of concrete" (1 part cement, 2 parts sand, and 5 parts broken stone) at:

	Material	Manufacture	Total Cost
Broken stone, 0.92 cubic yard	$1.6539	---	---
Cement, 1.43 barrels	1.5187	---	---
Sand, 0.37 cubic yard	0.0437	---	---
Charging and running mixer	---	$0.29310	---
Delivering under derrick	---	.08315	---
Hoisting	---	.11224	---
Placing and tamping	---	.22838	---
Making and setting up forms	---	.12286	---
Lumber and nails	---	.06532	---
Cost per cubic yard	$3.2163	$0.90505	$4.12135

Note.--One charge of the mixer was equal to 1.05 cubic yards of masonry in place, machine mixed and deposited by derrick.

Colonel Gillespie placed the total cost of the masonry, including superintendence, purchase and maintenance of plant, repairs to buildings, and general work at:

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5. Ibid.

Concrete masonry; 13,025 cubic yards, at $4.12135	$53,680.58
Excavation	814.92
For purchase and maintenance of plant; 13,025 cubic yards, at $0.59597	7,111.26
For work of plasterers finishing walls of magazines and gun pits	166.53
For repairs to buildings	1,605.74
For maintenance of public animals	287.92
For superintendence and office expenses	2,496.95
Total cost	$68,748.15

Masonry constructed during the year cub. yds.	13,025
Total cost of masonry constructed	$68,748.15
Cost per one cubic yard	$5.27816

The cost per cubic yard of masonry, including the expense of sand cover for the embankment, clearing, and ditch grading was:

Total cost of masonry constructed	$68,748.15
Cost of excavating, hauling, hoisting, and placing 9,449 cubic yards sand, at $0.22686	2,144.64
For labor of clearing ditch of undergrowth and stumps for grading	584.03
Total cost	$72,476.82
Total cost per one cubic yard of masonry	$5.48766

The cost for one cubic yard of concrete masonry, including all the work done since the starting of construction in the last fiscal year was:

Masonry and sand embankment, constructed cub. yds.	13,025
Total cost of same	$102,407.87
Cost per one cubic yard	$7.8624

The average daily number of employees in each category for the year was:

Overseers	1.5	Blacksmiths	.5
Locomotive engineer	.17	Plasterers	.17
Engineers	1.5	Painters	.475
Firemen	1.25	Carpenters	4.5
Master Laborers	2.6	Bricklayers	.0006
Watchmen	.08	Laborers, daily	40.3
Laborers, monthly	.33	Riggers	.17

Colonel Gillespie placed the average plant in use daily for the year at:

Hoisting engines	1.75	Flat cars	4.75
Stationary engines	.83	Derricks	2
Concrete mixers	.75	Horses	2.4[6]
Dump cars	4.4		

d. Colonel Gillespie Secures a Change Order

During a period of unusually high flood tides in October 1891, Colonel Gillespie and his assistant, Lieutenant Warren, observed that the water in the sand underlying the mortar battery reached a level higher than that assumed when plans were formulated and approved. Accordingly, Colonel Gillespie secured authority for a change order to raise the footings of the foundations two feet. This was done at a "trifling additional cost" and added to the security of the foundations, while simplifying the drainage of the battery and construction of the mortar platforms.[7]

3. Construction in Fiscal Year 1893

a. Chief Engineer Casey Provides More Funds

In Fiscal Year 1893 Chief Engineer Casey made further allotments. On February 24 he allotted $33,000 from the appropriation for Gun and Mortar Batteries, enacted July 23, 1892, for application to the completion of the battery. Then on March 10 he made available $20,000 from the appropriation Act of February 18, 1893, "for gun and mortar batteries," for the construction of eight mortar platforms.[8]

b. Colonel Gillespie Pushes the Project

Work was suspended on the masonry for five months, from December 1, 1892, to May 1, 1893, because of cold weather on the

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6. Ibid.

7. Ibid.

8. Executive Documents, Ser. 3199, III, 600. Data for his entire section is based on pp. 600-06 of this source.

Hook. During the seven-month construction season, the counterscarp wall (2,200 feet in length) and galleries in the opposite angles for the Gatling guns for defense of the ditch were completed, with the exception of about 140 feet of the wall where openings were left for construction purposes. The floors in the magazines and main galleries were laid to within four inches of their finished level, and the concrete protection for the interior slope of the four mortar pits was nearly finished. During Fiscal Year 1893, 13,827 yards of masonry had been added to the battery at an average cost of $5.60 per cubic yard.

A large force beginning on September 12, 1892, had been continuously employed filling sand in the embankments covering the magazines and galleries and surrounding the mortar pits. By the end of the fiscal year, 118,478 cubic yards had been excavated, hauled, and deposited, thus coming within 5,000 cubic yards of completing the sand cover inside the ditch.

According to the plans, Colonel Gillespie informed Chief Engineer Casey, there was supposed to be 125,184 cubic yards of sandfill within the ditch. With the 118,478 cubic yards positioned in Fiscal Year 1893 added to the 9,449 cubic yards placed the previous year, there were now 127,927 cubic yards of sandfilling. The excess of 2,743 cubic yards was not the result of error, but was easily accounted for. The sand at the site was dry and with the frequent strong winds was blown into drifts. Sand from the battery's superior and "end" upper exterior slopes was driven into the ditch and onto the lee slopes. This would be checked, he reported, as soon as the sod, which was to cover the upper and windward slopes, was laid. The surplus sand would be employed in fillings in "the covering of the sand exterior to and resting against the counterscarp wall."

During the year experiments indicated to Colonel Gillespie that the "long slopes adjoining the ditch can be successfully and economically protected from wind and weather by planting thereon a kind of heath" growing on Sandy Hook. The heath was found in situations quite exposed, both to sun and wind, as were the slopes of the battery.

The excavation, transportation, and deposit of sand in the embankment was carried on by two methods. In the first, sand was shoveled by hand into cars with removable boxes, having a capacity of about one cubic yard. These cars were then run under derricks, by means of which the car boxes were raised and dumped as desired. The other system called for loading rotary dump cars of three cubic yards capacity by steampowered grapples, then for hauling the car up an incline by steam and hand dumping it.

To illustrate the difference in cost between excavating and loading sand by grapple and by hand, Colonel Gillespie prepared a table:

41,096 cubic yards of sand excavated by grapple and loaded at $0.06851 per cubic yard	$ 4,185.69
Hauling and placing same in embankment at $0.0691 per cubic yard	4,216.23
37,382 cubic yards of sand excavated and loaded by hand at $0.08522 per cubic yard	4,890.09
Hauling and placing same in embankment at $0.7827 per cubic yard	4,491.29
Total	$17,783.30
Total cubic yards placed in embankment	118,078
Cost of excavating, loading, hauling, and placing same in embankment per cubic yard	$0.150094

The difference in cost, 1.67 cents per cubic yard, would have been greater had the facilities for transportation been such as to enable the grapple buckets to work at full capacity. One grapple could excavate and load about 500 cubic yards of sand in eight hours, but, because of the lack of a proper power plant for transportation purposes, the maximum output per grapple at Sandy Hook had not exceeded 350 cubic yards for an 8-hour shift. During the year sand for the embankment was obtained from three barrow pits.

c. Colonel Gillespie Reports and Explains the Increased Unit Cost

In Fiscal Year 1893 the cost of a cubic yard of concrete was $4.23815, whereas in Fiscal Year 1892 it had been $4.12135. This was an increase of 11 cents per cubic yard. Cost of materials during the period had dropped 20 cents per cubic yard. Colonel Gillespie attributed this dichotomy to the type of work accomplished.

In Fiscal Year 1892 the cost of materials and manufacture of one cubic yard of concrete had been:

Cost of Materials

	Cement per barrel	Broken stone per cubic yard	Sand, per cubic yard
On scows or canal boats alongside wharf	$1.02	$1.63	
Unloading into cars	.0227	.1211	
Hauling to yard or shed	.0032	.0193	
Storing in yard or shed	.0161	.0273	
Hauling sand	---	---	$0.1181
Cost of materials delivered at works	$1.0620	$1.7977	$0.1181

Composition, 1 part cement, 2 parts sand, and 5 parts broken stone. Note.--One charge of the mixer was equal to 1.05 cubic yards of masonry, machine mixed and deposited by derrick.

Material

Broken stone,	0.92 cubic yard	$1.6539	
Cement,	1.43 barrels	1.5187	
Sand,	0.37 cubic yard	.0437	
			$3.2168

Manufacture and Deposit

Charging and running mixer	$0.29310
Delivery under derrick	.08215
Hoisting	.11224

Placing and tamping	.22838	
Making and setting up forms	.12286	
Lumber and nails	.06532	
		$ .90505
Cost per cubic yard		$4.12135

For the purposes of comparison, the cost of materials and manufacture of one cubic yard of concrete in Fiscal Year 1893 was:

Cost of Materials

	Cement per barrel	Broken stone per cubic yard	Sand, per cubic yard
On scows or canal boats alongside wharf	$0.96137	$1.38601	
Unloading into cars	.02579	.14679	
Hauling to yard or shed	.00677	.03809	
Storing in yard or shed	.01666	.08596	
Hauling sand	---	---	$0.13043
Cost of materials delivered at works	$1.01059	$1.65685	$0.13043

Composition: 1 part cement, 2 parts sand, and 5 parts broken stone.

Material

Broken stone,	0.92 cubic yards	$1.52430	
Cement,	1.43 barrels	1.44514	
Sand,	0.37 cubic yards	.04826	
			$3.01370

Manufacture and Deposit

Charging and running mixer	$0.35171	
Delivery under derrick	.04952	
Hoisting	.17597	
Placing and tamping	.31734	
Making and putting up forms	.22374	
Lumber and nails	.05217	
		1.22045
Total cost per 1 cubic yard		$4.23415

It was necessary on occasion to double the mixing plant, though in so doing the output was not doubled. For about three months, two concrete mixers were in use, but in the absence of adequate transporation, "the full manufacturing capacity of which each was capable was never attained." Colonel Gillespie ascribed this problem to the increased cost of "charging and running mixers."

The next three items (delivering under derrick, hoisting, and placing and tamping) had also shown an increase in unit price. This, Colonel Gillespie wrote, resulted from the nature of the construction: the material being placed largely in the counterscarp wall, which was more than 2,200 feet in length and 15 feet in height, with a thickness of 7 feet at the bottom and 3 feet at the top. The concrete accordingly had to be "distributed over a long line, increasing the haul and necessitating the frequent shifting of derricks, and deposited in [a] restricted area, which involved shoveling the concrete from the boxes."

The increase in the cost of "making and setting up forms" resulted from a greater "quantity of this class of work relative to the number of cubic yards of concrete" poured. The average thickness of the counterscarp wall was 5 feet and that of the other walls 9 feet. Therefore, the "forms corresponding to 1 yard of masonry of the counterscarp wall exceeded in cost those for 1 cubic yard of wall, having a greater thickness by about four-fifths."

d. Contracting for Materials

As of June 30, 1892, two contracts for materials had been in force. The first was with the Lawrence Cement Co., dated December 29, 1890, for delivey of 30,000 barrels of cement at $1.02 per barrel. This contract had been completed on July 25, 1892. John A. Bouker held the other contract for supplying 21,000 cubic yards of broken granite at $1.63 per cubic yard. He fulfilled his contract on July 29, 1892.

Colonel Gillespie, having called for sealed bids for the delivery of 25,000 barrels of "Old Newark" Rosendale cement and 20,000

cubic yards of broken stone on July 29, 1892, opened and abstracted the proposals. Upon doing so, he found that the lowest responsible bidder was Calvin Tompkins of New York City. Tompkins' price for the cement was $0.939 per barrel and for the stone $1.28 3/4 per cubic yard. By June 30, 1893, Tompkins had delivered 12,102 cubic yards of broken stone and 23,410 barrels of cement, of which 10,000 cubic yards of stone and 19,773 barrels of cement had been used in the masonry of the battery.

On April 12, 1893, Colonel Gillespie opened and abstracted the sealed proposals received for providing materials for construction of mortar platforms. Waldo & Stout of Bridgeport, Connecticut, were awarded a contract for furnishing bolts and nuts for eight mortar platforms.[9] Case & Sherwood of New York City were given the contract for "eight sets of eight stones each, or 1,063 cubic feet of granite rings (which form the upper surface of the mortar platforms and the seat of the base ring for the mortar carriage)" at $319 per set. The contractors were bonded to make delivery on or before July 15, 1893.

e. Changes and Innovations

In Fiscal Year 1893 a suitable drainage system for the battery was devised, the material for which was purchased at a cost of $355.14. By June 30 all the pipe, except for 400 feet, was positioned. The drainage was discharged into the swamp about 500 feet southwest of the battery.

Lieutenant Warren introduced an innovation in the mode of constructing the counterscarp wall and galleries to obtain a smooth surface and "one which is apparently weatherproof." Colonel Gillespie's plan had been to build all the concrete masonry in forms of undressed spruce lumber, and upon removal of the forms to plaster the

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9. Waldo & Stout would supply 192 aluminum bronze bolts, 192 phosphor-bronze washers, 192 steel nuts, and 128 wrought-iron anchor bolts with hexagonal nuts.

exposed face with cement. This coat of plaster could not be made to adhere to the older masonry, which rapidly absorbed its moisture and weakened the bond between the two. The bond was rapidly destroyed by the first cold weather, and the plaster cracked and dropped off, "much to the injury of the appearance of the work." In addition, there was no economy in the use of spruce lumber, which warped when subjected to the moisture of the concrete and could not be reused.

Lieutenant Warren substituted forms of first quality dressed white pine, grooved on both edges and united by loose tongues of yellow pine. He then constructed the concrete as follows:

> that portion of the masonry next to the form, 4 inches thick, was poured in without stone, the proportion of sand and concrete remaining one part cement to two parts sand, thus securing a perfect bond between the face and the back of the wall. The forms were removed while the "work was comparatively fresh," and the face rubbed with a float to give it a smooth surface.

Colonel Gillespie found that, although the winter of 1892-93 was unusually severe, there were no cracks or scaling of the counterscarp wall and galleries constructed in accordance with Lieutenant Warren's formula.

4. Construction in Fiscal Year 1894

a. Despite Difficulties the Platforms are Built

When ground was broken, the Ordnance Department had not yet perfected a carriage for its 12-inch breech-loading mortar. No plans therefore existed for the requisite platforms.

The spring-return carriage was adopted by the Ordnance personnel early in 1892. Plans for the platforms were developed by the Board of Engineers and approved by Chief Engineer Casey on March 10, 1893. The plan contemplated formation of circular wells of concrete, 4 feet, 11 inches interior radius, and 12 inches deep, faced with granite blocks having an extreme rise of 15 inches. The thickness of the concrete forming the bottom of the well was to be 3 feet, 10½ inches, at the center, and 4 feet on the periphery.

Colonel Gillespie was confronted by a vexing problem while implementing the plan at Sandy Hook. Water penetrated the surrounding sand under ordinary circumstances to a height of 2 feet above mean low water, and the lower surface of the concrete was projected to be laid at 2 feet, 3½ inches above mean low water. Consequently, economical excavation of the enclosed sand without injury to the already-constructed breast-height walls of the pits at 5 feet above mean low water became a serious problem.

Excavation for these foundations commenced in July 1893. To fund the operation, Gllespie employed the $20,000 previously allotted for construction of eight platforms. Workmen used well-points to drain the sand in the vicinity of the excavation, and construction was confined to one pit at a time.

At 8 A.M. on August 10, the water was found to be low enough to permit excavation, and the digging began and was carried on as rapidly as the lowering of the water would admit. Concrete was placed as fast as excavation permitted, the pump being employed continuously until 2:00 P.M. on August 11, when the concrete was at elevation 4.2.

The drainage of the pit in this fashion left the sand water-free but damp enough to stand vertically under the wall of the pit, thus permitting the concrete to be positioned against it without forms. Wooden forms were employed for the concrete platforms, except when it came under the footing of the wall. No precaution was taken to preserve the well-points that came within the concrete, but they were subsequently withdrawn, only two being lost in the operation.[10]

At the time of the excavation for the southeast pit on October 9, the level of the soil water had risen to 4.8 feet. In addition,

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10. Executive Documents, Ser. 3269, pp. 450-52.

a bed of course gravel, about 3 feet thick, underlying the foundations allowed the water "to flow in the sod more rapidly." One pump was insufficient. A second pump was added, connected to six additional well-points distributed over the center of the area to be drained. Even with this additional power, headway was slow against the water, and the pumps were kept running from 3 P.M., October 9, until 1 P.M., October 11, before J. H. Casey deemed it safe to stop the small pump. The large pump continued to operate until noon on October 12.[11]

The bolts, 24 in all, that held the roller path to the platform were to extend through the concrete foundation and be held at the bottom by washers. As the setting of these bolts was an operation requiring great accuracy, it was thought best not to attempt it while the foundations were positioned. These bolts were installed as follows: at the bottom of the excavation, about where the head of each bolt would come, was placed a small layer of concrete about two feet in diameter and six inches thick. This was rammed in place, and an empty cement barrel inverted over it. The foundation was then carried up around these barrels, leaving holes eighteen inches in diameter which allowed a large latitude in setting bolts. The upper head, being left in the barrel, kept the hole clear during the work and until the time came for setting the bolts. The concrete at the bottom of the hole kept the sand from flowing in when pumping was stopped and also served as a support for the head of the bolt when it was set.

To set the bolts a skeleton frame, or template, swinging on a fixed position was employed to hold the bolts in position after the center had been accurately located and one bolt set at the proper distance from it. The barrels were broken up and removed preparatory to setting the bolts. Since the holes were full of water, the concrete in which the bolts were to be set was lowered into place in bags, where it was deposited and tamped. The sections of the template

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11. Ibid., p. 452.

were moved progressively around the circle as the bolts were set. The bolt in the center was set in a temporary mound of concrete, which was afterwards broken up and removed.

The platforms were completed except for the floor foundations, pavement, and setting of the index rings in the southeast and southwest pits. An additional $5,000 was requested by Colonel Gillespie to finish these foundations. On December 19, 1893, Chief Engineer Casey made available $2,000 for this work.[12]

b. Positioning the 16 Carriages and Mounting 12 Mortars

Four spring-return carriages for 12-inch mortars had been received and transferred by the Ordnance Department to the Corps of Engineers on June 18, 1893. They were to be mounted on four of the eight platforms programed to be constructed. It was proposed to emplace them upon the platforms of the northeast mortar pit, the masonry of which had been constructed longer than that of the other pits. Moreover, its inner slopes could be "most conveniently completed first."[13]

The base ring and carriage race, carrying the upper and lower roller paths, were of such dimensions (more than 13 feet) that it was necessary to deliver them into place over the battery's main parapet. To accomplish this, the construction track was carried along an inclined trestle over the counterscarp, across the ditch, and onto the main parapet. The carriage, positioned on a flat car, was brought to this incline, hauled to the top by a cable from a 20-horsepower hoisting engine on the parapet, and lowered by means of a similar incline into the pit. Smaller parts of the carriage (the cheeks, transom, etc.), as well as the mortar, were taken through the main entrance directly into the pit and handled by a derrick. The mortar was mounted on its carriage by a pair of shears made of two pieces of timber--12 inches by 12 inches by 44 feet.

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12. Ibid., pp. 452-53.

13. Executive Documents, Ser. 3199, III, 606.

On April 13, 1894, a 4-inch rope, being used to lower the carriages into the southwest pit, snapped, dropping and breaking the base ring of carriage no. 5 and causing considerable damage to the platform. The carriage had slid down the incline, striking the granite rings of the two rear platforms, dislodging a number of stones, and bending several of the bronze "holding down bolts." One stone was so damaged as to be useless, and a replacement was cut from a granite block from the old masonry fort. Three of the bronze bolts had to be taken out and sent to the foundry to be reforged. The base ring of the carriage could not be repaired, and, as it was not interchangeable, a new carriage, no. 26, was issued by the Ordnance Department.

By June 30, 1894, the carriages had been positioned and assembled. The northeast and northwest pits were completed, and the eight mortars mounted, ready for service. In the southeast pit the carriages were assembled, and the mortars mounted. Although the pit floor had not been laid or the index rings set, these four mortars, in event of war, could be fired. The southwest pit's four carriages were in place, and the heavier parts assembled. The mortars had been received from the Ordnance Department, and one had been mounted. All the earthen slopes had been seeded in grass.[14]

c. Test Firing One of the Battery's Mortars

On June 22, 1894, the first firing took place, having for its object the proof of gun, carriage, and platform and the effect of the blasts upon breast-height walls and interior slopes. The mortar employed was the southeast gun in the northeast pit.[15] Five rounds were fired, with the mortar elevated at 45 degrees, and the direction of fire south 60 degrees east. No damage was done to the platforms, breast-height wall, and interior slopes by the firing.[16]

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14. Executive Documents, Ser. 3269, pp. 8-9, 453-54.

15. Ibid., p. 454.

16. Ibid.

Thus, the Sandy Hook mortar battery has the distinction of being the first Endicott emplacement of this category to be completed and have its armament fired.[17]

5. Battery Completed in Fiscal Year 1895

a. Proofing and Test Firing the Mortars

By autumn of 1894 the last of the 16 mortars had been emplaced, the southeast and southwest platforms finished, and the gap purposely left in the counterscarp wall closed. The proof firing of each mortar was completed on November 25. In testing these weapons "valuable light" had been shed upon the "probable accuracy of fire when served in volleys from separate pits."

Col. Henry L. Abbot of the Engineer Corps subjected these firings to the usual tests of precision, "independent of errors of pointing." Firing was done from the southeast, northwest, and northeast pits, usually to the seaward. Points of impact were fixed by triangulation from a base line about five miles distant. Before each volley a single shot was fired, usually from the southeast pit, with a setting corresponding to that of the volley to enable the observers to calibrate their instruments. Jets of water thrown up by the shells were of sufficient height to accurately fix the point of impact.[18]

The final battery firing was on April 11, 1895, when two volleys were fired at horizontal targets on land with the intention of retrieving the shells, which had been marked for identification. The first volley was sent screaming at a target 6,000 yards down range, propelled by 60 pounds of brown prismatic powder, with the mortars at an elevation of 60 degrees. The second volley zeroed in on a target 3,000 yards away, with each piece charged with 29 pounds of hexagonal powder and the elevation unchanged. In both tests the projectiles employed were the service 800-pound shell.

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17. Ltr., Erwin Thompson to Bearss, Jan. 8, 1976.

18. Executive Documents, Ser. 3371, IV, 519-20.

The mortars in each volley were fired electrically in groups of four, at two-second intervals, the operator having taken station in the firing recess of the north end of the longitudinal gallery. The electrical connection was made through a switchboard. A single igniter, the Laflin & Rand No. 4, was employed for firing the entire battery.[19]

b. Colonel Gillespie Files His Completion Report

On May 7, 1895, Colonel Gillespie submitted a completion report for the mortary battery, the first Endicott emplacement of this type to be finished, armed, and tested. His breakdown of expenditures revealed:

Purchase and erection of plant for construction	$ 15,923.36
Construction of battery proper	228,498.54
Platforms for 16 carriages	25,330.74
Total cost, without armament	$269,752.67
Assembling 12 carriages, and mounting mortars thereon	3,600.00
Balance on hand, May 1, 1895	699.33
Total	$274,052.00
Cost of Armament	
Sixteen spring-return carriages	$144,000.00
Sixteen cast-iron steel-hooped mortars	120,000.00
	$264,000.00[20]

Accompanying this report were four sheets of "General Drawings" of "Mortar Battery No. 1, Sandy Hook, N.d." The drawings were titled, "Sheet No. 1 Plan of Battery"; "Sheet No. 2 Horizontal Section at Reference (10.25)"; "Sheet No. 3 Vertical Sections";

19. Ibid., p. 505.

20. Ibid., pp. 8, 506.

and "Sheet No. 4 Counterscarp Gallery, Main Entrance & Mortar Platform."

B. Structural History of the Battery: 1895-1901

1. Lighting the Battery with Electricity

On March 15, 1895, Colonel Gillespie submitted to the department plans for lighting the interior of the battery by electricity and for an overhead hoist and trolley along the longitudinal gallery to facilitate the service of ammunition. Chief Engineer Casey approved the plans and allotted $952 for their implementation.

The installation of the lights was completed in time for the April 11 firing. They consisted of 12 incandescent lights of 24 candle-power, located along the longitudinal gallery, and 6 lights of 24 candle-power in the interior rooms. The lights were powered by an accumulator charge from the gun-lift battery dynamo, 2,000 feet to the north. The accumulator consisted of 43 chloride cells, with a capacity of 100-ampere hours at the normal discharge rate of 10 amperes and an electrometer force of 80 volts.[21]

The accumulator was charged at the gun-lift battery and hauled to the mortar battery whenever lights were required. When and if it were determined to install the accumulator permanently, Colonel Gillespie proposed to connect the battery in two branches of 21 cells each, giving a voltage of 40 with a normal discharge rate of 20 amperes. This would allow for the necessary fall of potential in the leads of the chargings.[22]

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21. Executive Documents, Ser. 3371, IV, 505. The lamp used was of 80 volts with a high efficiency. Colonel Gillespie placed the cost of the project at $474.53.

22. Ibid., p. 506.

In Fiscal Year 1898 the electrical wiring was removed from the wooden conduits and placed in iron pipes.[23]

Six years later, in Fiscal Year 1901, new electric lighting equipment was installed. The equipment included a 52-cell accumulator in one of the bombproofs, with armored distribution wires and moisture-proof fixtures.[24]

2. Installation of an Overhead Hoist and Trolley System

In November 1895 the overhead trolley tramrail and hoists were positioned.[25] They consisted of an iron rail three inches by one-half inch, carried along the haunch of the arch of the longitudinal gallery by iron hangers spaced five feet apart. The hangers were fastened to the masonry by three iron expansion bolts, seven inches by five-eighths-inch. Upon the rail were carried two different hoists, each having a capacity of 1,000 pounds. The rail was in two sections, which extended above the floor space allotted to the stacking of projectiles and intersected the transverse galleries at either end.[26]

3. Maintenance of the Battery in Fiscal Year 1896

In Fiscal Year 1896 the battery's doors were repaired and the slopes resodded where they had eroded.[27]

4. Battery is Turned over to the Artillery

In March 1898, one month before the United States declared war on Spain, Colonel Ludlow inspected and turned the battery over to the artillery.[28]

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23. Executive Documents, Ser. 3746, IV, 631-32.

24. Executive Documents, Ser. 4279, p. 768.

25. Executive Documents, Ser. 3631, p. 618.

26. Executive Documents, Ser. 3749, p. 480.

27. Ibid.

28. Executive Documents, Ser. 3746, IV, 631-32.

5. Mortar Carriages Get the New Pattern Index Ring

In Fiscal Year 1898 personnel from the Sandy Hook Ordnance Detachment dismantled eight of the platforms and provided them with new pattern index rings. By June 30 the rings had been tested and the pits were being "graded up."[29]

The paving under the newly-installed index rings was completed in August 1898. Under an allotment made by the Chief of Engineers on December 8, 1898, the other eight mortar platforms were dismantled and the concrete excavated for the new index rings. The rings were received and installed by the Ordnance Detachment in the summer of 1899.[30]

6. Maintenance of the Battery in Fiscal Year 1898

Maintenance projects undertaken in Fiscal Year 1898 included painting the doors and ironwork and landscaping earthen slopes.[31]

7. Installation of an Emergency Range-Finder Pier

In Fiscal Year 1899 a pier was erected for installation of an emergency range-finder.[32]

8. Changing the Grade of the Interior Slopes

Time and experience having demonstrated that the interior sand slopes were too steep to withstand the blasts of the mortars, they were regarded in Fiscal Year 1900 to a slope of 1 to 2 and resodded.[33]

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29. Ibid., p. 631.

30. Executive Documents, Ser. 3905, p. 7785; Executive Documents, Ser. 4089, p. 839.

31. Executive Documents, Ser. 3746, IV, 631-32.

32. Executive Documents, Ser. 3905, p. 778.

33. Executive Documents, Ser. 4089, p. 840.

9. Providing Fixtures for Implement Racks

Steel implement racks were positioned in the mortar pits in Fiscal year 1901.[34]

C. Naming the Battery

In 1903 the War Department issued General Order No. 78, designating the mortar emplacements Battery Reynolds in honor of Maj. Gen. John F. Reynolds. Born in Lancaster, Pennsylvania, in September 1820, Reynolds was graduated from the U.S. Military Academy in 1841 as a 2d lieutenant in the 3d U.S. Artillery. Serving with the 3d Artillery in the Mexican War, Reynolds was breveted twice for gallantry.

At the outbreak of the Civil War, he was serving as Commandant of Cadets at West Point. Commissioned a lieutenant colonel in May 1861, Reynolds' ability and leadership earned for him a succession of rapid promotions. By the autumn of 1862 he was a major general of volunteers commanding the I Corps in the Army of the Potomac. While leading his corps, he was killed at Gettysburg on July 1, 1863.[35]

The division of the 16-gun mortar battery into two commands was reflected by a General Order in 1906, designating the northeast one-half of the emplacement Battery Alexander McCook. The southeast one-half of the battery continued to be known as Battery Reynolds. The officer honored was one of Ohio's "Fighting McCooks."

An 1852 graduate of the U.S. Military Academy, McCook was commissioned a 2d lieutenant in the 3d U.S. Infantry. In April 1861 McCook was posted at West Point, where he was an instructor in tactics. Four days after the surrender of Fort Sumter, he was commissioned colonel of the 1st Ohio Volunteer Infantry. Like Reynolds, his rise was

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34. Executive Documents, Ser. 4279, p. 768.

35. General Order 78, War Department, May 25, 1903; Ezra Warner, Generals in Blue: Lives of the Union Commanders (Baton Rouge, 1964), pp. 396-97.

meteoric, and in September 1862 he was a major general of volunteers leading a corps in the Army of the Ohio. His reputation was tarnished at Chickamauga, and he was relieved of his command. Although subsequently exonerated by a court of inquiry, he did not again lead troops in the field during the Civil War. In 1868 McCook was promoted to lieutenant colonel of the 26th U.S. Infantry. He continued to serve in the Army until 1895, when he retired with the rank of major general. McCook died in Dayton, Ohio, in June 1903.[36]

D. Improvements to the Batteries: 1907-1912

1. An Improved Trolley System is Installed and the Galleries Widened

a. Settling on a Plan

On January 31, 1907, Assistant Engineer Hurlbut mailed to District Engineer Marshall plans for "a general extension" of the batteries' trolley system. This plan utilized all existing trolleys, except a short section in the traverse gallery which was to be removed. The 1895 trolley was to be curved into the traverse gallery and carried along the center line to the doorway, then by reverse curves turned two feet to the right and carried across the pit to the corridor wall.

In the galleries this extension was to be supported by brackets, as heretofore. In the pits, the trolley rail was to be supported under the telephone "booth to floor of booth and beyond that by brackets on the corridor wall." Hurlbut would position the brackets 10 feet apart with I-beams between to carry the intermediate support.

The second or parallel trolley in the longitudinal (main) gallery was to be 6 inches, face to face with the old, diverge from the other about 20.2 feet from the center of the traverse gallery, and cross the longitudinal gallery before entering the traverse. It could then turn into the center of the traverse and pass out of the pit. This was

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36. General Order 20, War Department, 1906; Warner, Generals in Blue, pp. 294-95.

to permit one pit to receive up to 50 projectiles without interfering with the other. After these were fired, the trolleys could be employed alternately.

The Coast Artillery was pushing to have a trolley for each shellroom, presumably the 16- x 20-foot rooms near the magazines. After some thought, Hurlbut concluded that the ceilings were so low near the walls as to preclude the use of trolleys in these rooms. It would be necessary to cut the ceilings of the traverse galleries four inches to allow room for the trolley and for the foot of the bracket.

Hurlbut estimated the cost of the project to be $2,000. This figure was broken down as follows: 40 large brackets for longitudinal gallery, $320; 32 small brackets for traverse galleries, $160; 12 pit brackets, $180; 6 medium brackets, $60; 275 holes for expansion bolts, $550; 720 feet of trolley rail, $130; cutting concrete, $100; and installation, $500.[37]

After reviewing the plans, Colonel Marshall forwarded them to the Chief Engineer. By extending the overhead trolley system and by construction of independent passages of steel and concrete from the magazines to the traverse galleries for the use of powder carriers, he explained, there would be a marked increase in the batteries' ammunition service. Moreover, it was believed that the proposed passages would materially reduce the effects of the mortar blasts, which were very severe in the rooms and galleries. By adding other passages to the project, Marshall boosted its estimated cost to $9,000.[38] Chief Engineer Mackenzie approved the project in late March and allotted the requested sum.[39]

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37. Hurlbut to Marshall, Jan. 31, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

38. Marshall to Chief Engineer, February 28, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

39. Abbot to Marshall, March 27, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

In the meantime, Assistant Engineer Hurlbut had cautioned that excavating concrete entrances to the powder gallery would not be difficult as his employees were experienced in this type of work. Tunneling in soft sand, however, would be a serious matter, because of the danger of cave ins. To combat these, they would have to resort to shoring.

Hurlbut believed it would be more economical to widen the galleries than to open new passages as suggested by Colonel Marshall. His plan provided for widening the traverse gallery of both Batteries Reynolds and McCook to 12 feet, an increase of 2 feet on either side, raising the ceilings one foot, and rounding the corners where the trolley curved into the longitudinal gallery.

If the longitudinal gallery were widened three feet on each side up to the magazine door, thereby leaving a five-foot wall to support the roof (which was sufficient), they would have a 16-foot gallery. This would allow "abundant room for ammunition, as well as a powder passage through the center." The Coast Artillery believed that widening the galleries would be as efficient as Marshall's projected tunnels.[40]

Colonel Marshall was impressed by Hurlbut's logic. On April 24 he notified Chief Engineer Mackenzie that, as the contemplated tunneling would be exceedngly dangerous, because of the character of the sand surrounding the magazines and passages, it was proposed to widen the galleries by removing portions of the existing concrete walls.

This would also provide space for storage of projectiles on both sides of the longitudinal gallery, with ample space for

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40. Marshall to Mackenzie, April 24, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

a powder passage, and permit installation of a more efficient form of overhead trolley tracks than those currently in the batteries.[41]

Assistant Engineer Hurlbut had placed the cost of widening the longitudinal gallery to the magazine door, three feet on each side, at $9,500. The statistical break down of this sum was:

Excavating concrete about 180 cubic yards at $15 per cubic yard		$2,700.
Trimmings		450.
Concrete refilling about 100 cubic yards		1,850.
Total		$5,000.
Widening traverse galleries		
Trimming	$ 100.	
Refillings	350.	
Excavating concrete	550.	
Two at	$1,000.	2,000.
New		
New trolley system		2,000.
Electric drafts		500.
Total		$9,500.[42]

To enable the department to better understand what was proposed, Colonel Marshall enclosed a drawing titled, "Proposed Modification of Batteries Reynolds and McCook." After reviewing the drawing and correspondence, the Chief Engineer approved the amended proposal as submitted.[43]

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41. Ibid.

42. Hurlbut to Marshall, March 22, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

43. Abbot to Marshall, May 2, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

b. Implementing the Project

With work about to commence, Capt. P. R. Ward of the Coast Artillery knew that Batteries Reynolds and McCook would be out of action for the coming season. This would involve considerable blasting, thus making it impossible to hold drills or practice of any kind at the mortar battery.

As the 55th Company, Coast Artillery, was assigned to Battery McCook, he asked that it be reassigned to Battery Richardson, then out of commission. The 55th Company would then be able to hold its prerequisite drills.[44] The transfer of the 55th Company was approved to take place after completion of its next service practice.[45]

The project proved to be time consuming. In February 1908 the workmen were still drilling holes and blasting concrete. The following month, two mortars in Pit B and one mortar in Pit A of Battery Reynolds were dismounted to facilitate construction. On July 29 Assistant Engineer Hurlbut forwarded plans for widening the four doors of the traverse galleries. The doors were made as "two-leaf doors," but if he added one foot to each, they would become too heavy for their hinges. He proposed to rivet to each a two-foot steel plate and suspend them from a trolley, thus utilizing the trolleys formerly employed for shot, and the flat steel rail, and part of the old bracket hanger.[46]

District Engineer Roessler, who had replaced Colonel Marshall, approved the method suggested. The modernization project having proved to be more expensive than anticipated, another $2,000 was allotted by the Chief Engineer in August 1908.

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44. Ward to C.O., Southern Artillery District of New York, March 22, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

45. Adj. Gen. to Ward, April 18, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

46. Hurlbut to Roessler, July 29, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

By mid-August the workmen had nearly finished with Battery McCook, and Colonel Harris inquired, "When will it be available for drilling my command?" On the 21st Hurlbut was directed to turn the battery over to the Coast Artillery.

In November Hurlbut informed District Engineer Roessler that he had pinpointed in the galleries a number of "hollow sounding places in the new arch." Where the concrete was "very thin," he was having it removed. Where it was more than 1½-inches thick, removal had proved to be difficut as it came off in small pieces when pried. Although the artillery had fired the eight mortars of Battery McCook, before the forms were removed from the Battery Reynolds traverse gallery, Hurlbut did not believe this was the source of the problem.

He concluded that it had been caused by his decision to employ a force pump with the grout on the second day. On the first day the forms were apparently full, but, on examination the next morning, the grout had settled, and they had poured. This had been an error, as he should have given the concrete a week to harden. The loss of substance, he presumed, had occurred when the mix seeped into the porous Rosendale concrete and into cracks left by blasting. Hurlbut did not anticipate any danger because of this, but he suggested they position a row of 3/4-inch expansion bolts, 8 inches long and 3 feet apart, on each side of the center of the arch in the longitudinal gallery.[47]

After receiving the approval of Roessler, Hurlbut saw that the expansion bolts were positioned and the concrete patched. By January 1, 1909, the work was completed and Battery Reynolds was returned to the troops.

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47. Hurlbut to Roessler, Nov. 23, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

2. Construction of Battery Commander Stations

On February 15, 1906, Colonel Marshall transmitted to Chief Engineer Mackenzie plans and details of a proposed battery commander station for Battery Alexander McCook. The same plan would be used for the "station proper for Battery Reynolds, with earthwork and approaches adapted to a structure mounting an instrument five feet higher than in the Battery McCook station."[48]

On June 21 Marshall notified Assistant Engineer Hurlbut that it had been determined that the station for Battery McCook be built to mount its instruments as reference 52, with its floor level at 46.92. The station for Battery Reynolds was to mount its instruments at reference 56 with its floor to be 50.92.[49]

The battery commander stations for the two mortar batteries were constructed in 1907. They were positioned on the fill covering the longitudinal gallery and to the rear of the pits constituting the respective batteries. On December 12 they were inspected by Colonel Marshall and turned over to the Fort Hancock commander.[50]

5. Instructions for Maintenance of the Drainage and Electrical Systems

In Fiscal Year 1911 Colonel Roessler, in accordance with instructions, prepared plans depicting the drainage and electrical systems

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48. Marshall to Mackenzie, Feb. 15, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock. The post commander had suggested to Marshall that the forward station (McCook) have the height of its pedestal "about six feet above the surface" and the rear station (Reynolds) to have its level "about three higher." The plan submitted, as General Mackenzie would see, provided the instrument in the rear station "the proper depression over the roof of forward station." To avoid an undue height of the rear station, it was proposed to mount the instrument in the forward station only four feet above the present level of the site.

49. Marshall to Hurlbut, June 21, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

50. Marshall to Chief Engineer, Nov. 8, Dec. 26, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

for Batteries Reynolds and McCook. With these plans were included instructions for the garrisons regarding maintenance of the batteries. The troops were informed that: (a) all floors and pavements were graded to fall toward strainers at drain inlets. Arrows showed the direction of flow in drains. Inlets in magazines, storerooms, and the longitudinal gallery drained into the underlying sand. (b) All drains were to be carefully inspected and cleaned at least once a week. On occasions the pipes were to be flushed by hoses run from the hydrants. (c) All rooms and galleries were to be swept and all rubbish removed weekly, care being exercised that the holes in the strainers were kept open and free from dirt. Sweepings were to be removed to a place from which they could not be carried into the drains by wind or water. (d) After each rain the earthen slopes would be inspected, and any erosion corrected. Any serious problems of this nature were to be called to the attention of the District Engineer in writing. (e) No one would be allowed to walk on the earthen slopes, except when necessary to inspect or repair them. (f) All doors were to be open from daylight until 2 P.M. on clear days, when there was a good breeze and the temperature was above 60 degrees. (g) The lights were controlled from switchboxes, while the "conductors" were partly in conduits and partly in exposed armored cable.[51]

4. Construction of Two Ventilator Shafts

On October 23, 1911, Colonel Roessler informed the Chief Engineer that Batteries Reynolds and McCook were among the oldest in the Endicott System. As such, the only ventilation afforded the magazines was what "little air" that could be induced whenever the doors were opened. Consequently, the magazines were seldom, if ever, free from moisture or condensation. No other magazines in the district were more in need of ventilation. To construct a 20-inch ventilator for each magazine would be an expensive operation, because of the deep sandfill

51. "Plan Showing Drainage and Electric Systems Battery Reynolds, Fort Hancock, N.J., September 10, 1910"; "Plan Showing Drainage and Electric Systems Battery Alexander McCook, Fort Hancock, N.J., February 11, 1911," NA, RG 77.

above the concrete and the necessity of supplying the core drill for this special task with a long shaft.

Colonel Roessler proposed to sink a vertical shaft, 6 by 6 feet, through the overlaying fill. He would then bore a 20-inch vertical hole down to meet a horizontal drift from the wall of the magazine, just under the crown of the enclosed ceiling. The shaft was to be lined with vitrified tile, supported by a concrete wall and encased in 6-inch timbers. A galvanized hood would be positioned at the top. To assist the department in understanding his proposal, Colonel Roessler enclosed a drawing illustrating, "Ventilating Flues for Magazines, Batteries Reynolds and McCook." The estimated cost of the project was $500 per shaft or $1,000 for the two that were needed.[52]

Chief Engineer William Bixby allotted the requested sum, and directed that construction be commenced as soon as the season's target practice was completed and the sixteen mortars were secured.[53] By May 24, 1912, the workmen had connected the ventilator shafts with the magazines and finished the refilling. Next they cut out concrete from the inside of the magazines. On June 18 Colonel Roessler reported that the ventilator shafts were completed.[54]

E. Batteries Receive a New Mission

1. Disarming the Batteries

During World War I an emplacement for an 8-gun mortar battery was constructed on the Navesink Highlands. As the new battery was part of the Fort Hancock complex, to complete its armament four

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52. Roessler to Chief Engineer, Oct. 23, 1911, and Roessler to C.O., Southern Artillery District of New York, Nov. 3, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

53. Burr to Roessler, Oct. 30, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

54. Hurlbut to Roessler, May 23, June 18, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

12-inch mortars and their carriages were removed in the summer of 1917 from Batteries McCook and Reynolds and positioned in the new emplacement. Removed from Pit A of Battery Reynolds was Gun No. 3, Model 1886, Serial No. 20, mounted on a spring-return carriage, Model 1891, Serial No. 4; from Battery Reynolds' Pit B, Gun No. 1, Model 1886, Serial No. 21, mounted on a spring-return carriage, Model 1891, Serial No. 25; from Battery McCook's Pit A, Gun No. 3, Model 1886, Serial No. 18, mounted on a spring-return carriage, Model 1891, Serial No. 12; and from Battery McCook's Pit B, Gun No. 1, Model 1886, Serial No. 58, mounted on a spring-return carriage, Model 1891, Serial No. 9. Both the mortars and the carriages had been manufactured for the Ordnance Department by Builder's Iron Foundry of Providence, Rhode Island.[55]

Batteries Reynolds and McCook were declared obsolete and surplus to the nation's defense needs in 1919. During the winter and spring of 1920, the remaining twelve 12-inch mortars and their carriages were removed from the pits, condemned, and sold as salvage. The materiel disposed of included:

Battery Alexander McCook

Pit A

Gun No. 1, Model 1886, Serial No. 14, mounted on a spring-return carriage, Model 1891, Serial No. 12.

Gun No. 2, Model 1886, Serial No. 13, mounted on a spring-return carriage, Model 1891, Serial No. 8.

Gun No. 3, transferred to Navesink in February 1918.

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55. Emplacement Books, Fort Hancock, Batteries Reynolds & McCook, Records of the Office, Chief of Coast Artillery, Record Group 392, National Archives; Kuchule to District Engineer, July 29, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. In the years since preparation of the 1910 drawing of the mortar pits, the emplacements in Pits A of Batteries Reynolds and McCook had been renumbered. In 1910 the emplacements in these pits were numbered 1 to 4 counterclockwise, with No. 1 in the southeast corner. By 1917 these emplacements had been renumbered and position No. 1 was in the northeast corner of the subject pits. As heretofore they were numbered counterclockwise.

Gun No. 4, Model 1886, Serial No. 30 mounted on a spring-return carriage, Model 1891, Serial No. 11.

Pit B

Gun No. 1, transferred to Navesink in February 1918.

Gun No. 2, Model 1886, Serial No. 67, mounted on a spring-return carriage, Model 1891, Serial No. 10.

Gun No. 3, Model 1886, Serial No. 65, mounted on a spring-return carriage, Model 1891, Serial No. 2.

Gun No. 4, Model 1886, Serial No. 66, mounted on a spring-return carriage, Model 1891, Serial No. 3.

Battery Reynolds

Pit A

Gun No. 1, Model 1886, Serial No. 15, mounted on a spring-return carriage, Model 1891, Serial No. 14.

Gun No. 2, Model 1886, Serial No. 19, mounted on a spring-return carriage, Model 1891, Serial No. 15.

Gun No. 3, transferred to Navesink in February 1918.

Gun No. 4, Model 1886, Serial No. 64, mounted on a spring-return carriage, Model 1891, Serial No. 16.

Pit B

Gun No. 1, transferred to Navesink in February 1918.

Gun No. 2, Model 1886, Serial No. 22, mounted on a spring-return carriage, Model 1891, Serial No. 7.

Gun No. 3, Model 1886, Serial No. 17, mounted on a spring-return carriage, Model 1891, Serial No. 6.

Gun No. 4, Model 1886, Serial No. 70, mounted on a spring-return carriage, Model 1891, Serial No. 1.

All the 12-inch mortars and their spring-return carriages had been manufactured for the Ordnance Department by Builder's Iron Works of Providence, Rhode Island.[56]

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56. Ibid.

2. Mortar Battery as the HDCP

The Army, however, would not abandon the costly emplacement. On April 6, 1921, the Chief Engineer allotted $20,000 for construction of a "protected fire control switchboard room" in the longitudinal gallery of Batteries Reynolds and McCook.[57] By the late summer of 1922 the "protected switchboard room" had been completed and equipped. On September 2 it was transferred by the District Engineer to the post commander.[58]

During the 1930s the Harbor Defense Command Post (HDCP) was located in the bombproof magazines and galleries of the abandoned mortar battery, adjacent to the fire-control switchboard room. Also located there were Radio Station No. 3 and the auxiliary post telephone switchboard for Fort Hancock. The antiaircraft group command post and message center were installed in another bombproof, while its observation post was positioned atop the parapet of Batteries MCook and Reynolds.[59]

In May 1938 the battery's counterscarp, which had been an anachronism, was partially demolished. The southeast, northwest, and northeast angles, the latter with its reverse-fire casemates, were demolished along with the northeast and northwest fronts. A new entrance was cut through the southwest front of the

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57. Chief Engineer to District Engineer, April 6, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

58. District Engineer to Chief Engineer, Aug. 16, Sept. 2, 1922, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

59. "Annexes to Harbor Defense Project, Harbor Defenses of Sandy Hook, March 21, 1938," NA, RG 407. In this fire-control switchboard room were five BD-74 switchboards; two BD-75 distributing panels; and two closed type 15-cell, 30-volt storage batteries. The charging equipment included a 30-ampere rectifier, an AC-DC motor-generator set, and a DC-DC motor-generator set. The switchboard room was well ventilated and was kept dry by a hot water heating system. A 100-pair cable connected the switchboard room with the post telephone switchboard room in post headquarters.

counterscarp, opposite the entrance to the bombproof gallery providing access to Battery Reynolds.[60]

F. Recommendations

Batteries Reynolds and McCook were among the first Endicott System mortar batteries completed and armed. Their 12-inch mortars fired the first rounds from the pits. As a prototype for many four- and two-pit mortar batteries constructed by the United States during the next 28 years, these batteries pioneered many features found in later batteries. They also included some--a ditch, counterscarp, and casemates of reverse fire--that were identified with Third System forts. These features, designed to protect the batteries from an invading force, were eliminated from pending projects.

Armed with the Model 1888 cast-iron mortar, Batteries Reynolds and McCook were declared obsolete in 1915 and partially disarmed in 1918. One year later, in 1919, the remaining mortars and their carriages were removed from the pits. The battery was given another mission. The bombproof galleries and magazines were converted into the Harbor Defense Command Post and switchboard room. During the 1930s and throughout World War II it sheltered these vital facilities.

Batteries Reynolds and McCook should be entered on the Service's List of Classified Structures. As structures of the First Order of Significance, they should be restored to their appearance, circa 1942. The counterscarp, where it has been demolished, should not be reconstructed. If efforts to locate and acquire a 12-inch mortar and spring-return carriage are successful, they should be emplaced in one of the pits. The other pits could be adapted to a compatible usage, provided measures are taken to protect the structures.

A Furnishing Study and Plan should be programmed with the goal of refurnishing and interpreting the HDCP and switchboard room.

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60. "Supplement to Harbor Defense Project, Harbor Defenses of New York, Aug. 1943," NA, RG 407.

VII. BATTERY GRANGER: A STRUCTURAL HISTORY

A. Army Builds a 10-Inch Battery

1. Plans are Approved and a Site Prepared

On June 29, 1896, Secretary of War Daniel S. Lamont allotted $100,000 from the appropriation for Gun and Mortar Batteries, Act of June 6, 1896, for construction at Sandy Hook of a two-emplacement 10-inch gun battery. This project was substituted for a second gun-lift battery projected for this site. Its guns were to be mounted on U.S. Disappearing Carriages, Model 1896. Chief Engineer Craighill instructed Colonel Gillespie to "proceed with least possible delay, to the end that as much work as possible be done before the close of the working season."

Colonel Gillespie and his staff prepared plans and specifications, while his foremen and a number of laborers overhauled the "plant," which had been in storage since 1894, and set it up on-site. On July 29 Craighill approved the plans which generally conformed to the "typical drawings of The Board of Engineers for this caliber of gun."

The site was cleared and installation of the plant completed sufficiently by August 6 to begin receiving materials. Excavation for the battery, which would be limited in comparison with the mortar battery, begun on July 28 and was carried on simultaneously with the positioning of the plant. The magazine floors were placed at 8 feet above mean low-water, a series of water-level observations extending for more than a month having shown this would place the lowest point of the foundation (elevation 6.0) above the level of the water in the soil.[1]

On August 25 workmen started pouring concrete. At first, it was carried on by hand, because on the first day's run a new gear wheel on the mixer broke. Colonel Gillespie was unable to replace it

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1. Executive Documents, Ser. 3631, p. 620; "Battery No. 1, for Two 10-inch Guns Mounted on U.S. Disappearing Carriages at Sandy Hook, N.J., 1896, Engineer Office, U.S.A., New York, N.Y., July 21, 1896," NA, RG 77.

until September 2, when mixing by machinery was resumed. Seven days later, an extra shift for mixing and placing concrete was added to the payroll. The Duane mixer operated 16 hours per day, except Saturdays and Mondays, when the run was 12 hours.[2]

2. Masonry and Construction Details

The "body" of the masonry was of Rosendale cement in the proportion of 1 part cement, 2 parts sand, and 5 parts broken stone. The platforms were of American Portland concrete in the proportion of 1 part cement, 3 parts sand, and 7 parts broken stone. All exposed corners of masonry, inside and outside, including door jambs, were built up with quoins of brick carried up simultaneously with the concrete, thus insuring a perfect bond.

Facings for the walls, the interior pavement, and the top pavement for the magazine traverses was Rosendale mortar in the proportion of 1 part cement to 1½ parts sand. All exterior pavement was granolithic--1 part cement, 2 parts sand, and 5 parts crushed granite.

Walls surrounding the rooms and passages were built with hollows extending two feet above the ceilings. At this level and extending to the hollows in the walls was placed a waterproof covering of asphalt mixed with ten percent coal tar and 25 percent sand.[3]

3. Battery Takes Shape

By November 30, 1896, four months after ground was broken, the masonry of the battery and platforms was completed and the

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2. Executive Documents, Ser. 3631, p. 620. The Duane mixer had a hollow shaft for supplying water, and the materials were put in from a charge car without previous mixing. The machine was operated at the rate of 14 revolutions per minute, each charge being given 16 turns or more depending on the dryness of materials. With this treatment the concrete was always found to be thoroughly mixed.

3. Ibid., pp. 620-21.

paving underway. The platform bolts were set and the platforms declared ready to receive their carriages and guns on November 15.

A heavy snow during the night of November 29, accompanied by bitterly cold weather, caused Colonel Gillespie to order a cessation of the paving until spring. The concrete plant was dismantled and the equipment stored. Arrangements were made to begin filling the sand in the main parapet, which was to be brought from a ridge about 700 feet to the rear of the battery. The cut over the sight of the battery was small, ranging from four feet at the deepest point to about one foot, thus requiring a large quantity of sand to be excavated elsewhere. The fill was completed March 17, and Lt. Col. William Ludlow, who had replaced Colonel Gillespie as project engineer on February 23, 1897, had the plant removed.

An early spring permitted the men to resume laying pavement on March 1. The top surfaces were found to have been injured by frost and had to be cleared off. New forms were erected for the pavement which was completed in mid-May.

The overhead trolley rails and hoists for moving ammunition were purchased on April 15, and their installation completed on May 26. The system consisted of eight lines of 5-inch I-beams (four to each emplacement) secured to the ceiling beams by malleable clips, with four-wheel trolley and hoist to each line. The hoists were of the Western triple pattern, and the installation was tested to 1,000 pounds by Colonel Ludlow.

Shot cranes, two for each platform, were erected on May 17. A test of their capacity on June 4 demonstrated that one man could raise a 10-inch armor piercing shot the full height of the lift--10 feet--in 1¼ minutes, while two men could raise the same load in 50 seconds.[4]

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4. Ibid.

By June 30 the electric light wiring was completed, except for the switchboard. The storage battery, which was to furnish energy for the emplacements in conjunction with the gun-lift dynamo, had not been purchased, but the emplacements could be lighted directly from the dynamo if necessary. There were 19 lights in the battery, eight of which--those in the magazine and shellrooms--were 32-candlepower. The remainder were 16-candlepower. The wiring was carried in "iron-armored conduits, with waterproof outlets."[5]

On May 18 Colonel Ludlow was notified that the two 10-inch disappearing carriages had been received at the Proving Ground, and that one of them would be turned over to the Corps by the Ordnance Department for immediate mounting. By June 30, 1897, the battery was reported to be completed in all its details, except for the ammunition hoists.[6]

Colonel Ludlow provided a breakdown of the battery's cost of construction:

Repair and installation of plant		$ 7,135.59
Construction of permanent railroad track, 3-foot gauge		1,246.60
Clearing site for battery		140.50
Excavation for foundation		361.50
Rosendale concrete in parapet:		
228 cubic yards by hand, at $4.40	$ 1,003.50	
9,344 cubic yards by machine, at $4.15	38,765.77	
317 cubic yards Portland concrete, at $4.72	1,496.56	
422 cubic yards rubblestone, at $3.59	1,514.98	
1,487 cubic yards Rosendale paving, at $0.974	1,447.81	
1,112 cubic yards of granolithic paving at $2.30	2,561.97	
		46,790.29

5. Ibid., p. 621.

6. Ibid.

Drain pipe		41.34
37,000 brick, in place at $26.88		999.66
Waterproofing, 412 square yards, material and labor, at .33¢		137.15
Whitewashing, 795 square yrds, at 15.2¢		120.94
Stonecutter		28.50
Ironwork:		
4,100 pounds platform bolts and washers, in place at 3.6¢	147.12	
27,970 pounds of steel beams, in place, at 2.5¢	689.03	
200 feet speaking tube, iron	20.50	
		865.65
Electric wiring, 20 lamps, at $8.69		173.81
Trolley lines, 317 feet, at $2.466		865.65
Shot cranes		173.81
Hand rails		117.76
Doors:		
2,621 feet of lumber	193.11	
787 pounds of bronze fittings	149.53	
19 locks	105.00	
Paint	34.78	
Labor, making and hanging	482.82	
Twenty openings at $48.16		963.24
Installing plant for sand filling	719.24	
Cost of sand fillings, 12,506 cubic yards at 25.4¢	2,460.30	
		3,180.14
Grading and clearing up site		994.27
Assembling and mounting 10-inch rifle and carriage		1,000.00
Legal holidays, including time lost by rain, etc.		115.88
General labor		174.54
Repair and maintenance of plant and buildings, including care of public animals		5,963.53
Material on hand, lumber and fittings for doors		195.99
Superintendence and office expenses		2,731.55
Total expenditures to June 30, 1897		$74,588.92

7. Ibid., pp. 621-22.

4. Battery is Armed and Turned Over to the Artillery

One gun and carriage were mounted in June 1897. In Fiscal Year 1898 the second gun and its carriage were received from the Ordnance Department and mounted. Emplaced on no. 1 platform was a 10-inch gun, Model 1888, M11, Serial No. 61; and on no. 2 platform was a 10-inch gun, Model 1888M, Serial No. 36. Both pieces had been manufactured at the Army Gun Factory at Watervliet. Gun No. 1 was mounted on a disappearing carriage, Model 1896, Serial No. 19, and Gun No. 2 on a similar model carriage, Serial No. 20. The carriages had been manufactured by the Bethlehem Iron Works.[8]

In Fiscal Year 1898 the ammunition lifts were installed, and the electrical lighting system completed. The battery was turned over by the Corps of Engineers to the commanding officer, Fort Hancock, on March 22, 1898, one month before Congress declared war on Spain.[9]

5. Battery Gets a Name

On April 4, 1900, the War Department issued General Order No. 43 assigning names to a number of Endicott emplacements. This battery was designated Battery Granger to honor Maj. Gen. Gordon Granger.

A New Yorker, Granger had graduated from the U.S. Military Academy in the Class of 1845. Commissioned a 2d lieutenant, Granger served in the Mexican War, winning two brevets for gallantry. During the years before the Civil War, Granger was on the frontier as an officer in the Mounted Rifles. He led a brigade at Island No. 10 and was promoted brigadier general of volunteers to rank from March 26, 1862, and major general to rank from September 17, 1862. At Chickamauga, Granger marched his corps to support Maj. Gen. George H. Thomas at

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8. Executive Documents, Ser. 3746 IV, 631; Emplacement Books, Fort Hancock--Battery Granger, NA, RG 392.

9. Executive Documents, Ser. 3746, IV, 631.

Snodgrass Hill, thus helping to save the Army of the Cumberland from destruction. Granger commanded a corps at Missionary Ridge, and his troops captured Forts Gaines and Morgan and distinguished themselves in the campaign that resulted in the capture of Mobile in April 1865. In the reduction of the Army following the Civil War, Granger was commissioned colonel of the 25th U.S. Infantry. He died at Santa Fe on January 10, 1876.[10]

B. Improvements to the Battery

1. Maintenance of the Battery: 1899-1901

In Fiscal Year 1899 the battery's doors were repaired, and two concrete pillars erected for installation of emergency range-finders.[11] The following year found a crew painting the doors, laying drains, and closing up the battery commander's station.[12]

In Fiscal Year 1901 galleries to connect the loading platforms of the emplacements were built. They consisted of wooden floors on steel columns with gas-pipe hand rails.[13]

Steel implement racks were positioned on the emplacement walls. These racks were similar to those installed in the other Sandy Hook 12-, 10-, and 6-inch batteries in that year.[14]

In November 1904 the Corps of Engineers prepared and issued a "Plan Showing Drainage and Electric Systems" for Battery

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10. General Order 43, War Department, April 4, 1900; Warner, Generals in Blue, p. 181.

11. Executive Documents, Ser. 3905, p. 778.

12. Executive Documents, Ser. 4089, XV, 839.

13. Executive Documents, Ser. 4279, p. 768.

14. "Implement Rack for 12-inch and 6-inch Gun Emplacements to accompany specifications issued by Major W. L. Marshall, Corps of Engineers, U.S.A.," NA, RG 77.

Granger. Along with the plan came instructions for the garrison regarding its maintenance. The troops were informed that: (a) all drains led from strainers in rooms into settling basins. The floors had been graded to fall toward the strainers, which were removable. (b) All drain pipes were to be carefully inspected and cleaned once a week. The pipes were to be occasionally flushed by a hose connected to a hydrant. (c) The rooms and passages were to be swept weekly, care being taken that the holes in the strainers were kept open and free of dirt. (d) Immediately after each rain, the earthen slopes were to be inspected and any erosions corrected. Serious gullying would be reported in writing to the district engineer. (e) No person was to walk on the earthen slopes, except those detailed to inspect or repair them. (f) All doors were to be open from daylight until 2 P.M. on clear days, whenever there was a good breeze and the temperature was above 60 degrees.[15]

On making his semi-annual inspection on July 7, 1906, Colonel Marshall commented on the good condition of the battery. Although constructed of Rosendale cement and hitherto reported as "wet," "leaky," etc., it was in the best condition of any battery in the New York Engineer District.[16]

2. Modernization in Fiscal Year 1907

In Fiscal Year 1906 the Chief Engineer allotted $5,995 for modernizing Battery Granger. Part of this sum would be expended to make permanent the improvements made to the battery five years earlier. When the battery had been built, little was known about the rapidity with which modern high-powered guns could be safely fired and less as to methods of serving them. With experience, improved techniques of construction had been developed. Target practice with smokeless powder,

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15. "Plan Showing Drainage and Electric Systems Battery Granger, Fort Hancock, N.J., November 1904," NA, RG 77.

16. Marshall to Mackenzie, July 7, 1906, NA, RG 77, Press Copies, Ltrs. Sent, New York Defenses.

invented after many of the batteries were completed, also had demonstrated the desirability of certain additions and modifications. As rapidly as the needs were identified, they were met by changes which were incorporated into plans for future emplacements. Changes found necessary for the improved efficiency of batteries such as Granger included: the widening of the loading platforms to avoid accidents to the gunners and confusion in the ammunition service, as well as to provide more storage room for projectiles; and the construction of protected battery commanders' stations.[17]

Assistant Engineer Hurlbut would oversee the extension of the Battery Granger loading platforms, the roofing over of narrow parts of corridors, and the construction of a battery commander's platform and elevated walks and stairways. All new work was to be of reinforced concrete.[18] To guide his workmen, Hurlbut provided a detailed set of drawings for "modernizing Battery Granger." Sheet No. 1 contained plans and details of the platform extension, and sheet no. 2 details of "B.C. Station and Elevated Walk."[19]

The project was completed by August 17, 1907, and reported ready for transfer to the troops. On September 20 Colonel Marshall made his final inspection and turned the battery commander's station over to the post commander.[20] Soon thereafter, during the autumn of 1907, fatigue details from the garrison felled a number of trees to improve the battery's field of fire.[21]

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17. Executive Documents, Ser. 4785, VI, 5-10.

18. Marshall to Hurlbut, June 5, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

19. "Plans and Details for Modernizing Battery Granger, May 1906," NA, RG 77.

20. Hurlbut to Marshall, Aug. 17, 1907, and Marshall to Chief Engineer, Sept. 23, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

21. Hurlbut to Marshall, Nov. 26, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

3. Maintenance in Fiscal Years 1909-1913

In April 1909 Ordnance personnel dismounted Gun No. 2 in Battery Granger and removed its carriage. After the concrete around the splices had been cut from the well, the carriage and gun were remounted.[22]

In the autumn of 1909 Assistant Engineer Hurlbut called upon the District Engineer to supply him with 60 gallons of drop black paint for Battery Granger.[23] The paint was supplied, and the troops did the painting.

On September 19, 1913, Hurlbut requisitioned a supply of white Portland cement sufficient to coat all the interior walls.[24]

C. Veteran Recalls Manning the Guns

Pvt. Lander W. Radford, who served at Fort Hancock from March 1906 until March 1909, was a member of the 113th Company, Coast Artillery, the unit assigned to man the guns of Battery Granger. He recalled:

> My first impression of the ten inch guns at Battery Granger was a deep feeling of excitement and wonder at their apparent formidability. When fired, the report sounded loud and rather dull, not sharp enough to affect the eardrums. My iniation [sic] at these guns took place in the fall of 1906, at the regular semi-annual target practice. Another recruit and myself, were told by our Captain, Wright Smith[,] to stand on top of the parapet, abreast of the muzzle of the guns, but

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22. Hurlbut to Roessler, April 28, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

23. Ibid., Nov. 2, 13, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

24. Ibid., Sept. 19, 1913, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

about 20 feet off to one side, and at the first shot we were severely jolted. I don't know about the other fellow, but I ended up with a bitten tongue, but someone saw our plight and yelled, "stand on your toes and open your mouth." We did, and fared better during the remaining five shots.

The gun crew reacted at target practice the same as they did at drill, maybe a little faster. All gun crew members were assigned to their stations by number, but I don't remember just what particular number did what. There was a man on the trip lever, one on the rotating or traverse crank, one on the range drum and one on the telautograph as reader, three on the ammo cart (called "baby carriage"), two on the breech block, four on the ramrod and a lanyard man. I'd guess it took about 14 men to make up the crew, not counting the gun pointer and gun commander, and the rest was relegated to ammo, or just stood about observing the drill. Two men would open and close the breech block, four men handled the ramrod, and when the ammo cart arrived, rammed the projectile home, and placed the two bags of smokeless powder in behind it, the breech was closed, the gun was tripped into battery ready for firing. When the pusher of the "baby carriage", aided by his two helpers at the ammo window conveyer, had loaded the projectile and powder on the cart, he'd take off like a streak, headed for the gun breech and most times he'd strike it with such force as to send the projectile from its tray clear into its proper seat in the chamber and the ramrod wasn't needed. I might add, the ammo cart had a tray at the top for the projectile and a tray on each side, lower down for the powder bags.

Here, I might mention the range section of the gun crew, called the "white collar" gang, which consisted, as I remember, of about 12 men. All first class gunners. We used the base line system in obtaining corrected ranges and directions; none of this was done at the Battery. We had two observing towers.

One was called the Primary station and there was called the Secondary station. They were some 1600 yards apart, and the Battery was somewhere in between. These observing stations were equipped with large range finders, or azimuth instruments. Each station was manned by two men, an observer and a reader, with a phone headset. Our Primary station was built on top of battery Potter, behind the parapet, the observer and reader, however, on top of the parapet and exposed. The Secondary station was located some 1,600 yards south of the Primary station. The plotting board, some 4 feet in diameter, shaped to a half circle, was equipped with two arms, or straight edges, one arm was pivoted so as to represent the line of sight from the primary station and one represented the secondary station. An arm with a scale graduated in yards was pivoted in between and represented the gun. I might add, the half circle plotting board scale was graduated in degrees and hundredths of degrees. (The scale: 300 yds. to the inch).

The plotting board was manned by three men, a chief plotter, who handled the gun arm and two assistant plotters, who wore phone head sets, and set on the board circle the observation readings from the two outer stations. The intersection of these two arms represented the position of the target being tracked, and the gun arm was brought up to the intersection and the range in yds. was read from the gunarm. These readings came over every 15 seconds.

In the meantime, the men at the meteorological station would furnish the men on the range board, with the weather conditions. Such as: direction of the wind and velocity, density of the atmosphere and the height of the tide. That information, or the proper reference numbers went to the man on the deflection computer, and from there to the chief plotter, who would set the corrected range on his gunscale, and send the data to the range setter at the gun along with the proper

deflection for the gun pointer to set on his gun sight. The members of this section were often rotated from station to station.

In case of combat, the soldier, in the magazine had the safest place of all the gun crew. The mags were virtually impregnable to gunfire from incoming enemy ships, and he took it in stride knowing that eventually he would reach the gun crew and from there on to the range section.

I filled any and all positions on the disappearing guns, from time to time, while in the gun crew, but when I qualified at the first class gunnery test, I was after that assigned to the range section, and filled any and all poitions there.

When the trip lever was raised, it took the gun about 3 to 5 seconds to complete its "in battery" position'; it did not go into battery with a bang, because it was controlled by the recoil cylinders. The "Time Interval" bell sounded, at all stations, every 15 seconds, and the range section, supplied, by phone, the corrected range to the guns every 15 seconds. The greatest delay between shots were the swabbing of the charge chamber, after each shot to eliminate sparks. However, the powder bags were composed of a raw silk fabric and were highly flammable and most of them were completely destroyed by the fire of the shot. I do not remember the figures, but I feel sure the 113th company, held the record for speed and markmanship with the ten inch guns.[25]

D. Battery is Declared Obsolete and Disarmed

In the spring of 1921 the superior slopes of the battery were brushed off to remove the old waterproofing and given two coats of

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25. Ltr., Radford to Hoffman, Aug. 6, 1978, files, Sandy Hook Unit, Gateway NRA.

Elaterite Waterproofing Compound. The waterproofed surface was then sanded.[26]

Battery Granger was declared obsolete by the army in 1933. When the War Department prepared its Defense Project for Sandy Hook in 1938, there was no place for the 10-inch disappearing guns of the 1896-97 emplacement. The battery, however, was not disarmed, its weapons being used for drill and practice by the National Guard and reserve units in the 1930s. They were still in position on December 16, 1942, when they were listed as no longer required. The following year the guns and carriages were dismounted and sold for scrap.[27]

E. Recommendations

For more than 30 years, through two wars, Battery Granger was an important element in the defenses of Sandy Hook. It was one of four emplacements for 10-inch guns for the protection of the southern approaches to New York Harbor commenced by Colonel Gillespie with funds allotted from the Act of June 6, 1896.[28]

Battery Granger merits inclusion on the Park Service's List of Classified Structures. It is of Third Order of Significance, and accordingly it should be stabilized and preserved. If feasible, the battery should be adapted for a compatible usage, as long as its structural integrity is not compromised.

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26. Carruth to C.O., Sandy Hook Defenses, June 9, 1921, NA, RG 77, Ltrs. Sent, Fort Hancock.

27. "Annexes to Harbor Defense Project; Harbor Defenses of Sandy Hook," March 21, 1938, NA, RG 407.

28. Executive Documents, Ser. 3631, p. 14.

VIII. THE 9-GUN BATTERY: A STRUCTURAL HISTORY

A. Construction of 10-Inch Battery No. 2

1. War Department Decides to Contract for Some of its Emplacements

The Act of June 6, 1896, besides appropriating $2,400,000, provided that "contracts may be entered into, under the direction of the Secretary of War, for materials and work for construction of fortifications, to be paid for as appropriations may from time to time be made by law, to an additional sum in the aggregate not to exceed $2,500,000."[1]

During the next twelve months, the War Department utilized this authority to enter into contracts for the construction of 78 emplacements. One of these was at Sandy Hook.

On June 29, 1896, Chief Engineer Craighill notified Colonel Gillespie that plans and specifications for construction of a battery to mount three 10-inch guns on disappearing carriages, Model 1896, had been approved and the necessary funds allotted. This project was substituted for one calling for two iron casemates. Unlike the other emplacements constructed or underway at Sandy Hook, "Ten-inch Battery No. 2, would be built under contract, rather than by day labor."[2]

This emplacement, authorized during the summer of 1896 as was Battery Granger, would cost much less than Battery Potter. Plans and specifications had been revised. These emplacements, as well as those that followed, were designed to utilize much less concrete. Earth or sand fill was substituted for masses of masonry wherever practicable. Experience on the part of the engineer in charge, along with the

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1. Executive Documents, Ser. 3479, pp. 8-9.

2. Executive Documents, Ser. 3631, p. 622.

acquisition of the "plant" used for earlier operations, enabled the department to affect economies.[3]

2. Frank W. Molloy is Awarded a Contract

On October 20, 1896, Colonel Gillespie advertised for proposals for the construction of the battery. On November 28 Colonel Gillespie and his staff opened and abstracted the bids received from sixteen interested contractors. On doing so, they found:

No.	Name of bidder.	11,500 cubic yards concrete masonry, Rosendale cement.		1,500 cubic yards concrete masonry, American Portland cement.		750 cubic yards large broken stone.		1,100 square yards pavement, Rosendale cement mortar.	
		Per cubic yard.	Amount.	Per cubic yard.	Amount.	Per cubic yard.	Amount.	Per square yard.	Amount.
1	Irving A. Hodge	$4.87	$56,005.00	$6.00	$9,000.00	$0.80	$600.00	$0.75	$825.00
2	John L. Grim	5.20	59,800.00	7.50	11,250.00	2.60	1,950.00	1.50	1,650.00
3	Frank W. Molloy	4.45	51,175.00	5.00	7,500.00	1.50	1,125.00	1.00	1,100.00
4	E. J. McKeever	5.75	66,125.00	8.75	13,125.00	.86	645.00	1.55	1,705.00
5	Thos. J. Regan	5.98	68,770.00	7.48	11,220.00	4.75	3,562.50	.85	935.00
6	Millard & Lahey	5.11	58,765.00	5.92	8,880.00	1.00	750.00	1.50	1,650.00
7	J. W. Hoffman & Co.	4.40	50,600.00	6.20	9,300.00	1.00	750.00	.80	880.00
8	The Wilson & Baillie Manufacturing Co.	5.30	60,950.00	5.88	8,820.00	1.00	750.00	.96	1,056.00
9	John J. Donovan	7.35	84,525.00	8.10	12,150.00	.75	562.50	2.07	2,277.00
10	William Morgan	3.86	44,390.00	5.89	8,835.00	1.40	1,050.00	.89	979.00
11	Manhattan Concrete Co.	4.80	55,200.00	13.50	20,250.00	.50	375.00	.60	660.00
12	Naughton & Co.	5.45	61,525.00	6.20	9,300.00	.60	450.00	.70	770.00
13	Richard H. Brodhead	4.85	55,775.00	10.00	15,000.00	4.85	3,637.50	3.00	3,300.00
14	American Artificial Stone Pavement and Construction Co.	5.75	66,125.00	7.50	11,250.00	2.00	1,500.00	1.35	1,485.00
15	Stephens & O'Rourke	5.00	57,500.00	6.00	9,000.00	5.00	3,750.00	.75	825.00
16	Holmes & Cogan	6.00	69,000.00	7.00	10,500.00	1.50	1,125.00	1.60	1,760.00

No.	Name of bidder.	1,000 square yards granolithic pavement, American Portland cement mortar.		850 square yards asphalt waterproofing, in place.		45,000 brick laid in work.		45,000 pounds steel I-beams and channels, in place.	
		Per square yard.	Amount.	Per square yard.	Amount.	Per 1,000.	Amount.	Per pound.	Amount.
1	Irving A. Hodge	$1.50	$1,500.00	$0.20	$170.00	$20.00	$900.00	$0.02¾	$1,237.50
2	John L. Grim	2.25	2,250.00	1.50	1,275.00	18.00	810.00	.03	1,350.00
3	Frank W. Molloy	2.00	2,000.00	.50	425.00	20.00	900.00	.03	1,350.00
4	E. J. McKeever	2.07	2,070.00	1.03	875.50	25.00	1,125.00	.02¾	1,237.50
5	Thos. J. Regan	1.85	1,850.00	.95	807.50	25.00	1,125.00	.04	1,800.00
6	Millard & Lahey	2.00	2,000.00	1.25	1,062.50	20.00	900.00	.04	1,800.00
7	J. W. Hoffman & Co.	1.20	1,200.00	.35	297.50	16.00	720.00	.02	900.00
8	The Wilson & Baillie Manufacturing Co.	[illegible]	[illegible]	.72	612.00	19.20	864.00	.03	1,350.00
9	John J. Donovan	[illegible]	[illegible]	1.40	1,190.00	17.50	787.50	.04	1,800.00
10	William Morgan	[illegible]	[illegible]	.33	280.50	18.90	850.50	.02¾	1,260.00
11	Manhattan Concrete Co.	1.50	[illegible]	[illegible]	[illegible]	15.00	675.00	.04	1,800.00
12	Naughton & Co.	[illegible]	[illegible]	[illegible]	[illegible]	23.00	1,035.00	.02¾	1,305.00
13	Richard H. Brodhead	[illegible]	[illegible]	[illegible]	[illegible]	16.00	720.00	.03	1,350.00
14	American Artificial Stone Pavement and Construction Co.	[illegible]	[illegible]	[illegible]	1,530.00	25.00	1,125.00	.03¾	1,575.00
15	Stephens & O'Rourke	[illegible]	[illegible]	[illegible]	[illegible]	25.00	1,125.00	.04	1,800.00
16	Holmes & Cogan	2.00	2,000.00	.50	425.00	22.50	1,012.50	.03	1,350.00

3. Executive Documents, Ser. 3631, p. 11; "Battery No. 2, Fort Hancock For Three 10-inch Guns Mounted on U.S. Disappearing Carriages, Model 1896 . . .," NA, RG 77.

No.	Name of bidder.	6,450 pounds steel anchor bolts, with nuts and washers, in place.		400 feet 4-inch cast-iron pipe, set up.		300 feet iron pipe railing, set up.		150 pounds iron perforated covers for drains in place.	
		Per pound.	Amount.	Per linear foot.	Amount.	Per linear foot.	Amount.	Per pound.	Amount.
1	Irving A. Hodge	$0.04	$258.00	$0.60	$240.00	$0.60	$180.00	$1.00	$150.00
2	John L. Grim	.06	387.00	.65	260.00	.35	105.00	.04	6.00
3	Frank W. Molloy	.05	322.50	.35	140.00	.50	150.00	.15	22.50
4	E. J. McKeever	.05½	354.75	.50	200.00	.25	75.00	.20	30.00
5	Thos. J. Regan	.07	451.50	.25	100.00	.35	105.00	.02	3.00
6	Millard & Lahey	.06	387.00	.50	200.00	1.00	300.00	1.50	225.00
7	J. W. Hoffman & Co.	.06	387.00	.35	140.00	.35	105.00	.04	6.00
8	The Wilson & Baillie Manufacturing Co.	.034	225.75	.36	144.00	.31	93.00	.25	37.50
9	John J. Donovan	.05	322.50	.50	200.00	.20	60.00	.03	4.50
10	William Morgan	.09⅞	632.10	.22	88.00	.21	63.00	.50	75.00
11	Manhattan Concrete Co.	.05	322.50	.30	120.00	.20	60.00	.10	15.00
12	Naughton & Co.	.04	258.00	.25	100.00	.25	75.00	.70	105.00
13	Richard H. Brodhead	.05	322.50	.40	160.00	.15	45.00	.05	7.50
14	American Artificial Stone Pavement and Construction Co.	.09	580.50	.40	160.00	.25	75.00	.03	4.50
15	Stephens & O'Rourke	.05	322.50	1.00	400.00	.50	150.00	1.00	150.00
16	Holmes & Cogan	.05	322.50	.30	120.00	.20	60.00	.50	75.00

No.	Name of bidder.	150 feet 6-inch vitrified drain pipe, in place.		150 feet 4-inch vitrified drain pipe, in place.		15 single-leaf doors, with composition fittings, in place.		13 double-leaf doors, with composition fittings, in place.	
		Per linear foot.	Amount.	Per linear foot.	Amount.	Each.	Amount.	Each.	Amount.
1	Irving A. Hodge	$0.40	$60.00	$0.40	$60.00	$29.00	$435.00	$60.00	$780.00
2	John L. Grim	.70	105.00	.40	60.00	25.00	375.00	50.00	650.00
3	Frank W. Molloy	.30	45.00	.25	37.50	10.00	150.00	15.00	195.00
4	E. J. McKeever	.25	37.50	.20	30.00	35.00	525.00	20.00	260.00
5	Thos. J. Regan	.25	37.50	.20	30.00	12.00	180.00	15.00	195.00
6	Millard & Lahey	.25	37.50	.20	30.00	25.00	375.00	40.00	520.00
7	J. W. Hoffman & Co.	.25	37.50	.20	30.00	25.00	375.00	35.00	455.00
8	The Wilson & Baillie Manufacturing Co.	.24	36.00	.24	36.00	36.00	540.00	30.00	390.00
9	John J. Donovan	.25	37.50	.20	30.00	25.00	375.00	45.00	585.00
10	William Morgan	.14	21.00	.12	18.00	14.50	217.50	18.00	234.00
11	Manhattan Concrete Co.	.30	45.00	.25	37.50	90.00	1,350.00	100.00	1,300.00
12	Naughton & Co.	.18	27.00	.10	15.00	18.40	276.00	36.00	468.00
13	Richard H. Brodhead	.40	60.00	.30	45.00	20.00	300.00	25.00	325.00
14	American Artificial Stone Pavement and Construction Co.	.40	45.00	.20	30.00	25.00	375.00	40.00	520.00
15	Stephens & O'Rourke	.30	45.00	.25	37.50	20.00	300.00	30.00	390.00
16	Holmes and Cogan	.20	30.00	.10	15.00	10.00	150.00	10.00	130.00

	Name of bidder.	450 linear feet trolley line, including 20 trolleys.		6 hoists and fixtures in place.		6 steel cranes and fixtures in place.		1,800 cubic yards stone demolition, measured in place.	
		Per linear foot.	Amount.	Each.	Amount.	Each.	Amount.	Per cubic yard.	Amount.
1	Irving A. Hodge	$4.62	$2,079.00	$1,700.00	$10,200.00	$200.00	$1,200.00	$1.00	$1,800.00
2	John L. Grim	3.00	1,350.00	550.00	3,300.00	250.00	1,500.00	.90	1,620.00
3	Frank W. Molloy	3.50	1,575.00	500.00	3,000.00	300.00	1,800.00	.50	900.00
4	E. J. McKeever	2.00	900.00	500.00	3,000.00	300.00	1,800.00	1.00	1,800.00
5	Thos. J. Regan	3.90	1,755.00	595.00	3,570.00	295.00	1,770.00	1.85	3,330.00
6	Millard & Lahey	2.50	1,125.00	400.00	2,400.00	200.00	1,200.00	1.00	1,800.00
7	J. W. Hoffman & Co.	2.50	1,125.00	500.00	3,000.00	200.00	1,200.00	1.25	2,250.00
8	The Wilson & Baillie Manufacturing Co.	3.00	1,350.00	1,200.00	7,200.00	210.00	1,260.00	.60	1,080.00
9	John J. Donovan	4.00	1,800.00	377.50	2,265.00	200.00	1,200.00	1.00	1,800.00
10	William Morgan	3.75	1,687.50	750.00	4,500.00	250.00	1,500.00	1.36	2,448.00
11	Manhattan Concrete Co.	.60	270.00	900.00	5,400.00	500.00	3,000.00	.50	900.00
12	Naughton & Co.	4.00	1,800.00	520.00	3,120.00	212.00	1,272.00	.90	1,620.00
13	Richard H. Brodhead	3.70	1,665.00	100.00	600.00	300.00	1,800.00	1.50	2,700.00
14	American Artificial Stone Pavement and Construction Co.	.50	225.00	565.00	3,390.00	300.00	1,800.00	1.00	1,800.00
15	Stephens & O'Rourke	3.00	1,350.00	400.00	2,400.00	250.00	1,500.00	.40	720.00
16	Holmes & Cogan	1.20	540.00	80.00	480.00	400.00	2,400.00	.50	900.00

No.	Name of bidder.	2,000 cubic yards earth excavation, measured in place.		27,000 cubic yards sand filling, measured in place.		Total amount.
		Per cubic yard.	Amount.	Per cubic yard.	Amount.	
1	Irving A. Hodge	$0.20	$400.00	$0.25	$6,750.00	$94,829.50
2	John L. Grim	.25	500.00	.25	6,750.00	97,303.00
3	Frank W. Molloy	.12	240.00	.15	4,050.00	78,262.50
4	E. J. McKeever	.20	400.00	.15	4,050.00	100,370.25
5	Thos. J. Regan	.25	500.00	.43	11,610.00	113,707.60
6	Millard & Lahey	.30	600.00	.18	4,860.00	99,607.00
7	J. W. Hoffman & Co.	.25	500.00	.18	4,860.00	79,118.00
8	The Wilson & Baillie Manufacturing Co.	.48	960.00	[illegible]	[illegible]	98,554.25
9	John J. Donovan	.75	1,500.00	[illegible]	[illegible]	113,171.50
10	William Morgan	.30	600.00	[illegible]	[illegible]	74,923.10
11	Manhattan Concrete Co.	.22	440.00	[illegible]	[illegible]	[illegible]
12	Naughton & Co.	.18	[illegible]	[illegible]	[illegible]	[illegible]
13	Richard H. Brodhead	.50	[illegible]	[illegible]	[illegible]	[illegible]
14	American Artificial Stone Pavement and Construction Co.					[illegible]
15	Stephens & O'Rourke	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	Holmes & Cogan	.10	200.00	.20	[illegible]	[illegible]

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4. Executive Documents, Ser. 3631, pp. 625-26.

Frank W. Molloy of New Rochelle, New York, was the lowest responsible bidder and thus was awarded the contract. The agreement signed by Molloy required that the project be commenced on or before April 1, 1897, and be completed on or before November 1 of that year. Molloy would have "free and full use" of the Engineer wharf, plant, and housing, if needed, and would keep these facilities in good repair.[5]

3. Molloy Builds a Battery

Construction began on March 31, 1897, under Colonel Ludlow's supervision. The three-gun battery was sited on the curtain of the northeast front of the old masonry fort and some 2,000 feet north of ten-inch Battery No. 1 which was nearing completion. At first, progress was "slow and unsatisfactory." Colonel Ludlow attributed this problem in part to the "cheap labor" employed by Molloy and partly to the "lack of proper conception of the work by the contractor himself." Materials had been slow to arrive on-site, and many had been rejected by Lt. Robert McGregor, Ludlow's assistant, as not meeting the requirements of the specifications. Thus, it was May 20 before the excavation was advanced sufficiently to begin mixing concrete. The average quantity mixed and placed by hand per hour was 3.1 cubic yards.

By June 30, 1897, the Molloy workmen had excavated 2,956 cubic yards of earth and sand and had demolished 1,142 cubic yards of masonry constituting the old fort. They had positioned 1,203 cubic yards of Rosendale concrete, 339 cubic yards of random stone, 8,000 brick, and 80 linear feet of vitrified 8-inch drainpipe.[6]

Molloy's workmen, having become accustomed to what was expected, improved their efficiency. The contract was closed on February 28, 1898, when the battery was completed, except for part of the handrail and pavement. By June 30 these had been finished. The

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5. Ibid., p. 623.

6. Ibid.

emplacement, however, lacked electric lighting, which had not been included in Molloy's contract.[7] In Fiscal Year 1899 the electric lighting plant was installed.[8] On January 6, 1900, the battery was inspected and transferred to the artillery.

4. Contracting Policy is Scrapped

The experiences that the War Department had with Molloy and contractors on other projects soured the Chief Engineer on the contracting system "in its application to fortifications." Chief Engineer Wilson complained that it was open to grave objections, the principal one being "the undue publicity necessarily given to the plans to enable intended bidders to submit proposals intelligently." Moreover, the character of the work was such that "perfect freedom to introduce changes during construction is extremely desirable, a freedom that is seriously hampered by the existence of a contract." A comparison of the results accomplished in Fiscal Year 1897 between "the contract and hired labor system shows that the latter is in every way superior, being more rapid, satisfactory, and equally economical." The contracting system for construction of fortifications was abandoned accordingly.[9]

5. Arming the Battery

Positioned in the battery in May 1898 were three 10-inch rifles. Platform no. 1 was occupied by a Model 1888, M11 gun, Serial No. 57, mounted on a disappearing carriage, Model 1896, Serial No. 43; platform no. 2 was armed with a Model 1888 gun, Serial No. 2, on a disappearing carriage, Model 1896, Serial No. 8; and platform no. 3 supported a Model 1888, M1 gun, Serial No. 35, on a disappearing carriage, Model 1896, Serial No. 18. The three guns had been manufactured by the Army Gun Factory at Watervliet, carriages nos. 8

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7. Executive Documents, Ser. 3746 IV, 631-32.

8. Executive Documents, Ser. 3905, VIII, 778.

9. Executive Documents, Ser. 3631, p. 9.

and 43 by the Niles Tool Co., of Hamilton, Ohio, and carriage no. 18 by the Southwark Co.[10]

B. Construction of 12-Inch Battery No. 2

1. Major Adams Builds a Battery

On June 3, 1897, Colonel Ludlow submitted a plan for construction of a 2-gun battery mounting 12-inch breech-loading rifles on disappearing carriages, Model 1896. The disappearing carriage recently perfected by the Ordnance Department, besides being more efficient than the lift mechanism, was less expensive. The project was approved by Chief Engineer Wilson and was to be accomplished with hired labor. It would be funded from an allotment from the appropriation made by Congress on March 3, 1897, for construction of Gun and Mortar Batteries.[11]

By June 30 Colonel Ludlow had purchased the necessary track material and had perfected arrangements for positioning the plant. Construction would be commenced as soon as the work by Molloy on 10-inch Battery No. 2 reached the stage to permit the use of the wharf and plant.[12]

Construction began on September 1, 1897. Before the foundations could be excavated, hundreds of cubic yards of masonry constituting the northeast bastion of the old masonry fort had to be demolished. The new battery would tie into and be at a right angle to the three-gun emplacement under contract to Frank W. Molloy.

By June 30, 1898, 9,732 cubic yards of concrete had been poured. Both platforms were ready for their armament, the magazines

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10. Battery Halleck Emplacement Book, Fort Hancock, NA, RG 392.

11. Executive Documents, Ser. 3631, p. 623; Executive Documents, Ser. 3905, VIII, 778.

12. Executive Documents, Ser. 3631, p. 623.

built, and the battery "generally finished up to within 6 feet of the crest level." If there were no unexpected delays, Major Adams, who had replaced Ludlow as District Engineer, anticipated that twelve-inch Battery No. 2 would be completed by October 1.[13] With his annual report, Major Adams forwarded a plan of the battery to the department.[14]

Work dragged on the project in Fiscal Year 1899, thus dashing Major Adams' forecast. But, by June 30, he was able to report that the battery was completed, with the exception of "a small quantity of pavement and the construction of the portion of the sand parapet which could not be completed without interfering with the operations of the Ordnance Department." The magazines were finished and the platforms ready for their armament which was on hand.[15]

2. Adams Breaks Down the Costs

Concrete for the battery had been mixed in a four-foot cubical mixer and placed by derricks to which it was supplied in portable boxes positioned on flat cars. In the sixteen months beginning in March 1898 and ending June 30, 1899, 11,100 cubic yards of concrete and 1,625 square yards of pavement had been placed. During Fiscal Year 1899, 2,300 cubic yards of concrete had been mixed, placed, and rammed at an average cost, exclusive of the plant, of $3.82 per cubic yard. In addition, 625 square yards of pavement, 1 foot thick, had been positioned at a mean cost of $1.32 per square yard; 11,289 cubic yards of sand had been excavated and placed in the sand parapet at an average cost of 24½ cents per cubic yard; and 82 cubic yards of masonry had been blasted and removed from the walls of the old fort at a cost of 37 cents per cubic yard.

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13. Executive Documents, Ser. 3746, IV, 632.

14. "Design for Battery of Two 12-inch Rifles Mounted on U.S. Disappearing Carriages, Model 1896, At Fort Hancock, N.J.," NA, RG 77.

15. Executive Documents, Ser. 3905, VIII, 778.

Most of the concrete, except for the pavement, was made with Rosendale cement. The material for the concrete, delivered at the wharf, cost: Rosendale cement, 67 cents per barrel; broken stone, $1.06 per cubic yard; and Portland cement, $2.06 per barrel. Sand was excavated on the reservation.

Sand for the parapet was excavated by a derrick operating a 4-bladed grapple of 1-cubic yard capacity. The grapple placed the sand in dump cars, which were hauled to the parapet by cable. The average length of the haul was 3,500 feet.[16]

3. Arming the Battery

The battery was armed in March 1900. Positioned in emplacement no. 1 was a 12-inch rifle, Model 1888, M11, Serial No. 4, and in emplacement no. 2 another 12-inch rifle, Model 1888, M11, Serial No. 7. The former was mounted on a disappearing carriage, Model 1896, Serial No. 28, and the latter, a similar model disappearing carriage, was Serial No. 8. Both guns had been manufactured in 1899 by the Bethlehem Iron Works. The carriage in emplacement no. 1 had been manufactured by Morgan Engineering Co., of Alliance, Ohio, and the other by Bethlehem Iron Works on contract with the Ordnance Department. The battery had been given its final inspection by the Engineer in charge and turned over to the post commander eight months before on July 15, 1899.[17]

C. Construction of 12-inch Battery No. 3

1. Another Battery Takes Shape

During Fiscal Year 1898 Colonel Ludlow moved the plant into position, and in April (the month the United States declared war on Spain), his workmen began constructing twelve-inch Battery No. 3.

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16. Ibid., pp. 778-79. The plant used for positioning the sand included one 10-ton locomotive, one hoisting engine with boiler, one boiler for the old hoisting engine, and a derrick mast. Ibid., p. 779.

17. Battery Alexander Emplacement Book, Fort Hancock, NA, RG 392; Executive Documents, Ser. 4089, XV, 839.

This emplacement, designed to mount two 12-inch guns on disappearing carriages, would tie into the left flank of ten-inch Battery No. 2. It would be funded by an $80,000 allotment from the appropriation for "National Defense" signed into law by President William McKinley on March 9, 1898. In his annual report for the fiscal year, Major Adams forecast that both "platforms will be ready for armament by August, and with fair weather the battery may be completed by January 1, 1899."[18]

The construction of the battery necessitated demolition of much of the southeast bastion of the old fort. The battery's right flank extended to within a few yards of the boardwalk and railroad leading to the Ordnance Department's proof battery. Obstructing the battery's field of fire and compelling the Engineers to defer positioning the sand constituting the battery's exterior slope were the salient angle of the bastion, on which Proving Ground personnel had erected a searchlight and observation tower, and other proof battery structures (a tool house, paint shop, and service magazine) fronting the bastion's exterior slope.[19]

The battery was completed in June 1899, and provided with the necessary machinery. Guns and carriages had been delivered by the Ordnance Department but had not been mounted.[20]

During the fifteen months that the battery was under construction, 12,200 cubic yards of concrete and 2,244 square yards of pavement had been placed, and 8,380 cubic yards of sand and 1,800 cubic yards of masonry from the old fort had been excavated and placed in the parapet. In Fiscal Year 1899, 12,190 cubic yards of concrete had been mixed, positioned, and rammed at a mean cost, less the plant, of $4 per cubic yard. In addition, 2,442 square yards of concrete pavement,

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18. Executive Documents, Ser. 3746, IV, 632, 635.

19. "Sketch of 12-inch Battery . . . [No. 3] and Part of Ordnance Proving Ground at Sandy Hook, N.d.," NA, RG 77.

20. Executive Documents, Ser. 3905, VIII, 779.

12 inches thick, had been poured at an average cost of $1.30 per square yard; 8,230 cubic yards of sand had been excavated and placed in the parapet at a cost of 23 cents per square yard; and 1,806 cubic yards of masonry excavated from the scarp and casemates of the old fort at an average cost of 58 cents per cubic yard. Asphalt was placed over all rooms and passages in a layer approximately one inch thick at a cost of $1.67 per yard.

The cost of materials delivered at the wharf was: Rosendale cement, 67 cents per barrel; broken stone, $1.06 per cubic yard; and Portland cement, $2.06 per barrel. Sand was excavated from the reservation, with the average haul being 3,000 feet.[21]

2. Arming the Battery

In October and November 1899, the two 52-ton, 12-inch breech-loading rifles, Model 1888, M1½, were mounted. Positioned in emplacement no. 1 was Gun No. 43 and in emplacement no. 2 was Gun No. 42. Both pieces had been manufactured in 1897 at the Army's Watervliet Gun Factory. The guns were mounted on Model 1896 disappearing carriages. The former was on carriage no. 22 manufactured by Morgan Engineering Co., and the latter on carriage no. 19 sold to the Ordnance Department by Bethlehem Iron Works.[22]

On December 20, 1899, the battery was transferred to the garrison by Major Adams.[23] The battery had not been completed, however. Until the Ordnance Department relocated the proof battery, the positioning of the sand parapet and removal of the scarp of the old fort's bastion was deferred. To prevent seepage, the exposed concrete was treated with Sylvester waterproofing compound.[24]

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21. Ibid., pp. 778-79.

22. Battery Bloomfield Emplacement Book, Fort Hancock, NA, RG 392.

23. Adams had been promoted to lieutenant colonel on May 2, 1901.

24. Executive Documents, Ser. 4089, XV, 839.

D. Battery During the Early Years of the 20th Century

1. Seven Emplacements Become Battery Halleck

On April 4, 1900, the War Department published General Order No. 43, designating as Battery Halleck the seven-gun battery on the "old stone fort at Sandy Hook." The officer honored was Henry W. Halleck, a New Yorker, who had graduated from the U.S. Military Academy in the Class of 1839. After serving as an assistant engineer on several of the New York Harbor forts, Halleck was sent to Europe in 1844 to study and report on the French coastal defenses. His report which was published by Congress secured for him an invitation from the Lowell Institute of Boston to deliver a series of lectures which were published. En route to California in 1846, he translated Henri Jommi's monumental Vie Politique et Militaire de Napoleon.

While in California, Halleck discharged numerous important administrative duties for which he was breveted a captain. In 1854 he resigned from the Army to become head of the prestigious California law firm, Halleck, Peachy & Billings. Soon after the firing on Fort Sumter, in April 1861, Lt. Gen. Winfield Scott recommended to President Abraham Lincoln that Halleck be named a major general in the regular establishment. This was done with Halleck's rank to date from August 19, 1861. In November 1861 Halleck assumed command of the Department of the Missouri. A series of victories by his subordinates--U.S. Grant at Forts Henry and Donelson, Samuel R. Curtis at Pea Ridge, and John Pope at Island No. 10--was capitalized upon by Halleck to increase his authority. He took the field following Shiloh and with three armies slowly closed in on the Confederate army holding Corinth. The Rebels, although outnumbered two to one, stole a march on Halleck, evacuated Corinth, and left the Federals with a barren victory.

In July 1862 Halleck was called to Washington to serve as President Lincoln's general-in-chief. He was ineffective in that role, and in March 1864 when General Grant was promoted and given command of all the Union armies, Halleck was shunted aside and became chief-of-staff--a position in which he served as a glorified paper shuffler.

In the post Civil War years, Halleck held several important departmental commands. While commanding the Division of the South, he died at Louisville, Kentucky, on January 9, 1872.[25]

2. Maintenance of the 7-Gun Battery: 1900-1904

a. Projects Involving the Three 10-Inch Emplacements

In Fiscal Year 1900 a crew cut out and removed 836 square yards of Rosendale cement over the magazines of the 10-inch battery to a depth of one foot and replaced it with Portland cement pavement. Minor repairs were also made to the wiring.[26]

The following year galleries were constructed to connect the loading platforms of the three emplacements. These galleries had wooden flooring, supported by steel columns. To keep men from falling off, gaspipe handrails were installed.[27]

In Fiscal Year 1902 cracks in the loading platform of emplacement no. 2 were cut out and filled with waterproof cement to stop leaks in the ceilings and walls of Battery Halleck.[28]

b. Projects Involving the Seven Emplacements

Steel implement racks were affixed to the emplacement walls in Fiscal Year 1901.[29] At the same time minor repairs were made to the floor drains, superior slopes, and electric lighting system.[30]

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25. General Order 43, War Department, April 4, 1900; Warner, Generals in Blue, pp. 195-97.

26. Executive Documents, Ser. 4089, XV, 840.

27. Executive Documents, Ser. 4279 XII, 768.

28. Executive Documents, Ser. 4444, V, 692.

29. Executive Documents, Ser. 4279, XII, 768.

30. Ibid.

In Fiscal Year 1902 steel ventilating doors were hung at the entrance to the storage-battery rooms.[31]

Chief Engineer Gillespie allotted $10,525 for the preservation and repair of the Fort Hancock defenses in Fiscal Year 1903. This sum, in accordance with Assistant Engineer Hurlbut's estimates, was budgeted as follows:

Relaying floors and building systems for "positive" drainage:		
Battery Halleck	$3,500.00	
Gun-Lift Battery	1,250.00	
Battery Granger	1,000.00	
Mortar Battery	250.00	
5-inch rapid-fire battery	250.00	
15-pounder rapid-fire battery	250.00	
Total		$ 6,500.00
Care of gun-lift mechanism, one engineer	1,200.00	1,200.00
Twenty-five rooms, requiring slight repairs	625.00	
Brush fences to protect rapid-fire batteries	250.00	
One boatload of cinders at Battery Halleck to cover area where 1874-1901 proof battery had been removed	250.00	
Repairs to inside walls of gun-lift battery, scraping, plastering, and whitewashing	1,200.00	
Repairs to railroad to the batteries	500.00	2,825.00
Total		$10,525.00[32]

31. Executive Documents, Ser. 4444, p. 692; "Details of Steel Doors, specifications issued by Maj. W. L. Marshall, Corps of Engineers, U.S.A., June 5, 1902," NA, RG 77.

32. Marshall to Hurlbut, Sept. 9, 1902, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

After these projects had been implemented, plans "Showing the Drainage and Electric Wiring" in the Battery Halleck emplacements were prepared by the Corps of Engineers and approved by the Secretary of War. Attached to these plans were instructions for the garrison on the care and maintenance of these systems.

They were informed that: (a) 4-inch drain pipes led from strainers in the rooms to manholes in the rear of the battery and that 3-inch drains led into the counterweight wells, while a 6-inch drain led from each counterweight well to the manhole. (b) The floors were graded to fall toward strainers, which were removable (c) All drain pipes were to be carefully inspected and cleared at least once a week. Occasionally, the pipes were to be flushed by a hose run from hydrants. (d) All rooms and passages and open drains were to be swept and all rubbish removed once a week, care being taken to see that the holes in strainers were kept open and free from dirt. Sweepings were to be removed to such places that they could not be carried back by wind or water. (e) Immediately after each rain the earthen slopes were to be inspected and any erosions corrected. Any serious gullying was to be reported to the District Engineer. (f) No person, except those inspecting or repairing them, were to be allowed upon the earthen slopes. (g) Doors and ventilators would be closed in winter, except on days when there was a brisk breeze and clear weather with the temperature "well above the mean annual temperature"; in still or calm weather; when the air was full of fog or mist; and generally at night and after 2 P.M. (h) Doors and ventilators would be opened whenever there was a wind exceeding five miles an hour blowing across the battery and the temperature was above normal, with no fog, mist, or rain; between daylight and noon on clear days, whenever there was a breeze and the temperature was not too low; and every day in the summer when the humidity was normal. (i) Two duplex cables provided energy for the lights and motors. Branches of the light cables led from manholes through handholes in the floor to switch and junction boxes built inside walls and also through counterweight walls to switch-boxes on gun platforms. Branches of the motor cable led from manholes through handholes in the floor to controllers for ammunition hoists and also to motor generator equipment in

rooms under loading platforms. (j) Each light in the lower level rooms had a separate cable from a junction box, laid in an overhead conduit of sheet metal pipe. Lights on lift platforms and those in booths had cables from adjacent switches and junction boxes. Lights on walls of gun and loading platforms were fed by armored cables from switch boxes.[33]

E. Construction of 12-Inch Battery No. 4

1. Proof Battery is Relocated and Construction Begins

In 1901 the Ordnance Department succumbed to pressure and relocated its proof battery. Its new position was parallel to and several hundred yards south of the area which had served as the proof battery since 1874.

With the proof battery out of the way, Major Marshall utilized a $100,000 allotment from the Act of March 1, 1901, and had a crew begin construction of a two-gun battery on the right of 12-inch Battery No. 3 in the autumn of 1901. Colonel Adams had transferred the 12-inch battery to the artillery two years before. The new battery was to be armed with 12-inch breech-loading rifles, Model 1901, on disappearing carriages. Before work closed down for the winter, the foundations had been laid up to the bottom of the flooring.

In February and March 1902 the concrete plant was removed from near the Dynamite Battery to the construction site. The trestle, stone- and sand-bins, and cement shed were removed and rebuilt. Hoisting and mixer engines were set up, four well points driven and connected with a steam pump, and an engine house erected. Tracks were laid over which the concrete cars were handled by cable. Three derricks were positioned to move the concrete from the cars into position. By early April the plant was in operation, and by June 30, some

33. "Plan Showing Drainage and Electric Wiring Emplacement 1 and 2 of Battery Halleck"; "Plan Showing Drainage and Electric Systems Emplacements 3 and 4 of Battery Halleck"; "Plan Showing Drainage and Electric Systems Emplacements 5, 6, and 7 Battery Halleck"; and "Plan Showing Drainage and Electric Systems Emplacements 8 and 9, Battery Halleck," NA, RG 77.

4,000 cubic yards of concrete were in place at a cost of $6.02 per cubic yard. Steel beams had been delivered and doors contracted for.[34]

2. Battery is Armed

By November 1902 the emplacements, except for the sand parapet, were nearing completion. The carriages to be positioned in the battery were the first of a new model being manufactured for the Ordnance Department by Midvale Steel. Consequently, Chief of Ordnance William Crozier wanted them test-fired about 80 times from Endicott emplacements. Chief Engineer Gillespie was agreeable, provided the tests did not interfere with completion of the battery. General Crozier trusted that the tests would take place as soon as possible so that any necessary modifications could be made in the type of carriage before any more were delivered.[35]

In his reply, Major Marshall reported that all the concrete work, except for paving the rooms and sidewalks, had been "substantially completed." The guns could be mounted at once and be fired immediately thereafter. Although the sand parapet had not been positioned, Marshall believed the hollow tile drains, fronting the concrete, could be protected by sand before the big 12-inch rifles were mounted.[36]

On its arrival at Sandy Hook, carriage no. 3 was taken charge of by the commander of the Proving Ground. When Proving Ground personnel positioned it in emplacement no. 2, they found that to accelerate the return to battery of the 12-inch breech-loading rifle, Model

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34. Executive Documents, Ser. 4444, V, 691; "Fort Hancock, Sandy Hook, Two Emplacements for Twelve-Inch B. L. Rifles, Mounted on U.S. Disappearing Carriages, Model 1897, at Right Flank of Battery Halleck, drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., July 1901," NA, RG 77.

35. Gillespie to Marshall, Nov. 20, 1902, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

36. Marshall to Gillespie, Nov. 22, 1902, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

1900, the counterweight would have to be increased. This would necessitate increasing the depth of the counterweight well four inches and the dimension of the platform plate from 89 to 93 inches.

It was the spring of 1904 before these changes were made and carriage no. 4 positioned in emplacement no. 1. Gun No. 1, Model 1900, was mounted on carriage no. 4 and Gun No. 2, Model 1900, on carriage no. 3.[37]

Meanwhile, the sand parapet fronting the battery, as well as the two 12-inch emplacements on the left, was completed. The scarp of the old fort's southeast bastion, which had been left standing when 12-inch Battery No. 3 was constructed, was finally taken down, unmasking the fire of the big 12-inch rifles. On April 23, 1904, Colonel Marshall made his final inspection of the battery and turned it over to Fort Hancock commander Colonel Leary.[38]

F. Construction and Maintenance History: 1903-1905

1. Installation of Telautograph Niches, Telephone Booths, and Crows-Nests

In February 1904 Major Marshall sought the department's approval for cutting niches for telautographs and telephones in the emplacement of Batteries Halleck and Granger, except in the two recently completed 12-inch emplacements on the right of the former. In the right emplacement of Battery Granger, the niche would be in the traverse wall on the left side of the loading platform and about twelve inches from the corner formed by the corridor wall and the traverse. In emplacements nos. 3, 4, 8, and 9 of Battery Halleck, the niche was to be cut in that portion of the corridor wall which made an angle of 45 degrees with the direction of the capital and magistral lines. Locations for the niches in

37. Crozier to Gillespie, and Smith to Chief of Ordnance, Aug. 6, 1907, NA, RG 77, Correspondence, Fort Hancock, 1901-03.

38. Marshall to Engineer Officer, Div. of the East, May 4, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

the other emplacements would be settled in the future. A duct for wires, not less than 3 inches in diameter, would lead into the bottom of each niche in a manner best adjusted to each situation.[39]

The department was unable to allot funds for the niches at this time. Nine months later, in November 1905, Marshall reminded the department that there were needed at Fort Hancock ten telautograph niches--two at Battery Granger and eight at Battery Halleck. Those for the latter were to be installed: two each for emplacements nos. 1 and 2, 3 and 4, 5-7, and 8 and 9. Cost of the telautograph niches, with ducts and doors, would average $200.

At Battery Granger two crows-nests were also required. Four were called for at Battery Halleck, one for emplacements nos. 3 and 4, two for emplacements nos. 5-7, and one for emplacements nos. 8 and 9.

The crows-nests for the New York defenses, Colonel Marshall reported, would be adapted to a variety of conditions. Some would be cut out of concrete, some would be built of steel, while others would necessitate a bridge to provide access to them at the loading platform level. The average cost of construction would be $500.

At Battery Granger and the three 10-inch Battery Halleck emplacements, the positioning of the crows-nests, telautograph niches, and new ammunition hoists, together with hoods over the delivery tables, would necessitate "great ingenuity in complying with the demand for crow-nests and niches."[40]

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39. Marshall to Hurlbut, Feb. 17, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

40. Marshall to Mackenzie, Nov. 25, 1904, NA, RG 77, Press Copies, Ltrs. Sent, New York Defenses.

Chief Engineer Mackenzie approved the project and made the necessary funds available. A crew was soon at work cutting out and wiring the telautograph niches and positioning the crows-nests. By the summer of 1905 these two adjuncts to the fire-control systems of Batteries Halleck and Granger were inspected and turned over to the artillery by Colonel Marshall.

On April 29, 1905, Marshall forwarded to Assistant Engineer Hurlbut plans for a telephone booth for the mortar batteries. An allotment of $4,800 had been made by Chief Engineer Mackenzie for construction of four booths, one for each mortar pit. To resist the severe blasts, the foundations were to be built with care and the booth walls to be of concrete at least 18 inches thick.[41] After the plans were approved and the funds allotted, the telephone booths were built.

Within ten years the telautograph system was declared obsolete. It was replaced by telephones connecting the batteries with the various commanders' and fire-control posts.

In 1921 the old telautograph power lines entering Batteries Alexander, Halleck, Bloomfield, Richardson, and Granger were pulled and salvaged. The cables (6 pr. lead covered) running through exterior duct lines to the fire-control switchboard rooms were left in position to be utilized as heretofore for fire-control communication lines to telephones in the batteries. Some of the telautograph cables had been spliced at outside manholes opposite the batteries and pulled through ducts to connect with terminal boxes in the plotting rooms. Removal of the telautograph lines in the batteries necessitated re-installation of telephones and telephone lines.[42]

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41. Marshall to Hurlbut, April 29, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

42. Carruth to C.O., Sandy Hook Defenses, June 9, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

2. Maintenance and Improvements in Fiscal Year 1905

On August 2, 1904, Colonel Marshall notified Assistant Engineer Hurlbut that there was $9,260 available for preservation and repair of the Fort Hancock fortifications in Fiscal Year 1905. It was to be budgeted:

Employment of engineer for gun-lift mechanism	$1,200.00
Employment of engineer and stoker at powerhouse, at $155 per month	1,860.00
Laying conduits and placing cables from powerhouse to Battery Reynolds. The construction of macadamized road by Quartermaster Department along line of trenches made the conduit necessary	2,000.00
Repairs to superior slope Battery Granger, damaged by firing	500.00
Painting superior slopes of Batteries Halleck and Granger	250.00
General repairs to batteries (current)	500.00
Necessary repairs to Engineer barracks and painting and repairing Engineer office, Engineer's quarters, and overseer's house	600.00
Installing iron doors, four 12-inch emplacements, Battery Halleck	400.00
Lowering ground in rear of Batteries Halleck and Granger, to keep water out of galleries	450.00
Installing 18 iron ventilating doors for magazines and shellrooms of Batteries Halleck and Granger	1,500.00
Total	$9,260.00[43]

These projects were all accomplished by Hurlbut and his men.

In 1904 Colonel Marshall informed the garrison that it had not been the practice of his office to whitewash interior rooms of the emplacements after the batteries had been turned over to the "care" of the troops. The only exception had been when a "general overhaul" was needed.

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43. Marshall to Hurlbut, Aug. 2, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

Lime and other materials would be issued to the artillery on application of the post commander.[44]

3. Construction of Latrines

On November 18, 1903, Major Marshall contacted Lt. Col. Peter Leary, Jr., the Fort Hancock commander. As soon as funds became available, he planned to construct latrines for all the batteries. The latrines would be small, scattered, and at a considerable distance from the post sewers.

Several years before, the officer in charge of the Proving Ground had refused permission to the Engineers to tap their sewer as an outlet. The reason, with which the Engineers had no quarrel, was that the Proving Ground sewer was "inadequate in size for their own buildings."

Marshall had also learned that the Fort Hancock medical officers, although all the cities fronting on the lower Hudson discharged their sewers into the lower bay, insisted that no future Sandy Hook sewers be permitted to empty into Sandy Hook Bay. Instead, they were to flow into the ocean. As an engineering problem this was impractical, Marshall complained to Colonel Leary. No sewer could be kept open on the oceanside, and he for one would decline to "attempt such outlets."

A feasible solution would be to construct latrines "with water-tight receptacles, such as septic tanks, to be cleaned out at long intervals, or else adopt a system of earth closets." The most economical and effective arrangement would be a system of "septic tanks, water-tight and with final outlets into the sand of harmless sewage below the salt water level, . . . seaward of the batteries."[45]

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44. Marshall to Mackenzie, Nov. 25, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

45. Marshall to Leary, Nov. 18, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

Colonel Leary approved the septic tank approach. In Fiscal Year 1904 several small detached latrines were built for the use of the troops when they were on duty at the guns.

4. 10-Inch Batteries Receive Taylor-Raymond Chain Hoists

On April 5, 1904, Major Marshall, as requested, submitted estimates for remodeling the 10-inch emplacements to receive Taylor-Raymond chain hoists. These figures included the installation of the machinery. For the two Battery Granger emplacements he needed $1,800, and for the three Battery Halleck platforms $2,700. Covering the corridor would cost an additional $200 for each emplacement. Funds to the amount of $2,000 to expedite the work could be withdrawn from the allotment for six 3-inch rapid-fire emplacements.[46]

Later, on April 29 Marshall acknowledged receipt of a letter from Assistant Engineer Hurlbut relative to cutting out concrete to provide space for positioning the hoists. Hurlbut was to proceed with the work. Details of the ironwork needed to be finished before the new shafts were being prepared.[47]

On September 20 Marshall informed the post commander, Maj. H. L. Harris, that his men were installing the chain hoists in Battery Granger. It would therefore be impossible to fire the 10-inch guns unless it was for sub-caliber practice. If all went according to schedule, Hurlbut and his men would be finished within a month. But, to avoid damaging the new masonry, the big rifles should not be fired for another sixty days.[48]

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46. Marshall to Mackenzie, April 5, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

47. Marshall to Hurlbut, April 29, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

48. Marshall to Harris, Sept. 20, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

A box containing anti-noise prawls and controller rings for the 10-inch Taylor-Raymond chain hoists was received at Fort Hancock in mid-May 1905. Assistant Engineer Hurlbut would use these in implementing necessary changes.[49]

When he made his semi-annual inspection in the summer of 1905, Marshall found all the Taylor-Raymond hoists "out of order so far as the electric equipment was concerned." These hoists had been in use by the artillery for about eight months. An examination satisfied Marshall that inexperienced personnel had been tampering with the controllers. In the weeks following his inspection, the anti-noise prawls were installed, the machinery put back in order, and the chain-hoists of the 10-inch guns of Batteries Halleck and Granger turned over to the artillery.[50]

G. Three of the Batteries are Redesignated

1. War Department's General Order No. 194

The seven guns of Battery Halleck and the two of the new battery constituted four separate fire commands. To simplify and delineate this situation, the War Department on December 27, 1904, issued General Order No. 194 redesignating three of the batteries. The three 10-inch emplacements would continue to be known as Battery Halleck; the two 12-inch emplacements on the left of Battery Halleck were renamed Battery Alexander; the two 12-inch emplacements on the right of Battery Halleck were redesignated Battery Bloomfield; and the two 12-inch emplacements on the extreme right of the 9-gun battery were designated Battery Richardson.[51]

Battery Alexander honored William Alexander, better known as Lord Stirling, who was born in New York City in 1726. Like his

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49. Marshall to Hurlbut, May 16, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

50. Marshall to Mackenzie, undated, NA, RG 77, Press Copies, Ltrs. Sent, New York Defenses.

51. General Order 194, War Department, Dec. 27, 1904.

father, William was well educated, being especially proficient in mathematics and astronomy. Alexander, as a young man, was engaged in business with his widowed mother. In connection with this business, he joined the British Army in the commissariat early in the French and Indian War and became an aide-de-camp to Governor William Shirley. In 1762 he prosecuted unsuccessfully his claim to the earldom of Stirling before the House of Lords. In 1761 he married a daughter of Philip Livingston.

Alexander held the office of surveyor-general and was also a member of the New York Provincial Council. The former office had been held by his father. He was one of the founders of King's College and served as its first governor.

William Alexander was an ardent Whig. In November 1775 he was commissioned colonel of the 1st New Jersey Regiment. He distinguished himself in January 1776 by capturing the British armed transport, Blue Mountain Valley, for which exploit the Continental Congress appointed him a brigadier general in March 1776. At the Battle of Long Island in August 1776, his brigade was decimated and Alexander captured. He was soon exchanged, and in February 1777 promoted to major general. Alexander participated in the battles of Trenton, where he accepted the surrender of a Hessian regiment; Metuchin, where his division lost two cannon and 150 persons; Brandywine, Germantown, Monmouth, and Paulus Hook. He died of gout at Albany on January 15, 1783.[52]

Battery Bloomfield was also named for a Revolutionary War soldier. Joseph Bloomfield was born in October 1753 in Woodbridge, New Jersey. He was educated at the Rev. Enoch Green's school, read law, and was admitted to the bar in 1775. In February 1776 he was commissioned a captain in the 3d New Jersey Regiment. He served throughout the Revolutionary War, attaining the rank of major. In 1783

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52. Appletons' Cyclopaedia of American Biography (6 vols., New York, 1888), I, 48.

Bloomfield was elected attorney general of New Jersey. He was governor in 1801-02. Re-entering the service, he exercised command as a brigadier general in the War of 1812. Bloomfield was elected as a Democrat to the 15th and 16th Congresses, where he chaired the Committee on Revolutionary Pensions. He died at Burlington on October 3, 1825.[53]

Battery Richardson honored Israel B. Richardson of Vermont. Graduating from the U.S. Military Academy in the Class of 1841, Richardson was commissioned a 2d lieutenant of infantry. He served in the Second Seminole and Mexican Wars. In the latter, he was breveted twice for gallantry.

Richardson resigned from the Army in 1855 to become a farmer at Pontiac, Michigan. Within six weeks of the bombardment and surrender of Fort Sumter, Richardson had organized the 2d Michigan Infantry. As a colonel, he fought at First Manassas. In August he was promoted to brigadier general and led a division in Sumner's Corps in the Peninsula Campaign. He was made a major general in July 1862. At Antietam on September 17, 1862, as Richardson was leading his division in an assault on the Confederates holding the Bloody Lane, he was mortally wounded.[54]

2. Name Boards for the Batteries

Signs with the batteries' names were painted in 6-inch black block letters on a white background. The sign boards were metal plates, ten inches in width, with their length dependent on the number of letters in the battery's name.[55]

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53. Biographical Directory of the American Congress 1774-1971 . . . (Washington, 1971), p. 605.

54. Warner, Generals in Blue, pp. 402-03.

55. Marshall to Howell, Aug. 1, 1904, NA, RG 77, Press Copies, Ltrs. Sent, New York Defenses.

H. Modernization, Repairs, and Maintenance: 1905-1917

1. Battery Alexander Causes Problems

In the spring of 1905 Colonel Marshall observed that there were leaks in the shellrooms, magazines, and corridors of Battery Alexander.[56] When he made his semi-annual inspection in the summer of 1905, he reported seepage in the rooms. Battery William Alexander, he wrote, was "incorrigible, due [to] the incorporation of part of the old stone fort into its mass, and the poor connection with Battery Halleck." Despite painstaking efforts, the whereabouts of the crack or cracks causing the leakage had not been discovered.[57]

A year later, Marshall found a "general atmosphere of neglect." Both hoists were jammed and "inoperative on reverse."[58]

In November 1908 an electrical conduit was positioned, leading from the cable tank to Battery Alexander.[59] Its cost was $200, exclusive of labor. The following year, the battery's magazines and galleries were waterproofed.

On July 1, 1916, while the battery was being fired, someone inadvertently left the door to the 25-kilowatt shelter open. The concussion knocked the door from its hinges, leaving it badly damaged. The following year the post commander notified the Engineers that the Battery Alexander plotting room required repairs.[60]

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56. Marshall to Mackenzie, undated, NA, RG 77, Press Copies, Ltrs. Sent, New York Defenses.

57. Ibid., undated, NA, RG 77, Press Copies, Ltrs. Sent, New York Defenses.

58. Ibid., July 7, 1906, NA, RG 77, Press Copies, Ltrs. Sent, New York Defenses.

59. Roessler to Hurlbut, Nov. 24, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

60. Post Commander to District Engineer, July 1, 1916, and Aug. 23, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

2. 1906-1907 Modernization of Battery Halleck

On June 25, 1906, Marshall mailed to the department for approval plans and details for modernizing Battery Halleck. The details of the platform extensions and of the battery commander's station were similar to those already sanctioned for Battery Granger and would be of reinforced concrete.

It was proposed to build the elevated walks with wooden flooring, supported on a light steel framework. Behind the hoist delivery tables, where concrete roofs with steel columns had already been erected, the walkway would be supported on steel brackets attached to the columns. The remainder of the elevated walk would be supported on a single line of steel columns, braced to the rear edge of the platforms.[61]

The plans, as approved, called for: (a) reinforcing bars in the columns to be "plain square steel," while those in the beams and slabs would be square twisted steel; (b) forms for the beams and slabs would not be removed for at least four weeks after the concrete work had been finished; (c) no bars would be positioned with less than 3/4-inch of concrete on their underside; (d) concrete in beams, slabs, and columns would be one part Portland cement, two parts sand, and four parts broken stone about 3/4-inch in size; (e) concrete in column bases and footings was to be one part Portland cement, two parts sand, and five parts broken stone about two inches in size; and (f) all concrete was to be positioned wet.[62]

On July 19 Marshall informed Assistant Engineer Hurlbut that all the new stations (both battery commanders' and secondary) were

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61. Marshall to Mackenzie, June 25, 1906, NA RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

62. "Fort Hancock, n.d., Plan and Details for Modernizing Battery Halleck, drawn under direction of Lieut. Col. W. L. Marshall, Corps of Engineers, U.S.A., June 1906," NA, RG 77.

to have the top of their observation slots, with window open, five feet, six inches, above floor level.[63]

The battery commanders' stations were equipped with speaking tubes, linking them with the telautograph booths. The mouth pieces of these speaking tubes were positioned 3' 8" above the floors.[64]

In mid-July Marshall provided Hurlbut with plans for the lighting and telephone systems to be installed in the battery commanders' stations.[65]

The modernization of Battery Halleck was completed, the work inspected, and responsibility for the battery returned to the garrison in September 1907.[66]

3. <u>One Range-Finder Tower Becomes a Battery Commander's Station</u>

On March 16, 1906, Marshall mailed to the Fort Hancock commander plans of an addition to be erected in connection with the former range-finder tower which was to be employed as a battle commander's station. The first floor would house the commander's sleeping quarters, a lavatory, and space for five telephone booths, if needed. On the second floor there was space for ten telephone booths. Speaking tubes from the observation room to each booth were called for.[67]

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63. Marshall to Hurlbut, July 19, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

64. Hurlbut to Marshall, April 9, 13, May 15, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

65. Marshall to Chief Engineer, July 13, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

66. Hurlbut to Marshall, Aug. 14, 1907, and Marshall to Chief Engineer, Aug. 15, Sept. 23, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

67. Marshall to C.O., Fort Hancock, March 16, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

The range-finder tower, midway between Battery Granger and the mortar battery, was converted into a battery commander's station in the summer of 1907. Marshall made his final inspection of the station on October 25 and transferred it to the garrison.[68]

In June 1912 authority was given to paint the three towers. Three years later, in 1915, the towers were declared superfluous to the fire contract system and were demolished.[69]

4. Maintenance and Repairs: 1908-1912

a. A Fire Damages Battery Bloomfield

About daybreak on June 26, 1908, a fire was discovered in emplacement no. 2 of Battery Bloomfield. It was put out by the troops before it reached the magazines or shellrooms. When he checked the damages, Assistant Engineer Hurlbut found that the blaze had started in the storeroom on the left of the emplacement in front of the relocating room. This room had been used for oil storage. The ceilings of this room, the relocating room, and the guardroom had been damaged; two doors had been broken down fighting the fire; and electric light fixtures and wires were charred.[70]

On July 8 Hurlbut requested and received authority for repairing and waterproofing the emplacement damaged by the fire. This work was accomplished by August 15 at a cost of $272.43.[71]

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68. Marshall to Chief Engineer, Oct. 7, 23, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

69. Hurlbut to Roessler, June 14, 1912, and Roessler to Chief Engineer, March 19, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

70. Hurlbut to District Engineer, June 26, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

71. Ibid., July 8, Sept. 11, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

b. Stabilizing the Earthen Parapets Fronting the Batteries

On June 3, 1909, it was reported to District Engineer Roessler that muzzle blasts had stripped the sand from the top of the parapet of Battery Richardson.[72] Hurlbut replaced the sand with cinders and "coal pitch tar." Seeing that the blasts still caused problems, he employed wire mesh to hold the cover in postiion.[73]

To cope with this problem which caused sand to billow up in clouds whenever the big guns were fired, District Engineer Roessler asked the department for authority to sod the slopes of the batteries. The blown sand was continually drifting into the emplacements.[74] Chief Engineer Marshall vetoed the idea of sodding the slopes as too costly. Some other remedy must be found to combat the drifting sand.[75]

As an experiment Hurlbut employed a twine fence to form a sand screen to protect the superior slopes. This was unsuccessful. Beginning in May 1910 the superior slopes were treated with a mixture of cinders, tar, and pitch to curb the blowing sand and dust clouds, whenever the big 12- and 10-inch rifles were fired.[76]

The use of cinders, tar, and pitch helped to secure the sand, but it was only a temporary solution. In December 1912 Colonel

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72. Hurlbut to Roessler, June 3, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

73. Ibid., May 17, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

74. Roessler to Chief Engineer, March 14, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

75. Chief Engineer to Roessler, March 16, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

76. Hurlbut to Roessler, May 6, 10, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Roessler again asked the department for an allotment to replace with sod the sand embankment fronting Batteries Richardson and Bloomfield.[77] There was a new Chief Engineer, and this time the project to sod the earthen slopes of the nine-gun battery was approved.

c. Whitewashing and Painting the Batteries

On February 27, 1909, Assistant Engineer Hurlbut notified the District Engineer that several of the batteries' interior rooms required whitewashing and painting. Requisitions were submitted in March for whitewash and paint.[78] A dull brown paint was ordered for the Engineer buildings and the fire-control and battery commanders' stations.[79]

Colonel Roessler suggested to the department in May 1909 that the batteries be treated with a blue wash, similar to that employed at Fort Wadsworth.[80] The department was agreeable.

d. Repairing the Battery Halleck Apron

On June 21, 1909, Assistant Engineer Hurlbut notified the District Engineer that there was a crack in the concrete apron fronting Battery Halleck's emplacment no. 1. This was repaired.[81] Two and one-half years later, Hurlbut's attention was called by the battery

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77. Roessler to Chief Engineer, Dec. 3, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

78. Hurlbut to Roessler, Feb. 27, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

79. Ibid., March 5, 8, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

80. Roessler to Chief Engineer, May 27, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

81. Hurlbut to Roessler, June 21, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

commander to the concrete apron in front of emplacement No. 2. It was badly broken and would cost about $200 to repair.[82]

5. Rearming Battery Richardson

In March 1910 the two Battery Richardson 12-inch rifles, Model 1900, having become badly eroded by repeated firing, were replaced by two new Model 1895, M1, guns. Mounted in emplacement no. 1 was Gun No. 71 and in emplacement no. 2, Gun No. 64. Both these pieces had been manufactured at the Army Gun Factory at Watervliet.[83]

6. 1911-1912 Modernization of Batteries Bloomfield and Richardson

a. 1908 Estimates

In July 1908 estimates were prepared by the District Engineer for modernizing Batteries Bloomfield and Richardson. They were based upon a width of platform (gun-well center to rear edge) of 49 feet, 8 inches. When the design was plotted, it was decided to add three feet to this dimension to conform to "the 12-inch plan with an allowance for the increased length of the new model projectile." With no obstacles to a "definite extension of platforms toward the rear, it seemed best to make the areas ample to meet all demands."[84]

b. Waterproofing Battery Bloomfield

Almost three years were to pass before the department saw fit to approve and fund this project. Meanwhile, in March 1910 Hurlbut requested authority to spend $650 to waterproof

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82. Ibid., Sept. 17, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

83. Hurlbut to Roessler, July 10, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. The two guns removed from the battery were shipped to the Army Gun Factory where they were relined.

84. Roessler to File, undated, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Bloomfield's loading platforms.[85] This project was approved and necessary funds were allotted by the Chief Engineer in April 1911. The following month Union Construction & Waterproofing applied a coat of asphaltic mastic to emplacement no. 1.[86]

c. Allotment is Made and Plans Perfected

On April 11, 1911, Colonel Roessler informed the department that, because of heavy harbor traffic in the vicinity of the forts guarding the eastern and southern approaches to New York Harbor, the garrisons could only hold subcaliber practice with the big guns. Coast Artillery units manning these batteries were therefore brought to Fort Hancock for annual practice with the guns against towed targets. Consequently, it was desirable to bring the older type batteries at Sandy Hook up to standard as soon as funds were obligated.

Colonel Roessler reported that the platforms of Batteries Bloomfield and Richardson were too narrow and should be widened 8 feet, 6 inches, to bring them up to the standard called for in the latest specifications. Both works also should be provided with battery commanders' stations.[87]

Chief Engineer William Bixby, who had succeeded General Marshall in this position, called for the District Engineer to submit updated figures for modernization of Batteries Bloomfield and Richardson. Involved would be widening the platforms and raising the handrails to three feet. Colonel Roessler, however, allowed the $13,500 estimate of his predecessor to stand.

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85. Hurlbut to Roessler, March 13, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

86. Ibid., May 6, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

87. Roessler to Chief Engineer, April 11, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. As the platform was 6 feet deep at each side beyond the steps, there would be an offset of 1 foot, 8 inches. The steps would be retained but covered over. Hurlbut to Roessler, April 11, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

On May 24 Chief Engineer Bixby allotted the requested sum. When he saw that General Bixby had failed to allow money for construction of a battery commander's station, Colonel Roessler, in an effort to get him to change his mind, pointed out that Fort Hancock was the only seacoast defense in the harbor at which target practice, with the exception of subcaliber, was held. The department, however, refused to soften its stance.[88]

On July 8 Colonel Roessler called attention to standard plans for 12-inch emplacements, having the rear edge of the loading platform 52 feet behind the center of the gun-well. The new type projectiles were 5 inches longer than those in use when these plans were prepared. On his drawings for Bloomfield and Richardson, he had therefore placed the rear edge of the platform 52 feet, 8 inches, from the center of the gun-well to take cognizance of this change.[89] As the right emplacement of Battery Richardson was designed to fire to the flank and had a roofed corridor, supported on latticed steel columns, similar columns would be used for the corridor hood of the left emplacement.[90]

Plans for modernizing Battery Bloomfield called for the extension of the loading platforms to the rear and the removal of earthen embankment in the rear of the traverses, with existing corridor pavement. In addition, the plans provided for the construction of a new room under and a canopy over each delivery table platform.[91]

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88. Roessler to Chief Engineer, May 24, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. The sums budgeted for Batteries Richardson and Bloomfield were $5,500 and $8,000, respectively.

89. Ibid., July 8, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

90. Ibid.

91. Roessler to Post Commander, Fort Hancock, Aug. 15, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock; "Plan for Modernizing Battery Joseph Bloomfield, Fort Hancock, New Jersey," NA, RG 77.

d. Many Months Required to Complete the Project

With the annual drill season at hand, it was decided to defer commencement of the project. Meanwhile, the plant (derricks, concrete mixer, engines, locomotives, etc.) which had been in storage for months was assembled and repaired. Plans were prepared and approved for the installation of 33 platform lighting fixtures.

In late July Colonel Roessler organized his working force and announced that it would be activated in August at Battery Richardson. The Coast Artillery, however, continued with its service firing from neighboring Battery Bloomfield. This interfered with the modernization of Battery Richardson to such an extent that in late August the project was suspended and most of the men laid off until October 10, when the drill season for the Southern Artillery District of New York was scheduled to end.

The few men not furloughed cut a bench along the rear edge of the Battery Bloomfield loading platform similar to the one previously cut at Battery Richardson. To accomplish this task the handrail was removed, but, whenever there was target practice, a temporary barricade of barrels and scantling, similar to the one positioned at Battery Richardson, was erected.[92]

At the end of the drill season, Colonel Roessler reorganized his force. Men were soon busy removing the sand fill in the rear of the emplacements and certain wing concrete walls which were in the way of the widening of the platforms. The cost of eliminating the wing walls far exceeded estimates. This, added to unforeseen expenses associated with the suspension of work caused by the drills, exhausted the allotment in January 1912, before the project was finished. To

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92. Roessler to C.O., Fort Hancock, Sept. 6, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

complete the modernization of the batteries, Colonel Roessler notified the department, required another $2,000.[93]

On November 24 Colonel Roessler had advised Assistant Engineer Hurlbut that the handrails for the enlarged platforms were to have double railings. The horizontal line of the lower rail was to be 1 foot, 8 inches above the platform, and the upper rail 3 feet above the platform.[94]

First the cold weather and then the summer drill season compelled a continued suspension of the project. It was August 1912 before Chief Engineer Bixby allotted the requested $2,000. The labor force and plant were again assembled at the site, and, by winter of 1912-13, Colonel Roessler reported that Batteries Bloomfield and Richardson were modernized.

7. Removal of the 1874-1901 Proof Battery

a. A Need is Defined and Funds Allotted

In mid-December 1912 Lt. Col. Morris K. Barrol, commanding Fort Hancock, complained to his superiors of the presence in front of Battery Richardson of several abandoned concrete emplacements formerly serving the Proving Ground as a proof battery. One of these was on the Fort Hancock Reservation and the remainder on the Proving Ground. Colonel Barrol considered these platforms a menace, because they provided a "ricochet surface" for hostile projectiles. In addition, the detonation of an explosive shell striking one of them would shower men manning the nearby batteries with deadly fragments.[95]

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93. Roessler to Chief Engineer, Jan. 29, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

94. Roessler to Hurlbut, Nov. 24, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

95. Barrol to C.O., Southern Artillery District of New York, Dec. 13, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Barrol's complaint was forwarded through channels to the Chief Engineer. On January 29, 1913, General Bixby called on Colonel Roessler for a report as to whether it was feasible to remove the abandoned emplacements of the old proof battery with department funds. After reviewing the situation, Colonel Roessler reported that the subject emplacements (five of which were very large) were "scattered along a line nearly parallel with the capital of Battery Richrdson." The nearest one was at the foot of the exterior slope, and the farthest about 350 feet in front of the battery. He agreed that they constituted a threat to it. As to their removal, the smaller ones might be buried in the sand. If so, this would be the most economical way of getting rid of them. The larger platforms would have to be broken up by blasting, and the concrete buried or removed.[96]

Relaying this information to Chief Engineer Bixby, Colonel Roessler estimated that he needed $3,500 to remove the proof battery. This would be accomplished by "blasting the blocks into fragments of a cubic yard or less." The pieces were to be disposed of by "digging holes in the sand alongside them and pushing them into the holes."[97] On March 5 the Chief Engineer approved the plan and allotted $3,500 for implementing it.[98]

b. Implementing the Project

Although money was available, Colonel Roessler gave the project a low priority, and more than three years passed before it was completed. It was late summer before the Engineer Department began to stockpile the needed explosives. On August 29 Colonel Roessler

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96. Bixby to Crozier, Jan. 21, 1913, and Roessler to Chief Engineer, Feb. 11, 1913, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

97. Roessler to Chief Engineer, Feb. 28, 1913, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

98. Chief Engineer to Roessler, March 5, 1913, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

informed the post commander that he needed facilities for storage of 300 pounds of blasting powder in kegs, 100 pounds of dynamite, and some electric fuses.[99] Permission was granted for the Corps to store these explosives in the Battery Alexander magazines.[100]

In December 1913 the question surfaced of removing the remaining foundations of the old masonry fort, where they intruded into the nine-gun battery, in conjunction with demolition of the proof battery. It was dropped when it was determined that a new authorization would be required.[101]

By mid-May 1916 the Corps of Engineers had nearly finished the project. As was to be expected, a large quantity of iron, consisting of base rings, anchor bolts, plates, etc., was salvaged. These had belonged to the Ordnance Department, so Chief Engineer William M. Black asked the Proving Ground commander, Lt. Col. Charles Ruggles, if he wanted them.[102]

Colonel Ruggles was delighted to receive the salvaged materials, and arranged to have them removed by the Ordnance Detachment to the Proving Ground.[103] Ruggles' people were unable to remove "two base rings, which had been left in place on their concrete

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99. Roessler to C.O., Fort Hancock, Aug. 29, 1913, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

100. Allen to Roessler, Sept. 3, 1913, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

101. Roessler to C.O., Southern Artillery District of New York, Dec. 4, 1913, and Allen to Roessler, Dec. 29, 1913, NA, RG 77, Ltrs. Sent, & Recd., Fort Hancock.

102. Abbot to Ruggles, May 11, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

103. Ruggles to District Engineer, May 13, 1916, NA, RG 77, Ltrs. Sent & Recd., Chief Engineer.

foundations," and he assumed that they were to be buried.[104] On June 6, 1916, the project was reported completed. In removing the old proof battery platforms, the Engineers expended 416 pounds of black blasting powder.

8. Maintenance and Repairs in Fiscal Years 1912-1913

On December 9, 1912, a 14-inch rifle burst during tests at the proof battery. Flying fragments from the piece did $300 damage to Battery Richardson.[105]

Seepage continued to be a problem. On April 2, 1913, Colonel Roessler inquired as to what kind of oil was employed by Hurlbut in mixing concrete to make it waterproof. Hurlbut replied that he did not use oil for this purpose, but instead utilized soap and alum.[106]

I. World War I Years

1. Modernizing the Ammunition Hoists and Trolleys of the 12-Inch Emplacements

By October 1916 World War I had been raging for more than two years. Difficulties with Germany over "unrestricted submarine warfare" caused the United States to take action to strengthen its coastal defenses.

Among projects that would receive priority at Fort Hancock were the replacement of the obsolete ammunition hoists in the 9-gun battery. On October 17, 1916, Capt. Edward D. Andrey of the New York Engineer Office forwarded blueprints depicting changes necessary to

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104. Ruggles to District Engineer, May 10, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

105. Roessler to Chief Engineer, Dec. 9, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

106. Roessler to Hurlbut, April 2, 1913, and Hurlbut to Roessler, April 1913, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

facilitate installation of the 12-inch Taylor-Raymond projectile hoists slated to replace the Hodges hoists currently positioned in the 12-inch emplacements. Any concrete removed to facilitate this change would be cut out by compressed air drills.[107]

Three months later, in January 1917, Chief Engineer Black notified the commanding officer, Sandy Hook Defenses, that the Corps had been directed to replace the Hodges hoists with Taylor-Raymond hoists in Batteries Alexander, Bloomfield, and Richardson. This change had been dictated in part by the need to have a hoist capable of handling the new long-point projectiles. The new hoists were on hand, and it was desired to dismount the Hodges hoists to enable Engineer workmen to widen the hoist wells.[108]

The officer responsible for the defenses of New York asked that the batteries be modified in this sequence--Richardson, Bloomfield, and Alexander. He trusted that at least one of them would be ready for annual drill and target practice in 1917.[109]

It was decided by the District Engineer to give priority to replacing the hoists in the no. 2 emplacement of each battery. This would permit the Coast Artillery to have access to the No. 1 guns for practice and in event of an emergency.

By October 22, six months after the nation had entered World War I, the three Taylor-Raymond shot hoists for the no. 2 guns in

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107. Andrey to McCabe, Oct. 17, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

108. Abbot to C.O., Sandy Hook Defenses, Jan. 26, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Maj. Gen. William M. Black was Chief Engineer from March 1916 to October 1919. Col. Frederic Abbot was responsible for the Defenses of New York Harbor at this time.

109. C.O., Harbor Defenses, to District Engineer, Jan. 30, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Batteries Richardson, Bloomfield, and Alexander had been installed. They were so arranged that projectiles could also be delivered to the platforms of the no. 1 guns. The parts for hoists nos. 93, 94, and 95 had been received, and their installation would be commenced at an early date. Delays, heretofore experienced, had been caused by labor shortages at Sandy Hook.[110]

The hoists for the no. 1 emplacements were installed during the winter of 1917-18, and on April 3 transferred to the post commander. Still to be positioned at each of the delivery tables were new steel doors, but this would not interfere with their use by the troops.[111]

Colonel Harris, who commanded the New York Harbor Defenses, identified a deficiency in the system which should be guarded against in the future. This involved the platform on the delivery table at the top of the shot hoist. It was secured by iron rails imbedded in concrete onto which the projectile rolled when delivered from the hoist. These rails were positioned so that the rotating bands of the projectile struck one of them. In future installations, Harris trusted that the rails would be so spaced that the rotating bands cleared them, as the shells rolled from the shot hoist onto the truck.[112]

Double trolley powder carriers (Chisholm & Moore 453) were installed in the batteries, one in each powder room and four to a battery. The powder hoists were equipped with sheaves and shippers to

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110. Bingham to Chief Engineer, Oct. 22, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Brig. Gen. T. A. Bingham had been recalled to active duty on October 11, 1917, and made commanding officer of the Second Engineer District.

111. McCabe to District Engineer, March 6, 1918, and Bingham to Chief Engineer, March 20, April 5, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. See Appendix A for details regarding, "Installation of 12-inch Taylor-Raymond Hoists for Long-Point Projectiles, 1917-18."

112. Harris to District Engineer, April 10, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

raise a load at the far end seven feet, while the rear end was raised six feet. Eight shot trolley hoists were ordered for each battery. When installed, they provided two shot trolleys for each shellroom.[113]

2. Battery Halleck Loses Its No. 1 Gun

In November 1918, $4,250 was allotted by Chief Engineer Black for modification of the 10-inch Taylor-Raymond hoists at Batteries Halleck and Granger. Involved would be: removal of the hoists; widening of the lower hoist recesses and depressions in the floor under the hoists; removal of delivery tables and loading platforms and masonry and beams over the hoists; installation of new beams over the hoists; assembly and replacement of the hoists; placement of new masonry enclosure at the loading platforms; and installation of new electrical connections, steel doors, and delivery tables.[114]

Junior Engineer A. C. Swift ordered his men to work at Battery Halleck on February 10, 1919. On the 12th, after his men had dismounted Gun No. 1 gun and were removing the hoists in emplacements nos. 1 and 2, Swift was informed that it was doubtful that the two 10-inch batteries would be retained as units in the harbor defenses. Col. James Brady recommended against doing any major work on them until such time as a decision had been made as to their future utilization.[115]

Thus, work was stopped, and Gun No. 1 was not remounted. It was surveyed in June 1919 and shipped to the Army Gun Factory. On August 20 orders were issued by the District Engineer to ship the no. 1 emplacement hoist to Galveston, Texas. Four years later,

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113. District Engineer to Sanford, June 17, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

114. Bingham to Swift, Nov. 13, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

115. Swift to District Engineer, Feb. 12, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Colonel Brady had replaced Colonel Harris as defense commander in August 1918.

in 1923, the carriage was dismounted, surveyed, and sold for scrap by the post salvage officer. Henceforth, Battery Halleck was a two-gun position.[116]

3. Batteries Alexander, Bloomfield, and Richardson Get New Battery Commanders' Stations

On April 1, 1920, the Chief Engineer allotted $6,100 for construction of new battery commanders' stations at Batteries Richardson, Bloomfield, and Alexander, and a plotting room at Battery Engle to serve Battery Peck. The battery commanders' stations would be built by contract and the plotting room by day labor.[117]

Proposals were invited in June and contracts awarded in July for construction of the three battery commanders' stations. The structures were completed in early April 1921, and inspected by the District Engineer and transferred to the Coast Artillery on June 27.[118]

4. Hanging Doors and Providing More Generators

In the immediate postwar years, steel doors were hung at the ammunition hoists of Batteries Alexander, Halleck, Bloomfield, Richardson, and Granger. A powerhouse with two 25-kilowatt sets was constructed for Battery Alexander, while Battery Bloomfield was equipped with two 25-kilowatt generators.[119]

A small two-leaf steel door was hung in the interior room at the foot of the stairway leading from the firing platform to the

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116. District Engineer to Crawford, Aug. 20, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock; Battery Halleck Emplacement Book, Fort Hancock, NA, RG 392.

117. District Engineer to Carruth, April 1, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

118. Carruth to District Engineer, April 9, July 1, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

119. Ibid., Oct. 29, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

magazine of emplacement no. 2 at Battery Alexander. The door was locked from the inside by a padlock.[120]

5. Continuing Struggle Against Seepage

Seepage into the corridors and rooms was a continuing problem. On October 25, 1917, it was reported that the galleries and magazines of Battery Bloomfield were damp. In October 1919 Colonel Brady, as post commander, requested that the Engineer Department take steps to waterproof the magazines and casemates of Batteries Alexander, Halleck, Bloomfield, and Granger. The District Engineer estimated the cost of waterproofing the gun platforms of these batteries at $1,028 and the superior slopes at $11,314.[121]

With the nation's rush to demobilize and pare military expenditures down to the bone the Chief Engineer had to practice strict economy in the 1920s and through most of the 1930s. Consequently, only limited sums could be allotted to combatting the seepage.

In 1921 funds were programmed for attacking this problem at Battery Halleck. The battery's superior slope was brushed off to remove the old waterproofing and given two coats of Elaterite Waterproofing Compound. The waterproofed surface was then sanded.[122]

Three years later, in the spring of 1924, Batteries Halleck and Granger were given another waterproofing treatment.[123]

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120. Carruth to C.O., Sandy Hook Defenses, Aug. 2, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

121. District Engineer to Chief Engineer, Oct. 4, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

122. Carruth to C.O., Sandy Hook Defenses, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

123. Ladue to District Engineer, July 9, 1924, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

In the summer of 1925 Battery Richardson, which had had water seeping into its rooms, was waterproofed. This operation involved cutting out and grouting cracks in the exterior and superior slopes and applying a coat of liquid waterproofing.

The breakdown of the project's cost was:

Labor		
	Cutting out cracks	$131.50
	Applying waterproofing	125.75
	Total	$275.25
	Materials	74.53
	Overhead	88.43
	Total	$420.21[124]

J. Final Years

1. Role of the Batteries in the 1930s

By the mid-1930s two of the four batteries (Alexander and Halleck) had been dropped as obsolete from the Sandy Hook Defense Project. Battery Alexander's two 12-inch rifles and Halleck's two remaining 10-inch rifles, however, had not been dismounted and were still used for drill purposes.

Battery Halleck's position-finding stations continued to be utilized as they had been since 1907: battery commander's (B C) at the battery; primary station (B') on the Battery Potter terreplein; secondary station (B") near searchlights Nos. 1 and 2; and plotting room at the battery. The emplacements' shellrooms were designed to hold 300 projectiles and its magazines 300 powder charges.[125]

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124. Ladue to Martindale, Aug. 5, 1925, and Marshall to District Engineer, July 30, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. E. B. Martindale was commanding officer of the 7th Coast Artillery Regiment.

125. Battery Halleck Emplacement Book, Fort Hancock, NA, RG 392.

Battery Alexander's position-finding stations were as follows: battery commander's (BC) at battery; primary station (B') on the Battery Potter terreplein; secondary station (B") near searchlights Nos. 1 and 2; supplementary station (B'") at searchlight No. 5; and plotting room at the battery. The battery's shellrooms had a capacity of 320 projectiles and its magazines 400 charges of powder.[126]

Batteries Richardson and Bloomfield continued to be assigned important roles in the defense of the approaches to New York Harbor. Their principal mission was "to cover Ambrose Channel from its entrance to the Narrows, and to deny the use of this channel to enemy capital ships." These batteries were similar in firepower to Batteries Kingman and Mills. Although they were mounted on disappearing carriages, their areas of fire were restricted, and their maximum ranges were limited to 17,300 yards. Within their limited traverse and range, Richardson and Bloomfield were available to reinforce the fire of "Long Range Gun Battery Harris" (two 16-inch guns at Fort Tilden) and Long Range Gun Group 1 (Batteries Kingman and Mills). For ready reference and command purposes, they were designated "Medium Range Gun Group 2."[127]

Although the magazines of Batteries Richardson and Bloomfield would accommodate a battle allowance of 400 projectiles for each battery, only 250 propelling charges could be stored in the Battery Richardson magazines, and only 300 propelling charges at Battery Bloomfield. Consequently, the remaining 150 charges pertaining to Battery Richardson were stored in the cartridge and shellrooms at Battery Halleck, while the 100 charges pertaining to Battery Bloomfield were stored in the cartridge rooms at Battery Alexander.[128]

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126. Battery Alexander Emplacement Book, Fort Hancock, NA, RG 392.

127. Annexes to Harbor Defense Project: Harbor Defenses of Sandy Hook, March 1938, NA, RG 407.

128. Ibid.

The standard position-finding system for Battery Richardson during the late 1930s and early 1940s found the battery commander's station (BC) at the battery; the primary station (B') at Tower H; the secondary station (B") at Tower B; the supplementary station (B'") at South Tower Navesink Lighthouse; and the plotting room at the battery. The position-finding stations for Battery Bloomfield were: the battery commander's station (BC) at the battery; the primary station (B') at Tower H; the secondary station (B") at Tower B; the supplementary station (B'") at North Tower Navesink Lighthouse; and plotting room at the battery.[129]

The instruments assigned to the Battery Bloomfield stations to and those assigned to Battery Richardson were similar. Included were:

(a) Battery commander's station--1 azimuth instrument, M 1910, A1, No. 55 and headsets for communication with primary and secondary stations. The latter had been installed in September 1913.

(b) Primary station--1 Lewis DPF Range Finder, M 1907; 1 azimuth instrument, M 1910, A1, No. 58; and 3 wall telephones, with headsets.

(c) Secondary station--1 azimuth, M 1910, A1, No. 665; 1 Swasey DPF Range Finder; and 3 wall and 1 post telephones.

(d) Suplementary station--1 azimuth M 1910, A1; 1 Swasey DPF Range Finder; and telephones.

(e) Plotting room--1 rule set, forward, 10655; 1 Deflection Board, M 1905, No. 7; 1 Plotting Board, W & H, M 1904, No. 17855; 1 Board Pratt, M 1905, No. 5, SFH; 1 Scale, prediction, 300 yards to the inch, No. 455, SS; 1 Spotting Board, M3, No. 99, SFH; 1 Chest for Spotting Board, with accessories, No. 99, SFH; 1 Fire Adjustment Board, M1, No.

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129. Ibid. The battery commanders' stations for the two batteries were in concrete shelters at the respective emplacments between Guns Nos. 1 and 2. Tower H was in the 52d Coast Artillery (Ry) Gun Park, 300 yards southeast of Battery Richardson. Tower B was a three-story structure, about 500 yards east of the Fort Hancock road and 800 yards south of searchlights nos. 4 and 5.

111, SFH; 1 Percentage Corrector, M1, No. 201, SFH; 1 Circular Bench, SFH; and telephones.[130]

2. Disarming the Batteries

In 1943, two years after the United States entered World War II, several factors caused Batteries Richardson and Bloomfield to be withdrawn from the project for defense of New York Harbor. Most important was development of sophisticated aerial bombing techniques by planes operating from aircraft carriers, which made it mandatory to provide gun crews with overhead cover. Consequently, the 12-inch guns of Batteries Kingman and Mills were placed in casemates in 1942. Two new batteries were constructed on the Highlands. The first of these, Battery Lewis, mounted two 16-inch guns, while the second, Construction No. 219, emplaced two 6-inch rifles. Both these batteries were designed to afford maximum protection to personnel and materiel from air attack.

By the end of November 1942, the tide of war had turned against the Axis powers in North Africa, at Stalingrad, and in the Solomons. In the battle of the Atlantic, although German U-boats were still taking a terrible toll, the German and Italian surface fleets had been bottled up.

Pending completion of the new emplacements, Batteries Richardson and Bloomfield were retained as units in the Harbor Defenses of New York City. In 1943 the batteries on the Highlands were completed, armed, and manned. Batteries Richardson and Bloomfield were declared excess in November 1943 and abandoned.

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130. Battery Bloomfield Emplacement Book, Fort Hancock, NA, RG 392. The gun telephones and telautograph had been removed from the telautograph booths and attached to the carriages in February 1910. In June 1912 the telautograph had been removed from the emplacements. Two months later, the aeroscopes had been removed from the plotting room. In July 1912 the telephones had been relocated from the carriages to the niches.

In the spring of 1944, only a few weeks before Allied forces stormed ashore in Normandy, workmen from International Trading Co., 149 Broadway, New York City, New York, dismounted the four 12-inch guns and carriages of Batteries Bloomfield and Richardson. The carriages from both batteries and the Bloomfield guns were sold for salvage. The Richardson guns were shipped to the Army Gun Factory.[131]

Although they had been declared obsolete in the early 1930s, it was November 1944 before Batteries Halleck and Alexander were disarmed. On the 2d, six weeks before the Battle of the Bulge in Europe, Battery Alexander's two 12-inch rifles and their carriages were dismounted by Samuels & Sons Iron & Steel Co., of 214 Kent Avenue, Brooklyn, and turned over to the post salvage officer for sale. The following day, Samuels & Sons workmen removed the 10-inch guns and their disappearing carriages from Battery Halleck's emplacements Nos. 2 and 3. They were likewise sold for scrap.[132]

K. Recommendations

From the late 1890s until 1943 this massive battery was an important element in the defense of New York Harbor. One of the four batteries was built by a contractor, and the other three by day labor. The first three batteries were built of Rosendale cement, while Battery Richardson was constructed with Portland cement. The batteries were modernized on several occasions. These changes, which are important to an understanding of the evolution of the Endicott System, are easily traced in the extant fabric.

The 9-gun battery played a vital role in training the Coast Artillery units assigned to the various New York Harbor defenses.

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131. Batteries Richardson and Bloomfield Emplacement Books, Fort Hancock, NA, RG 392.

132. Batteries Alexander and Halleck Emplacement Books, Fort Hancock, NA, RG 392.

Annually, these commands spent several weeks at Fort Hancock firing at towed targets. Because of heavy harbor traffic, they were restricted to subcaliber drill with the guns emplaced at the other harbor forts.

The 9-gun battery is of the Third Order of Significance. As such, it should be stabilized, preserved, and entered on the List of Classified Structures.

IX. BATTERY GEORGE ARROWSMITH: A STRUCTURAL HISTORY

A. Colonel Marshall Reviews and Reevaluates the Needs

In the late winter of 1905 Colonel Marshall made a study of the tactical capabilities of the Sandy Hook defenses. He was satisfied that battleships protected with the latest Krupp armor could not be seriously damaged by direct fire from his 12-inch rifles at "considerable ranges." Nor was the Krupp armor, if it exceeded 4 inches, "penetrable" by the 6-inch projectiles issued to the Coast Artillery. Since the turn of the century, he warned, the nation's heavy guns, in the continuing armament race, had lost in relative efficiency, and the 6-inch guns now mounted in the Endicott Batteries were too light to attack the shields of secondary batteries of ships protected with Krupp armor if it were more than 4 inches thick. Henceforth, guns of greater power and larger caliber than 6-inch must be depended upon to smash the armor and destroy enemy cruisers and to engage battleships' secondary armament. Marshall considered the 6-inch guns, along with the 15-pounder and 3-inch rapid-fire batteries, to be effective only against destroyers and torpedo boats. Modern battleships, Colonel Marshall continued, could be "readily destroyed" by submarine mines and high angle fire, as their bottoms and decks were highly vulnerable.

Although there were too many heavy guns emplaced or proposed for the New York Harbor defenses, in comparison with mortars and rapid-fire guns, he did not regard the area as "over-fortified." A rearrangement of armaments would, in his opinion, "materially improve the defense, and enlarge its scope." At Fort Hancock, in addition to the guns and mortars now emplaced, there should be 16 mortars, two 8-inch rifles, and eight 6-inch rifles at Camp Low.

Colonel Marshall considered mortars and submarine mines as the two essential elements of any efficient seacoast defense against battleships. Properly emplaced mortars, capably manned, would deter any navy afloat. Other elements of the defense, he argued, were merely auxiliary to mines and mortars.

In the defense of New York Harbor, Sandy Hook was of first importance, not only because it afforded an "exceptionally favorable position for maximum efficiency of mortar fire over the channels of approach to the Narrows, but also on account of its great value to a naval power as a base of operations for either land or naval forces, whence the Southern Entrance to the port could be effectively blockaded." Its defense should be "placed beyond question." Although the firepower of its 10- and 12-inch rifles had been reduced by dredging of the new channel, that of its mortars had been increased. Its strategic importance, however, had not been compromised.

At present, there were no guns mounted bearing on the Horse Shoe anchorage in lee of the Hook and on the southern part of False Hook Channel, except the 12-inch rifles of Battery Potter which could be fired once every 8 minutes. Guns must be positioned to cover these waters. Any battleship venturing to attack New York City, Colonel Marshall wrote, "must pass for half an hour and for eight miles of its course within very effective range of mortars at the Hook before coming within equally effective range of mortars" from Forts Hamilton or Wadsworth. There should be sufficient mortars at Hancock, he argued, to destroy any fleet in the world before it debouched from the narrow dredged channels across the bar.[1]

Colonel Marshall took a dim view of the Proving Ground's position, which he deemed an incubus upon the defense. The proof battery and beach range occupied the best sites for coastal defense guns and prevented the "proper location for a battery designed to cover False Hook Channel." Fragments from Proving Ground tests had ripped into emplacements and searchlights necessarily placed near the beach range. The Proving Ground Reservation separated the garrison quartered in the Fort Hancock barracks from the guns it served. This had caused friction between the two commanding officers. Its location exposed the Proving

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1. Marshall to Mackenzie, March 6, 1905, NA, RG 77, Press Copies, Ltrs. Sent, New York Defenses.

Ground to attack. If Sandy Hook fell to an enemy, the numerous guns and much materiel awaiting test or proof would be lost. In addition, the Army would be deprived of its Proving Ground, pending establishment of another.[2]

To improve the defenses of the southern entrance to the harbor, Colonel Marshall recommended that five of the 8-inch rifles be removed from Fort Wadsworth, with two of them being emplaced at Princess Bay and three at Fort Hancock's Camp Low. The latter would cover the Horse Shoe. At Fort Hancock the two 12-inch rifles could be removed from Battery Potter for emplacement on disappearing carriages at Coney Island or Camp Low.

Four of the remaining 6-inch guns proposed under the project for the defense of the area should be mounted with the three 8-inch, or larger caliber, guns at Camp Low, and four others should be added to the defense of the False Hook Channel. Funds scheduled for four 6-inch guns at Fort Hancock, four 6-inch guns at Forts Wadsworth and Slocum, the two 12-inch guns dropped at Fort Totten, and the two 10-inch rifles eliminated from Fort Schuyler, should be reprogrammed for construction of an additional 16-gun mortar battery at Fort Hancock and for 12 mortar emplacements at Totten and Schuyler. As his "final recommendation" Marshall urged that Battery Reynolds be "modernized or reconstructed."[3]

B. Battery Takes Shape

1. Plans are Developed and Approved

The Board of Ordnance and Fortifications was unprepared to act on most of Marshall's recommendations. The majority of the members were not as enthusiastic as Marshall relative to the efficiency and capabilities of the 12-inch mortars. Many of his proposals would

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2. Ibid.

3. Ibid.

require considerable study. It did, however, approve partial implementation of the Camp Low project.

Apprised of this, Colonel Marshall directed Assistant Engineer Hurlbut to reconnoiter the site on April 25, 1905. Hurlbut was to determine: (a) whether the battery foundation would be on sand or mud; (b) if materials could be landed on the Camp Low wharf; and (c) if piles had to be driven, whether the subsoil was sound enough to support gun platforms. If the landing facilities at Camp Low could not be utilized, Hurlbut was to ascertain the cost of constructing a wharf with sufficient depth of water at low tide to bring alongside barges and tugs drawing 10 feet.[4]

With the $60,000 available, Colonel Marshall proposed to build at Camp Low a battery mounting three 8-inch rifles, "with old fashioned magazines, concrete rooms with sand cover, both horizontally and vertically." Except for a mass of concrete about the gun wells and fronting the pieces, the concreting would be limited to "simple retaining walls."[5]

On September 13 Colonel Marshall mailed the drawings that he had prepared for the Camp Low emplacements to the department for approval. The position, he pointed out, was well masked from the rear and not subject to attack by heavy armament. Consequently, the protection to be afforded was somewhat less than that usually provided for long-range coast defense guns. The design required a minimum amount of concrete; provided convenient ammunition service, with tables for reserve projectiles and recesses for reserve powder; required no hoists; provided ample loading space; called for crows-nests that were accessible and commanded a view of the platforms; and provided for

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4. Marshall to Hurlbut, April 25, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

5. Ibid.

magazines that were well to the rear so that their overhead earthen cover would be unlikely to disable the breech mechanisms of the 8-inch rifles, if scattered by bursting shells. Armament for the battery was to be transferred from Battery Duane at Fort Wadsworth.[6] Chief Engineer Mackenzie approved the plans on September 18.

a. Camp Low Rifle Range is Closed During Working Hours

Many months were to pass, however, before the department saw fit to allot the necessary construction funds. These were finally made available in the autumn of 1906.

As Colonel Marshall was desirous of completing the battery in one construction season, Assistant Engineer Hurlbut became disturbed in early June when he saw that the garrison was positioning targets at the Camp Low rifle range. As his men were working within range of the butts, construction would have to be suspended during the hours the soldiers were firing; thus, valuable time would be lost. Hurlbut therefore contacted Colonel Harris, informing the Fort Hancock commander that the working hours at the site were from 7:50 A.M. to 4:20 P.M., daily except Sunday. In addition, his enginemen had to be on the job at the "plant" about 30 minutes earlier to get the steam up in the boilers. If possible, Hurlbut hoped Colonel Harris would schedule his small-arms practice to permit the workmen to have possession of the area from 7 A.M. to 4:30 P.M.[7]

Colonel Harris reluctantly agreed to suspend small-arms target practice by his command until mid-September. He

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6. Marshall to Mackenzie, Sept. 13, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

7. Hurlbut to Harris, June 11, 14, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

cautioned, however, that commands other than the Fort Hancock garrison used the Camp Low range.[8]

Having secured Colonel Harris' cooperation, Hurlbut asked Colonel Marshall to intercede with Headquarters, Department of the East, to have all units in the New York area suspend use of the Camp Low facilities until October 1. Last season, he reminded Marshall, the small-arms practice had compelled him to suspend rehabilitation of the wharf and positioning of the plant to the detriment of the service.[9]

b. Building the Battery

Marshall was successful, and Hurlbut was able to push rapidly ahead. By August 14 work had reached the point where the iron doors could be ordered. He also needed a number of drawings. But, Hurlbut warned, laborers were so scarce that it would be September 30 before all the concrete work was completed.[10]

On October 7 Hurlbut notified Marshall that he needed more money to complete the project. At present, after paying all bills, including those for the iron doors, electric cables, etc., he had only $600 left in the account.

Although the concreting would be finished by tomorrow, there were about 14,000 cubic yards of sand embankment to be positioned in the parapet and as cover for the magazines. Of this,

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8. Harris to Hurlbut, June 20, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

9. Hurlbut to Marshall, June 20, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

10. Ibid., Aug. 14, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Plans were needed for: 3 trolley systems, 3 reserve tables, 3 sliding doors for telautograph niches, 1 hinged door for telautograph niches, 2 rolling lift doors, 3 doors for the motor room, 4 doors for 3' x 7.05' openings, 8 leaf doors, 1 sliding door for the B.C. station, 11 gratings, 7 window shutters, and 7 window gratings.

10,000 cubic yards of fill were to be positioned to the front, right, and left flanks. In addition, there were doors to be hung, trolleys to be placed, electrical wiring to be installed, and a general clean up to carry out. Hurlbut estimated the cost of this work at:

14,000 cubic yards sand fill		
10,000 cubic yards at 20¢ a cubic yard		$2,000.00
4,000 cubic yards at 50¢ a cubic yard		2,000.00
800 yards cinders for covering, placed		300.00
Electrical work, 125 lamps		400.00
Hanging doors		450.00
2 [illegible]	$100.00	
3 trolley systems	450.00	
3 reserve ammunition tables	450.00	
Cleaning up	250.00	
Superintending	600.00	1,850.00
		$7,000.00[11]

When the department was unable to come up with this sum, Colonel Marshall scaled down Hurlbut's figure to $3,500. On January 6, 1908, he wrote that this sum was needed to finish the battery. The necessary allotment was made available within 48 hours.[12]

d. Naming the Battery

Several months before the emplacements were completed, an annual encampment of the New Jersey Grand Army of the Republic obtained from Secretary of War William Howard Taft a general order designating the battery George Arrowsmith to commemorate a Union officer killed at Gettysburg on July 1, 1863.[13]

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11. Ibid., Oct. 7, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

12. Marshall to Chief Engineer, Jan. 6 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

13. General Order 101, War Department, June 17, 1908.

George Arrowsmith, a 22-year-old lawyer, was mustered into Federal service as captain of Company D, 26th New York Infantry, at Elmira, New York, on May 21, 1861. In June 1862 he was detached to brigade headquarters as assistant adjutant general to Brig. Gen. Zealous B. Tower. On October 17, 1862, Arrowsmith was ordered discharged as of September 9, 1862, to be appointed captain and acting assistant adjutant general of U.S. Volunteers.

Arrowsmith was mustered in on November 8, 1862, as lieutenant colonel of the 157th New York Infantry. He joined his new command at New Ballimore, Virginia, three days later. He was killed while leading his regiment at Gettysburg on July 1, 1863.[14]

Relaying this information to Colonel Harris, Colonel Marshall reported that the encampment wished to be present when the battery was turned over to the artillery by the Engineers and be permitted to take a photograph of the battery for their post. Colonel Marshall was agreeable but told the veterans they would have to consult with Colonel Harris since he was the post commander. Relative to the photograph, they would have to secure permission from the Secretary of War, as only he had the authority to grant such a privilege.[15]

Colonel Harris was delighted to learn of the veterans' interest and offered to provide transportation to and from the site for up to twelve individuals. In addition, he believed a photograph could be arranged for the encampment without violating orders or compromising security.[16]

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14. Compiled Service Records of Union Soldiers in the Civil War, NA, RG 94.

15. Marshall to Harris, April 2, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

16. Harris to Marshall, April 4, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Acknowledging the kind response, the George Arrowsmith encampment asked it it would be possible for 20 to 25 to attend. If so, they would travel by launch from Red Bank to the Horse Shoe.[17] Colonel Harris was agreeable, provided no wagon transportation was involved.[18]

d. Construction of the Position-Finding Stations

On January 9, 1907, Assistant Engineer Hurlbut transmitted to Colonel Marshall for approval plans and sections of the secondary position-finding station proposed for the battery. The plans were promptly approved, and Hurlbut was informed that this station was to be built at Battery Alexander.[19] The primary station for the battery would be at Camp Low and would be housed in the same structure with the supplementary station for the mortar batteries.[20] The secondary station was completed in the summer of 1907 and the primary station in April 1908.[21]

C. Arming the Battery

On July 8, 1908, Assistant Engineer Hurlbut reported that Battery George Arrowsmith was completed and ready for transfer to the Coast Artillery. Most of the existing plant had been removed and was on the dock.[22]

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17. Parsons to Marshall, April 9, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Charles B. Parsons was Department Inspector, Post 6, New Jersey Department, GAR.

18. Harris to Marshall, April 11, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

19. Hurlbut to Marshall, Jan. 6, 1907, and Marshall to Hurlbut, Jan. 22, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

20. Marshall to Mackenzie, undated, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

21. Hurlbut to Marshall, April 7, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

22. Hurlbut to Roessler, July 8, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Colonel Harris, on visiting the site, found the emplacements ready for transfer, but the guns and carriages, which had been removed and transferred from Battery Duane, were scattered about. The Engineers refused to touch the ordnance until the responsible artillery officers had vouched for its completeness, as it was feared that some of the parts were buried in the sand. As the battery had been built for less than the estimate, Colonel Harris suggested to the Chief of Coast Artillery that the Engineers might be agreeable to mounting the guns.[23]

Chief of Coast Artillery Arthur Murray went along with Colonel Harris' suggestion. On July 20 he wrote the Chief Engineer. To justify his position, General Murray pointed out that: (a) the garrison was understrength; (b) it had had considerable experience in mounting and dismounting guns; and (c) it could more profitably devote its time and energy to other work.[24]

On July 23, William L. Marshall, who had become Chief Engineer two weeks before, allotted $1,000 for mounting the guns. Under no circumstances, he cautioned, were Engineer employees to touch the ordnance until the responsible artillery officer had identified all components. While the guns were being mounted, the presence of a representative of the Ordnance Department was mandatory.[25]

While he relayed this news to Assistant Engineer Hurlbut, Colonel Roessler, who had replaced Marshall as District Engineer, explained that there were no funds on hand to begin work

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23. Harris to Chief, Coast Artillery, July 17, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

24. Murray to Chief Engneer, July 20, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

25. Marshall to Roessler, July 23, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

immediately. Meanwhile he would carefully inspect the carriages to ascertain whether all the parts were in proper condition, as the allotment was made to defray the cost of mounting. Any cleaning or repair of parts was the responsibility of the Coast Artillery.[26]

Hurlbut now learned from Colonel Harris that the Department Commander had ordered that the arming of Battery Arrowsmith be deferred until after the Camp Low rifle range had been closed for the season.[27]

On October 19, 1908, Colonel Harris again cornered Hurlbut, complaining about the plant machinery stored on the Camp Low wharf. He asked Hurlbut to get it out of the way, so his troops could remove the three 8-inch guns to the battery. General Murray, he added, had decided that the garrison was to arm the emplacements.[28] A hold-up in blasting loose stone from the old masonry fort in front of Battery Bloomfield for use in the seawall enabled Hurlbut to divert a few men to Camp Low. The wharf was repaired and the plant moved, and the Coast Artillery brought the guns ashore.[29]

In mid-December Colonel Harris turned out a fatigue detail to mount the guns. By the 28th Battery George Arrowsmith was armed.[30] On January 12, 1909, Hurlbut informed Colonel Roessler that

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26. Roessler to Hurlbut, July 27, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

27. Hurlbut to Roessler, July 28, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

28. Ibid., Oct. 19, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

29. Ibid., Nov. 11, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

30. Roessler to Chief Engineer, Dec. 29, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. The battery was armed with three 8-inch breech-loading rifles, M1, Nos. 14, 17, and 24, and three disappearing carriages, Model 1894, Nos. 1, 4, and 5.

the platform lights were not yet in place, as he wished to position the handrails first. In addition, the Coast Artillery had not removed the blocking or cleaned up the battery. After they had, he would be obliged to touch up the whitewashing. He would also see that several loads of cinders were spread on the slopes where they had been disarranged.[31]

On February 16 it was called to Colonel Roessler's attention that the base ring of platform no. 2 was 3/32d of an inch out of line. It was disputed whether the gun platform had settled, or if the racer had been warped during the move from Fort Wadsworth or while supported on its blocking for the past several years. Assistant Engineer Hurlbut argued that, as the base rings had been levelled by an Ordnance Department mechanic shortly before the carriages were mounted, the platforms were true.[32]

Before another week passed, Assistant Engineer Hurlbut notified Colonel Roessler that all the platform handrails had been set. But, because of inclement weather, he had not positioned the reflectors on the handrails.

Ordnance personnel from the Proving Ground took charge of Gun No. 2. In an effort to correct the alignment, they traversed the piece so that most of the weight was on the section of the ring that had bulged. It would be left in this position, in anticipation that the racer would "recover from the strain."[33]

On May 25, 1909, with the veterans of GAR post George Arrowsmith proudly looking on, Colonel Roessler transferred the

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31. Hurlbut to Roessler, Jan. 12, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

32. Roessler to Chief Engineer, Feb. 16, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

33. Hurlbut to Roessler, Feb. 24, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

battery to Colonel Harris. When he made his report to Headquarters, Department of the East, Colonel Harris observed that the galleries and magazines were dry; all doors worked properly; the means of ammunition service were adequate; the drains free and open; the parapets in good condition; and a gravel road gave access to the area. Guns Nos. 1 and 3 were run into and out of the battery with ease. The pieces traversed satisfactorily. Azimuth circles and elevation disks had not yet been graduated for these emplacements. The carriage on platform no. 2, however, was still out of plumb and would have to be corrected.

Colonel Harris pronounced the caliber of the guns unsatisfactory for their mission. He urged that they be removed and replaced with the latest model 6-inch rifles on disappearing carriages.[34]

Chief of Coast Artillery Murray vetoed Colonel Harris' recommendation. On doing so, he pointed out that the location and caliber of Battery George Arrowsmith had been determined by the Board of Ordnance and Fortifications, and it answered the requirements of its mission.[35]

D. Disarming the Battery

The additon to the system in the early 1920s of the 12-inch guns of Batteries Kingman and Mills, with their 360-degree range of fire, made the 8-inch guns of Battery Arrowsmith superfluous to the Sandy Hook Defense Project. In the late-1920s the battery was disarmed. Its magazines, however, remained in use. The three rooms of magazine no. 1 were used for storage of 200 propelling charges for the 6-inch guns of

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34. Harris to Adj. Gen., Dept. of the East, May 28, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

35. Bailey to Adj. Gen., Dept. of the East, June 18, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Lt. Col. C. J. Bailey was Acting Chief, Coast Artillery.

Battery Gunnison, and the rooms of magazines nos. 2 and 3 for storage of 1,150 propelling charges for Battery Peck's 6-inch guns.[36]

In 1939 the propelling charges for the 6-inch guns were removed from Battery Arrowsmith. Henceforth, magazine no. 1 was employed for storage of 500 rounds of ammunition for the 155 mm GPF guns; magazine no. 2 for 527 rounds of 3-inch practice ammunition for Batteries Morris and Urmston; and magazine no. 3 for 800 rounds of 3-inch antiaircraft ammunition for Antiaircraft Battery No. 1.[37]

E. Recommendations

For nearly 20 years Battery Arrowsmith was an important element in the Sandy Hook defenses of the southern approaches to New York Harbor. It was the only Fort Hancock battery during most of these years that could engage enemy warships that had fought their way past the 12- and 10-inch guns and reached Sandy Hook' Bay. After being disarmed in the late 1920s, its magazines continued in use through World War II.

The battery is of the Third Order of Significance, and should be stabilized and preserved.

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36. Annexes to Harbor Defense Project, Harbor Defenses of Sandy Hook, March 21, 1938, NA, RG 407.

37. Ibid.

X. BATTERIES KINGMAN AND MILLS: A STRUCTURAL HISTORY

A. Colonel Abbot Develops a Plan and Prepares Estimates

1. Selecting a Site

The outbreak of World War I in August 1914 hastened development and construction of a new "family" of emplacements for the nation's long-range coastal defense guns. These emplacements would usually shelter the magazines, power-rooms, quarters, etc., in a massive reinforced concrete traverse, as at Fort Hancock, or in dispersed tile structures as at Fort Tilden. The 12- and 16-inch guns of this system, unprotected by parapets, would be emplaced outside the casemates and mounted on new type carriages which permitted the guns a 360-degree field of fire.

In early July 1915 Secretary of War Lindley M. Garrison approved a proposal of the Ordnance and Fortifications Board to position at Fort Hancock "four new 12-inch guns adapted for high angle fire upon a carriage" then being designed by the Ordnance Department. Until the Ordnance personnel had proceeded further with the design of the high angle carriage, it would be impossible to proceed with plans for these emplacements. At the same time the Secretary vetoed a proposal to remove the 16 mortars from Batteries Reynolds and McCook.[1]

On November 23, 1915, Chief Engineer Dan C. Kingman directed Col. Frederic V. Abbot, the District Engineer, to consult with the commander of the New York Harbor Defenses and to submit a report on the best site for the newly authorized batteries.[2]

Frederic V. Abbot of Massachusetts had graduated from the U.S. Military Academy as no. 1 in the Class of 1879. Commissioned a 2d lieutenant in the Corps of Engineers, he was ordered to duty with the

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1. Baber to District Engineer, July 7, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

2. Winslow to Abbot, Nov. 23, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Engineer Battalion at Willetts Point, New York, in November 1879. From June 1882 until August 1884, Abbot, now a 1st lieutenant, was on detail surveying the Maryland-Virginia boundary. Abbot was Assistant Engineer to Col. Quincy A. Gillmore from August 1884 to April 1888. From April 1889 to September 1897 Captain Abbot was in charge of various river and harbor improvements in North and South Carolina and the fortifications under construction in Charleston Harbor.

On September 18, 1897, Abbot was placed in charge of the Sioux City District for Missouri River improvements. Abbot, having been promoted major in 1898, was named Assistant to the Chief Engineer in August 1900. In May 1910 Abbot, now a colonel, was ordered to Boston. There he had charge of the defenses of Boston Harbor and on Lake Champlain and river and harbor improvements in Massachusetts, New York, and Vermont. On July 6, 1915, Colonel Abbot was placed in charge of the works for the defense of New York Harbor, Colonel Roessler having retired on April 30, after 40 years' service.[3]

The following week Colonel Abbot was alerted that the department would probably request congressional authority for the "application of funds . . . next year to emplace two of these guns."[4]

2. Abbot Submits Preliminary Drawings and Estimates

Colonel Abbot responded with alacrity. On December 15 he submitted to the department preliminary drawings and estimates for installation of the four 12-inch guns on barbette carriages.

The proposed sites had been determined after a conference with Lt. Col. Delamere Skerrett, the Coast Defense commander. Skerrett deemed the sites considered (near the western margin of Sandy Hook,

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3. Cullum, Biographical Register, III, 308; IV, 306; V, 283-84; VI, 260.

4. Winslow to Abbot, Dec. 2, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

midway between the Horse Shoe and Spermaceti Cove) satisfactory, provided periscopes or other suitable means for direct sighting were provided. Colonel Abbot concurred, and felt the use of periscopes projecting above the tree tops was feasible.

The concealment afforded by the woods surrounding the site would afford "no small measure of protection," and was one of the factors weighed in selecting the location. In addition, war games had demonstrated that certain warships possessed the capability to run by the present armament and to enter Sandy Hook and Raritan bays, thus taking the existing heavy batteries in reverse. Battery Arrowsmith, with its three 8-inch guns, was the heaviest defense that could be brought to bear in that direction.

Although the proposed battery was primarily for long-range fire, it was desirable to afford protection to the inner waters of Sandy Hook and Raritan bays with more guns, provided there was no infringement on the principal mission. The selected site about 1,000 yards from the Atlantic beach would afford this fire to the rear, and at the same time, it would permit firing over the trees and obstacles "with an angle of departure of about 3 degrees or less, thus permitting of direct fire to the front as close in as approximately 3,000 yards from shore."

The designs submitted were such as to allow a 360-degree field of fire with zero elevation, except that an angle of departure of at least 10 degrees would be necessary in the sectors covered by the magazines. At an elevation of 10 degrees or more "an all around fire could be obtained." This would correspond to an "inferior range" of about 11,000 yards with 2,100 feet per second initial velocity and 870-pound projectiles. This "inferior limit of range" would result if a parapet were provided in front of the gun; thus, Colonel Abbot had eliminated the parapet. Inasmuch as no parapets were proposed, it was recommended that the guns be emplaced singly, with the magazine on the right flank, and the carriages designed for elevations from 0 to 30

degrees. Colonel Abbot believed the interval proposed between emplacements would permit single guns to fire safely over one another, while at the same time separating the guns and localizing the damage from enemy shells.[5]

His estimates, as the department would discover, included the cost of positioning piles under "the gun blocks and other mass concrete and wall." Only one 25-kilowatt power plant was proposed for each two-gun battery. If the decision were made to mount the 12-inch rifles in single-gun batteries, it would be desirable to have a power plant for each.[6]

Colonel Abbot submitted detailed estimates for the cost of the project. If completed in two years, it would be:

4 Single emplacements for 12-inch guns	
@ $126,500	$506,000.
Plant	37,000.
Total	$543,000.
or,	
2 Batteries of two 12-inch guns @ $202,000	$404,000.
Plant	37,000.
Total	$441,000.

The predicted itemized cost of one emplacement for a 12-inch rifle on barbette carriage, Model E, was:

Clearing and grubbing	$ 750.
800 cubic yards excavation @ 50¢	400.

5. Abbot to Chief Engineer, Dec. 15, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

6. Ibid.

16,000	cubic yards sand cover @ 40¢	6,400.
4,060	square yards top soil, 1 ft. thick, @ 75¢ . .	3,045.
4,060	" " sodding @ 30¢	1,218.
350	concrete piles for foundation @ $20.00	7,000.
9,175	cubic yards concrete @ $8.00	73,400.
60	tons reinforcement steel @ $38.00	2,100.
152	squares waterproofing @ $16.00	2,432.
2	shell tables @ $200	400.
	Doors and windows	1,200.
200	ft. speaking tubes @ $3.00	600.
	Trolley system	1,000.
	Mechanical indicator	1,500.
	Water supply	1,000.
	Latrines and sewers	1,000.
	Drains	550.
	Duct lines	750.
	Hold down bolts	500.
	Power plant (25-kw. set)	5,000.
	Electric lighting	1,500.
	R. R. track, standard gauge	2,500.
	Road, gravel surface	750.
		$114,995.
	Contingencies	11,505.
		$126,500

Colonel Abbot's breakdown of the cost figures for one battery for two-inch rifles was:

	Clearing and grubbing	$ 1,000.
1,500	cubic yards excavation @ 50¢	750.
18,250	" " sand cover, @ 40¢	7,300.
5,100	square yards top soil, 1 ft. thick, @ 75¢ . .	3,825.
5,100	" " sodding, @ 30¢	1,530.
600	concrete piles for foundation @ $20.00	12,000.

15,200	cubic yards concrete @ $8.00	121,600.
100	tons reinforcement steel @ $35.00	3,500.
205	squares waterproofing @ $16.00	3,280.
4	shell tables @ $200.00	800.
	Doors and windows	1,500.
750	feet speaking tubes @ $3.00	2,250.
	Trolley system	1,500.
	Mechanical indicators	2,500.
	Water supply	1,500.
	Latrines and sewers	1,500.
	Drains	1,000.
	Duct lines	1,500.
	Hold down bolts	1,000.
	Power plant (25-kw. set)	5,000.
	Electric lighting	2,000.
	R. R. track, standard gauge	5,000.
	Road, gravel surface	1,800.
		$183,635.
	Contingencies	18,365.
		$202,000.

His estimated cost of the "plant" called for:

	Wharf	$ 10,000.
9,000	feet R. R. track, 36" gauge	6,000.
1	Locomotive, 36" gauge	3,000.
24	Cars, 36" gauge	3,500.
3	Hoisting engines	3,000.
1	Mixing plant and storage bins	3,500.
1	Steel tower, hoist, elevator, &c	2,500.
1	Cement shed	1,000.
1	Storehouse	1,000.
1	Carpenter shop	1,500.
1	Blacksmith shop	1,000.

1 Lumber shed	500.
1 Field office	500.
	$ 37,000.[7]

3. Department Calls for Minor Revisions

Chief Engineer Kingman, in the meantime, had notified Colonel Abbot that the two-gun battery was similar in design to the "study sheet" furnished earlier. The most important difference was the doubling of the capacity of the powder magazines. This increase was necessary for all stateside batteries.

Abbot could secure the correct area of floor space by increasing the width of the powder magazines, depicted on the "study sketch," from 7 feet, 6 inches to 9 feet. This would accommodate eight longitudinal rows of storage cases and still leave ample aisle space.[8]

B. Plans are Finalized and Approved

1. Chief Engineer Black Sends the Plans Out for Review

On October 20, 1916, Maj. Gen. William M. Black (who had replaced General Kingman as Chief Engineer in March) forwarded to the Adjutant General drawings of the proposed design for emplacements for two 12-inch rifles both long- and short-range mounted on Model E carriages, as revised by Colonel Abbot. The plan showed the guns mounted in barbette without any protecting parapet. As such, they could be fired from below horizontal up to 30 degrees.

The battery was designed to position its two guns about 420 feet apart. Each piece was capable of a 360-degree field of fire, but the necessity of providing proper protection for the magazines made it mandatory to restrict each gun, for about a quadrant, to fire above 10 degrees elevation.

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7. Ibid.

8. Winslow to Abbot, Dec. 15, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

In designing these emplacements, an effort had been made to simplify them as much as possible and to restrict utilities provided to the absolute minimum. The traverse or casemate proper housed only the necessary powder magazines, shellrooms, and a power-room. On the flanks of the traverse but in a "thoroughly protected" position were two plotting rooms, one for each gun, connected by voice tubes and by electric cable with the battery commander's station above. Farther to the flank, a retaining wall was necessary to support the earth, and in this wall were the enlisted men's latrine, a room and toilet for the officers (the room to be fitted up in event of attack as an aid station), and two small storerooms--one of which could be used as a rehandling room for transferring powder received in bulk into metal storage cases. As the Ordnance Department had not determined all details of the manner in which powder would be made ready for service, it was expected that minor changes would be required in the arrangement for powder service as detailed on the drawing.

Shown along the rear face of the traverse was a corridor which could be omitted if the Board of Review deemed it unnecessary. This corridor had at its rear a series of concrete pillars and would be covered by a thin concrete wall. It was proposed to provide cover for the openings between the pillars by sliding or folding metal doors, so that the entire corridor could be converted into a shelter or dormitory when necessary.[9]

Maj. Gen. Erasmus M. Weaver, Chief of Coast Artillery, pronounced the plan satisfactory. As for handling powder, it would be sent to the fortifications in bulk shipping cases, each one holding about 110 pounds. Preparatory to going to war, the powder would be blended, and 150 single section charges made up, placed in hermetically sealed containers, and stored on the racks.

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9. Black to Adj. Gen., Oct. 20, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

It was believed that the corridor along the rear face of the traverse would provide a "suitable place" for blending the powder as well as a shelter for the "manning" detachment. To decrease visibility, General Weaver suggested that the concrete roof be covered with dirt and twigs.[10]

2. Board of Review Approves the Plans

Since no other substantive comments were received, the War Department's Board of Review considered and approved the plans for "emplacements for long range 12-inch rifles" at its meeting on December 5, 1916.[11]

On December 28 Chief Engineer Black notified Colonel Abbot that two batteries, each mounting a pair of 12-inch guns, were to be constructed at Fort Hancock.[12]

3. Site is Settled Upon

In the weeks following Colonel Abbot's December 1915 report, Colonel Skerrett had changed his mind as to the best site for the batteries. He now believed they should be located on the Navesink Highlands.

Reminding the department of this, Colonel Abbot observed that if they were to be positioned on the Highlands the question of paradoses would depend on the sites selected. If, however, the locations proposed by Abbot twelve months before met with Chief Engineer Black's approbation, and they were to be constructed "considerably before the defenses proposed for Rockaway Beach," he believed they should have

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10. Weaver to Adj. Gen., Nov. 6, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

11. Adj. Gen. to Black, Dec. 26, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

12. Winslow to Abbot, Dec. 28, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

paradoses. If the Rockaway defenses were not to be built in the near future, Abbot warned, "the 12-inch batteries at Fort Hancock should be better safeguarded by having paradoses provided for them."[13]

Colonel Abbot was of the opinion that a parados similar to that shown on design "B," submitted by the Board of Engineers on December 22, 1916, would be satisfactory. For Fort Hancock, it should be slightly modified to provide a larger area for powder service.

As his original estimates were prepared on the basis of a 20-foot concrete wall around the magazine, the difference between this and an 8- or 10-foot wall could be applied on the cost of the parados. If General Black's letter of December 28 were construed as authorizing preparation of plans and estimates based on design of the enclosed sketch, he would proceed along those lines.[14]

On January 12, 1917, three weeks before Germany resumed unrestricted submarine warfare, Chief Engineer Black informed Abbot that the House Committee on Appropriations, at the hearings on the Fortifications Bill, had insisted that the batteries be constructed during the summer of 1917. This made it impossible to locate them on the Highlands, or any other site not owned by the United States. Moreover, it made it necessary that detailed plans be formulated at once, "without bringing in any modifications from the type plans not absolutely essential."

The question of placing additional rooms in the batteries, such as those depicted on Abbot's sketch, had been taken up with General Wever of the Coast Artillery and the Board of Review and was reported by them as unnecessary. The parados problem was to be

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13. Abbot to Black, Jan. 8, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

14. Ibid.

resolved by local conditions. If paradoses were constructed, Colonel Abbot could place additional rooms in them.

The location for the batteries, as submitted in December 1915, had received the informal approval of the Board of Review, and were the sites for which plans, sections, and elevations should be prepared.[15]

Upon receipt of this information, Colonel Abbot contacted Maj. Gen. Leonard Wood, commanding the Eastern Department. He explained the reasons for urgency. Abbott wanted official word that the sites in question were satisfactory and acceptable to General Wood and the local defense commanders.[16]

Colonels Abbot and Skerrett accordingly reconnoitered the site, midway between the Horse Shoe and Spermaceti Cove, at the beginning of the fourth week of January. At Skerrett's suggestion, it was determined to separate the batteries by a 700-foot interval.[17]

4. Abbot Perfects His Plans and Estimates

On February 3, having secured the concurrence of General Wood and Colonel Skerrett, Colonel Abbot forwarded revised plans and estimates for the batteries for War Department approval. The design was that of the recently sanctioned plan "B" with some modifications:

(a) a parados had been added and the passage in rear of the battery covered. This permitted a reduction of the thickness of the

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15. Black to Abbot, Jan. 12, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

16. Abbot to Wood, Jan. 16, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

17. Skerrett to Abbot, Jan. 20, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

rear wall and the placement under the parados of the rooms (storeroom, quarters, implement and toolroom, toilet, and latrine) shown on the plans. This arrangement would result in a 10 percent increase in the horizontal arc of fire for each gun. The protection in the rear was needed, because under certain weather conditions enemy destroyers and torpedo boats might be able to pass the Sandy Hook batteries and enter Sandy Hook and Raritan bays.[18]

(b) The arrangement of the power-rooms had been changed slightly, so as to provide space for two 25-kilowatt sets without increasing the size of the battery.

(c) The trolley system in the powder magazines had been altered to provide for a continuous loop of single trolley rail connected with the main corridor rail. This use of two trolley hoists tandem connected and avoided transfer of loaded single section cases. It required the storage of single section cases in piles with the axis of the cases parallel to the major axis of the magazine. This would allow the storage of 300 powder cases, shipping, and 40 empty single section containers in each powder room. The remaining empty single section containers--140--would be stored in the rooms labeled storeroom and quarters until needed. Filling of containers would be done in the covered passage.

(d) Mechanical "indicating devises," considered necessary by the Coast Artillery, had been added.[19]

Colonel Abbot now estimated the cost of one battery for two 12-inch guns on barbette carriages, Model 1917, at:

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18. Abbot to Black, Feb. 3, 1917, and Chief Engineer to Adj. Gen., Feb. 7, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

19. Chief Engineer to Adj. Gen., Feb. 7, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock; Plans, "Fort Hancock, N.J., Batteries A and B for Two 12 in. Guns on Barbette Carriages, Model 1917, " U.S. Engineer Office, 2d District, New York City, Feb. 3, 1917, NA, RG 77.

	Clearing and grubbing	$ 1,000.00
3,500	cubic yards excavation @ 50¢	1,750.00
24,000	" " sand cover @ 40¢	9,600.00
12,000	" " reinforced concrete @ $17.00	204,000.00
6,000	square " top soil @ $1.00	6,000.00
6,000	" " sodding @ 30¢	1,800.00
250	squares waterproofing @ $16.00	4,000.00
8	powder and shell tables @ $200.00	1,600.00
	Doors and windows	2,000.00
	Speaking tubes (3" brass pipe)	2,500.00
	Trolley system	3,500.00
	Mechanical indicators	2,500.00
	Water supply	2,000.00
	Latrines and sewers	2,000.00
	Drains	1,000.00
	Duct lines	2,000.00
	Base ring anchor bolts	1,000.00
	Power plant (one 25-kw. set)	5,000.00
	Electric lighting	2,500.00
	R. R. track, standard gauge	5,000.00
	Road, gravel surface	1,800.00
		$262,550.00
	Contingencies	26,250.00
		$288,800.00

The estimated cost of plant to construct two batteries that year was:

2	Locomotives	$ 10,000.00
16	Cars	9,600.00
	Construction railroad, standard gauge	13,000.00
	Temporary buildings	3,000.00
	Sand and gravel bins	1,000.00
	Reconstructing old wharf	10,000.00
	Locomotive crane	3,000.00
	Concrete mixing and placing outfit	12,200.00
	Material handling outfit	9,600.00
		$ 71,400.00
	Contingencies	7,100.00
		$ 78,500.00

Recapitulation

Two batteries of two 12-inch guns each $288,800 . . .	$577,600.00
Cost of plant for two batteries	78,500.00
Total	$656,100.00
Deduct previous allotments $5,000 and $10,000	15,000.00
Amount to be allotted	$641,100.00[20]

5. Secretary of War Baker Approves the Project

On February 7, 1917, Chief Engineer Black transmitted the plans and revised estimates to the Secretary of War with his recommendation that they be approved, subject to such minor changes as may appear necessary or desirable during construction.[21] Secretary of War Newton D. Baker approved the plans in mid-February.

C. Building the Batteries

1. Colonel Abbot Contracts for Construction Materials

To facilitate the receiving of supplies for construction of the two massive batteries, Colonel Abbot had the Camp Low wharf repaired and a railroad spur built from the wharf south 1,500 yards to the construction site.[22]

As soon as he was notified of approval of the plans and the allotment of necessary funds, Colonel Abbot advertised for and then contracted for delivery of large quantities of construction materials. On March 19 he contracted with the Pennsylvania Cement Co. for furnishing and delivery at Highland Beach of 30,000 barrels of American Portland

20. Abbot to Black, Feb. 3, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

21. Black to Adj. Gen., Feb. 7, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

22. Abbot to Engineer, Eastern Dept., Feb. 21, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Cement;[23] on March 21 with Haverstraw Crushed Stone Co. for delivery of 24,000 cubic yards of broken stone alongside the Sandy Hook Engineer's Wharf;[24] and on March 30 with Lackawanna Steel Co. for 450 tons of reinforced steel bars to be delivered at Highland Beach.[25]

2. Arrangements Are Made to Facilitate Travel by Workmen to and from the Site

By late March the plant was being positioned and there were 69 men on the job. Getting to and from work constituted a problem. To solve it, Colonel Abbot called on the commander of the Proving Ground, Lt. Col. C. L. H. Ruggles. Abbot asked that the train departing north from the Highlands at 7:15 A.M., and the southbound train leaving Sandy Hook at 4:38 P.M., schedule a stop at a point midway between the batteries. Other trains would stop on signal to let off and take on passengers. At present, Abbot pointed out, the nearest stop was about three-quarters of a mile from the construction site. Colonel Ruggles was agreeable. The new stop was a great convenience to the labor force which soon exceeded 130.[26]

3. Electrical Equipment is Ordered Through the Engineer Depot

On March 14 Colonel Abbot asked that the Engineer Depot be directed to purchase and supply for installation:

Two 25-kilowatt gasoline-electric generating sets.

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23. Abbot to Black, March 21, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

24. Ibid., April 9, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

25. Ibid.

26. Abbot to Ruggles, March 28, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Two switchboards, each consisting of one generator and one feeder panel; the feeder panel to have nine 50-ampere switches and two 100-ampere circuit breakers, similar to Sheet 19, Standardization Board Drawings, revised January 31, 1913.

2,800 feet lead covered cable, single conductor, 1,300,000 cir. mils.

800 feet lead covered cable, duplex, 66,400 cir. mils.

6,000 feet lead covered and armored cable, duplex, 81 mils.

2,000 feet lead covered cable, duplex, 81 mils.

300 feet lead covered and armored cable, duplex, 26,300 cir. mils.

3,000 hangers for 81 mils. armored cable.

150 hangers for 26,200 cir. mils. armored cable.

If no motors were to be installed in conjunction with the guns and carriages, the order for the 800 feet of lead covered cable, duplex, 66,400 cir. mils. and the two 100-ampere circuit breakers could be cancelled. To enable Abbot to complete the batteries in 1917, it was essential that delivery be made by October 1.[27]

The officer in charge of the Engineer Depot, on checking the items needed, placed their cost at $20,330. It was also agreed that no motors for retracting the guns were needed, as they were to be mounted on barbette carriages.[28]

4. Abbot Describes the Trolley System

The declaration of war on Germany on April 6 spurred activity. In mid-April Colonel Abbot mailed to the department plans of the proposed trolley layout and details of a trolley for powder cases. The plan called for a continuous system of trolley tracks to all powder

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27. Ardery to Chief Engineer, March 14, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Capt. E. D. Ardery was an assistant to Colonel Abbot.

28. Abbot to Officer in Charge of Engineer Depot, May 22, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

magazines and shellrooms. Fixed frogs would be used for passing from one track to another, except at one point in the powder magazines where a switch was to be employed.

Single section powder cases, 16.2 inches in diameter and 6 feet, 8 inches long, would be stacked four tiers high, with their principal axis parallel to the major axis of the magazine. Each tier was to be on skids.

The trolley hoists consisted of two single trolleys, tandem connected, carrying the hoisting mechanism, consisting of a one-half ton quick speed hoist, with single hand-wheel and chain, operating two load chains through a flexibly connected shaft. Load chains would have suitable tongs attached for carrying the powder cases. There would be two hoists in each powder magazine.

Projectiles would be handled in the usual manner by trolley hoists designed to travel through the fixed frogs. Rear ends of the track would be extended beyond the doorway to permit unloading of projectiles and powder cases directly from railroad cars.[29]

5. Several Problems Delay and Vex the Engineers

The plan called for putting down wooden sheet piling. After it was in position, the areas enclosed would be excavated with a clam-shell bucket, no effort being made to pump out the water. Colonel Abbot proposed to employ wooden tanks of the same size and shape as the massive gun blocks. These tanks were to be floated on the water with the sheet piling. Concrete would then be placed within the tank which was expected to sink evenly as concrete was added.

The first problem came with the sheet piling, which the workmen expected to get into position without difficulty. When jetting

29. Abbot to Chief Engineer, April 19, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

failed, they called for a pile driver. Not strong enough to withstand hammering, the wooden piling started to go to pieces. Whereupon, Colonel Abbot called for sheeting. Having concluded that part of their difficulties resulted from the inexperience of their pile driving crew, Project Superintendent Capt. Lindsay C. Herkness contacted Henry Steers and secured the loan of his hands and equipment. Steers sent, along with his men, two centrifugal pumps, a 4-inch high pressure pump, a large quantity of pipes, pressure hoses, and accessories. Herkness added Steers' people to his payroll for the three weeks it took them to put down 1,100 sheet pilings in the four gun pits.

After the piling was positioned, Herkness' men moved to place waterproofing on the inside of the wooden tanks, but they were unsuccessful. Next, they attempted to place concrete in the tanks, but it came through the chutes a yard at a time. The tanks leaked. One end of the tank would dip downward, and two yards of concrete would come sloshing into the lower end increasing the tilt. Within a few minutes the concrete "was all cock-eyed and was starting to warp out of shape." To combat this, Captain Herkness had his men bore holes in the tanks and sink them. They then braced the steel piling on the inside to the wooden tank, and braced the tanks across. Eight- and six-inch centrifugal pumps were then employed to pump a hole and the form was filled with concrete.

There were many interruptions. The pumps would break down and the water would rise on the concrete. On one occasion, the bracing collapsed and the steel piling bulged inward, but not enough to damage the wooden form. Upon completion of the gun blocks, the steel pilings were withdrawn with a locomotive crane.[30]

The plant performed satisfactorily. Its maximum daily output of concrete with two mixers was 900 cubic yards. Five hundred

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30. Herkness to Brooke, Dec. 1, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Lt. Col. Mark Brooke was superintending construction for the Corps of Engineers on the fortifications guarding the Delaware River.

cubic yards was the best day's work logged for one mixer. If Haverstraw Crushed Stone Co. had not botched its contract, the concrete work would have been finished in late August, instead of the fourth week of October. Their troubles with Haverstraw would "fill a large volume."[31]

6. Several Change Orders are Implemented

During construction a number of change orders were implemented. They included: (a) constructing the retaining walls of a gravity section; (b) making the tops of walls over portals horizontal; (c) placing traverses on the rear firing trench wall; (d) providing chimneys for the quarters; and (e) lengthening reinforcing rods in the ceiling over the main corridor to give better anchorage.[32]

By the first week of November 1917, the batteries were completed, except for paving around the gun pits and mounting the guns and carriages. While waiting for the Ordnance Department to ship the carriages and guns, a few workmen waterproofed the traverses and prepared to begin the sand fill.[33]

D. Naming the Batteries

On August 20, 1917, Colonel Abbot had notified Junior Engineer John McCabe that the northern emplacement had been designated Battery Kingman and the other Battery Mills.[34] The former honored the memory of Dan C. Kingman of New Hampshire, who had graduated from the U.S. Military Academy as no. 2 in the Class of 1875. Commissioned a 2d

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31. Ibid., Nov. 5, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

32. Ibid.

33. Ibid.

34. Abbot to McCabe, Aug. 20, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Heretofore, the northern emplacements had been referred to as Battery B and the southern as Battery A; General Order 100, War Department, Aug. 2, 1917.

lieutenant in the Corps of Engineers, Kingman was assigned to the Engineer Battalion at Willetts Point, New York. From August 1878 to August 1881, he was on duty at West Point as Assistant Professor of Engineering. As a 1st lieutenant, he was Engineer Officer for the Platte River and in charge of improvements in Yellowstone Park from 1881 to 1887. His next assignment was as Engineer in charge of the Fourth District of the Mississippi River. From December 1890 to November 1899 Kingman was posted at Oswego, New York, as Engineer in charge of defensive works on Lake Erie.

In November 1895 he was placed in charge of improvements to the Tennessee River. From March 1906 until October 1913 Colonel Kingman was headquartered at Savannah, Georgia, where he was in charge of the coastal defenses along the South Carolina, Georgia, and east Florida coasts. On October 12, 1913, he was promoted to brigadier general and named Chief Engineer. General Kingman retired on March 6, 1916, at age 64, and died eight months later at Atlantic City.[35]

Battery Mills honored Albert L. Mills of New York, who had graduated from the U.S. Military Academy as no. 37 in the Class of 1879. Commissioned a 2d lieutenant in the 1st U.S. Cavalry, he served during the next seven years at various posts on the western frontier--Forts Walla Walla and Colville, Washington; Fort Coeur d'Alene, Idaho; and Forts Keogh and Custer, Montana. One year, July 1886 to August 1887, was spent by Mills as Professor of Military Science and Tactics at South Carolina Military Academy. Mills then rejoined the 1st Cavalry at Fort Custer in time to participate in the Sword Bearer Uprising. In April 1892 he was ordered to Fort Grant, Arizona.

From February 1894 to April 1898 Mills was stationed at the U.S. Infantry and Cavalry School at Fort Leavenworth, Kansas, as an instructor. He participated in the Santiago Campaign in the Spanish-American War as adjutant general of Young's Cavalry Brigade.

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35. Cullum, Biographical Register, III, 238; IV, 251; VI, 198.

He was severely wounded in the fighting on July 1, 1898, and for his gallantry was awarded the Medal of Honor.

On August 22, 1898, Mills was named superintendent of the U.S. Military Academy. He held this position for eight years. Mills, then a brigadier general, was ordered to the Philippine Islands in the autumn of 1906 and assumed command of the Department of the Visayas on January 14, 1907. General Mills returned to the United States in May 1909 to command the Department of the Gulf. He was detailed to the General Staff in 1912, and in September became Chief of the Division of Militia Affairs, a position he held until his death on September 18, 1916.[36]

E. Camouflaging the Batteries

In late May 1917, with the nation at war and work on the batteries progressing, Chief Engineer Black authorized Toch & Dougherty to inspect the exteriors of certain emplacements with a view to camouflaging them to blend with their environment. While at Sandy Hook, Maximilian Toch suggested that it would be possible to conceal existing batteries from observation not so much by painting the concrete surfaces, as by covering the concrete aprons with "artificial grass made of asbestos, and secured" with chicken wire. Loading platforms could be concealed by some sort of removable rug or carpet, appropriately decorated. In front of the guns, where the asbestos grass would be destroyed by muzzle blasts, Toch suggested painting in "blotches."

At the two 12-inch batteries under construction, Toch suggested that the concrete be so "colored that it will form an invisible splotched green." To accomplish this, he recommended alkali-proof pigments. He also suggested employing a coat of cement filler to prevent the exudation of lime, and treating the finished concrete surfaces with liquid Konkerit and cement floor paint of suitable tone. Toch urged that

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36. Ibid., III, 320; 314-15; V, 292; VI, 274.

"properly colored tarpaulines covered with grass, leaves, etc.," be used to conceal circular gun pits.[37] On June 12 the Chief Engineer approved the painting of the exterior of the concrete surfaces of the new batteries, as suggested by Toch.[38]

In October 1917 Maximilian Toch forwarded instructions for camouflaging Batteries Kingman and Mills. All concrete surfaces were to be prepared with a priming coat of liquid Konkerit primer, battleship grey in color. After this had dried, a second coat of liquid Konkerit of a lighter shade than the first was to be applied. After this had dried, Toch and his assistants employed colored chalk to draw on the Konkerit base outlines of "colored patches, trees and landscapes."

As the second step, trees (oaks and pines) were planted in the vicinity of the batteries. Interspersed among the oaks and pines were Norway maples. The distance between the trees was between 44 and 50 feet. As ground cover, the intervals between the trees were planted in morning glories, honeysuckle, and other evergreen vines.[39]

F. Batteries Become Part of the Sandy Hook Defenses

1. Mounting the Carriages and Guns

By October 27, 1917, construction had reached the point, where the installation of the gun carriages could be undertaken. A request was accordingly forwarded to the Chief Engineer by Brig. Gen. Theodore A. Bingham, asking that the Ordnance Department arrange for

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37. Abbot to Chief Engineer, June 6, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

38. Winslow to Abbot, June 12, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

39. Toch to Herkness, Oct. 22, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

delivery of the base rings as soon as practicable. If possible, they should be positioned before freezing weather came to the Hook.[40]

On January 4, 1918, the Chief Engineer was notified by the Ordnance Department that two 12-inch barbette carriages, Model 1917, were en route from the Watertown Arsenal to Fort Hancock. The second pair were expected to be completed and ready for shipment by March 1.[41]

Two weeks before, on December 21, the four 12-inch breech-loading rifles, Model 1895, M1A4, had left the Army's Watervliet Gun Factory for Sandy Hook.[42]

It was February 8, 1919, three months after the Armistice, before the Chief Engineer reported Batteries Kingman and Mills completed and ready for transfer to the Coast Artillery. The troops were to mount the four 52-ton guns which had been on hand for more than a month. In March and April the carriages and guns were positioned. At Battery Mills emplacement no. 1 was occupied by gun no. 69 and carriage no. 9 and emplacement no. 2 by gun no. 46 and carriage no. 8. Emplacements nos. 1 and 2 of Battery Kingman also mounted guns and carriages.[43]

2. Batteries are Transferred

A final inspection in May caused a hold-up in effecting the transfer of the batteries to the Coast Artillery, when it was found that there were a number of minor defects that required correction. Months

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40. Bingham to Chief Engineer, Oct. 27, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Bingham, having been recalled to active duty, had assumed command of the 2d Engineer District on October 11.

41. Chief of Ordnance to Chief Engineer, Jan. 4, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

42. Wheeler to Chief Engineer, Jan. 2, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

43. Battery Mills Emplacement Book, Fort Hancock, NA, RG 392.

passed before these were attended to. Finally, on October 20, 1920, Capt. John H. Carruth, who was overseeing the Fort Hancock projects, notified the District Engineer that during the past several years the Corps had completed a number of structures, which had not been formally transferred to the Coast Artillery. Several of these structures were presently occupied and being used by the garrison. Among these were Batteries Kingman and Mills and their respective heating systems.[44]

District Engineer James C. Sanford, who had replaced General Bingham, accordingly directed Captain Carruth to turn over to the Coast Artillery Batteries Kingman and Mills. At the same time, $240 was allotted for purchase of ventilating fans and other items recently stolen by vandals from the massive emplacements.

The heating systems, however, still required installation of certain items for which the Signal Corps was responsible. These facilities would be transferred without further reference to the Chief Engineer.[45]

With the nation at peace, the Army was in no hurry. It was April 2, 1921, before Batteries Kingman and Mills were transferred by the Engineers to the Coast Artillery.

3. Construction of Secondary (B") Towers

Eleven months before, in May 1920, a contract was signed for construction of the towers for the secondary stations (B") for the batteries.[46] The towers were completed and transferred on March 3, 1921.[47]

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44. Carruth to District Engineer, July 1, 29, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

45. Sanford to Carruth, Nov. 6, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

46. Carruth to District Engineer, May 17, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

47. Carruth to Sanford, Feb. 28, March 3, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

G. Improvements and Maintenance in the 1930s

1. Fabricating and Hanging Four Doors

In July 1921 Major Carruth had his workmen fabricate and hang four massive steel doors (8 by 15 feet) at Batteries Kingman and Mills. Each door, provided with a bottom stop (which could be operated from either side of the door), was hung at opposite ends of the rear corridors. These doors were designed to keep rain, snow, and sleet out of the batteries.[48]

2. Improvements to Battery Kingman

In the summer of 1922 a number of improvements were scheduled for Battery Kingman. These modifications, to be charged to the appropriation for Preservation and Repair of Fortifications, fell into four categories. They were:

a. To do away with noise in the plotting room involved construction of a heavy wooden door and windows shutters; construction of a concrete pit for mufflers on top of the battery, and exhausts from the 25-kilowatt sets leading to the mufflers; positioning pine boards coated with parafine under the engines and radiators; and installation of an 8-inch exhaust fan in the plotting room.

b. To overcome excessive moisture in the plotting room workmen boarded over the opening to the mechanical indicator tunnel, and constructed an inner room with corrugated asbestos ceiling and siding.

c. To overcome excessive moisture resulting from condensation in magazines, Col. John C. Oakes had his men box in the 25-kilowatt set radiators to force the entire discharge into the passageway leading to magazines, and install a ventilating duct with openings

48. Carruth to C.O., Sandy Hook Defenses, Aug. 2, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Carruth had been promoted to major.

into magazines, etc., together with a 36-inch motor driven blower with electric heating units.

d. To facilitate removal of water from the gun wells, laborers positioned two gasoline-engine driven sump pumps and one Davidson centrifugal sump pump.

This work was completed and transferred to the troops on December 4, 1924.[49]

3. Improvements to Battery Mills

In 1923 sump pumps were positioned to keep the gun wells free of water. Two years later, in 1925, $1,500 was expended on modifications to the plotting room.[50]

4. Lighting the Secondary Stations

In Fiscal Year 1925 the secondary (B") stations were wired for electricity.[51]

H. Batteries in the 1930s and 1940s

1. Their Mission

From the 1920s until 1943, when Battery Lewis was completed and armed with 16-inch guns, Batteries Kingman and Mills, next to Fort Tilden's Battery Harris, constituted the most formidable element in the coastal fortifications defending New York Harbor. Designated as Long Range Group 1, the two batteries' principal targets,

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49. Oakes to Chief Engineer, Dec. 4, 1924, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Colonel Oakes had succeeded Sanford as officer in charge of the 2d Engineer District. A pair of 25-kilowatt generators were installed in each battery's power-room.

50. Battery Mills Emplacement Book, Fort Hancock, NA, RG 392.

51. Oakes to Chief Engineer, Nov. 29, 1924, and Project Engineer to District Engineer, June 18, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

during an enemy naval attack, would be the capital ships, while cruisers and troop transports would be given second priority. The fire of Kingman and Mills would be employed to reinforce that of Battery Harris to "prevent long range bombardment of New York City by hostile capital ships."[52]

The 1938 Defense Project called for only minor additions to these batteries. To provide for local security, they were to be enclosed with "a man-proof, chain-link fence" to cost $10,000. Battery Kingman was to be equipped with a T-3 data computer and a T-7 data transmitter. The magazines were to be reconditioned to eliminate moisture.[53]

2. Fire-Control and Position-Finding Stations in the 1930s and 1940s

Fire-control for these batteries was based on these principles: (a) the length of each baseline would be about one-fourth the extreme range of each battery; (b) construction of plotting boards would require an angle of intersection of not less than 15 degrees, with the angle between the baseline and line of observation from each station being equal to or exceeding 15 degrees; (c) as average visibility in the area normally extended to 15,000 yards, the long-range batteries would require more than one baseline; (d) seacoast data computers would be employed rather than plotting boards; (e) the range of the armament and the general flatness of the terrain necessitated an extensive use of observation stations in towers, consequently, triple stations in a single tower, had been provided for certain of the long-range batteries; (f) to cover the entire field of fire of the long-range batteries, extending out to

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52. Annexes to Harbor Defense Project: Harbor Defenses of Sandy Hook, NA, RG 407.

53. Ibid.; Battery Mills Emplacement Book, Fort Hancock, NA, RG 392. At Battery Mills this involved installation of dehumidifying and air circulating equipment--consisting of a freon gas compressor, cooling coil, heating coil, fan, ducts, etc.,--to eliminate condensation. Each battery's magazines would hold 600 projectiles and 600 propellant charges.

29,000 yards, reliance had to be placed on use of a vertical base system and aerial observation; (g) spotter's instrument and a spotter line were provided for each base and station; and (h) flexible switchboards had been provided to permit rapid "interconnection of any desired line."[54]

The position-finding stations controlling the fire of Batteries Kingman and Mills included:

(a) The battery commanders' stations and primary stations (B') were housed in a structure dug into the side of a 250-foot hill, 650 yards south of the Navesink Light. The respective stations for each battery were equipped with one DPF M-1, Class 3 instrument and two azimuth instruments M1910.

(b) The secondary station (B") for Battery Kingman was in Tower D and the secondary station (B") for Battery Mills was in Tower C.

The former was about 600 yards south of Battery Gunnison and the latter about 650 yards south of Gunnison. Each station was equipped with one DPF and two azimuth instruments M1910.

(c) The supplementary stations (B''') were both in Tower E, 100 feet west of Battery Gunnison. Each station was equipped with one DPF, M1, Class 1, and two azimuth instruments M1910.

(d) The 100-foot steel tower at Monmouth Beach Coast Guard Station served as the base end and spotting station (B^4 S^4) for the batteries. The station for Kingman and Mills was on the tower's bottom deck and was equipped with one DPF, M1, and two azimuth instruments M1910.

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54. Annexes to Harbor Defense Project: Harbor Defenses of Sandy Hook, NA, RG 407.

(e) The tower at Elberon, on its bottom deck, housed the base end and spotting station (B^5 S^5) for Battery Mills and on its center deck a similar facility for Battery Kingman. Each station was equipped with one DPF and one azimuth instrument.

(f) Tower A at Fort Tilden provided the batteries with their base end and spotting stations (B^6 S^6). Housed on the bottom deck of the 100-foot steel tower were one DPF, M1, Class 1, and one azimuth instrument for each battery.

(g) The 100-foot steel tower on the Arverne Coast Guard Reservation, on its bottom deck, sheltered the base end and spotting stations (B^7 S^7) for Batteries Kingman and Mills. One DPF, M1, Class 1, and one azimuth instrument were required for these stations.

(h) Each battery had two plotting rooms within the bombproof traverses.[55]

3. World War II Modernization

The attack on Pearl Harbor which catapaulted the United States into World War II brought major structural changes to Batteries Kingman and Mills. These changes, which were everywhere made to this "family of emplacements," were dictated by lessons learned by the belligerents in the Spanish Civil War and in Europe between September 1, 1939, and December 7, 1941. Devastating attacks by "stuka" dive bombers had been particularly demoralizing to artillerists manning guns where there was no overhead protection. In the Philippines those coastal defense guns and mortars on Corregidor and the other Manila Bay forts mounted *en barbette* or pits, without overhead cover, were either disabled or neutralized by aerial bombardment and the fire of Japanese heavy artillery in April and early May 1942.

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55. *Ibid*.

To cope with this situation, it was determined to construct massive casemates of reinforced concrete for the 1915 family of emplacements. Once again, as in the "Third System" fortifications of the nineteenth century, many of America's coast defense guns would fire from casemates. New seacoast fortifications constructed during World War II accordingly would have their big guns either protected by casemates, of which Battery Lewis is an example, or by armored turrets similar to those of Construction 219.

The modernization of Batteries Mills and Kingman was accomplished in 1942-43 at an expense of more than $1,200,000, a sum twice their original cost. Massive concrete casemates, with walls 10 feet thick and 17 feet of masonry overhead, now protected the guns and their crew. Construction of the casemates reduced each gun's field of fire from 360 to 145 degrees. Each emplacement was connected with the magazines in the traverse by reinforced concrete corridors, with more than 8 feet of masonry, 20 feet of sand fill, and a 2-foot burster course of concrete overhead.

New power-rooms in the rear of the traverses were built for each battery. Protected by 5-foot concrete walls, with 5 feet of concrete and more than 6 feet of sand fill overhead, the structure was divided by concrete interior walls into a power-room, storeroom, water cooler room, muffler gallery, corridor, and two exhaust tunnels. On either side was a fuel storage tank positioned in a pit.[56]

The cost of the modernization of Battery Mills was:

Casemates and corridors added to original magazine . .	$475,097.27
Power-room added to central traverse magazine	131,745.63
Electrical power extension	1,760.77
Gasproofing system installed	6,582.54

56. Battery Mills Emplacement Book, Fort Hancock, NA, RG 392.

Alterations to septic tanks	1,510.84
Additions to ventilating system of traverse magazine .	2,463.22
New wood doors (power magazine room)	590.35
Blastproofing-modifications resulting from gunfire tests	4,068.18
Total	$623,818.80[57]

In 1944 several improvements were made to Battery Mills. A heating system, consisting of an oil-fired hot water boiler, induced draft fan, 4 unit heaters, and necessary piping, was installed at a cost of $2,240.97 in the power-room. Constructed at this time were "closures" to isolate the heated areas.

An additional dehumidification system, consisting of 3 self-contained dehumidifying units with 3-horsepower compressors, was installed. Including necessary duct work, condensate dry walls, and closures for corridors, its expense was $10,033.72.

Removal of the 1917 direct current gasoline powered generators, switchboard, jacket water cooling radiators, and related gear was accomplished for $1,380.[58]

Batteries Kingman and Mills constituted an important element in the defenses of New York Harbor during World War II. Their primary mission continued to be defense of the harbor against a naval attack by enemy forces. Secondary missions were protection, in conjunction with the Army Air Corps, of the Navy while leaving its bases in the harbor; defense against hostile naval or air attack on the defenses

57. Ibid.

58. Ibid.

of New York City, naval bases, or other sites of strategic significance in the area; and defense against an amphibious attack.[59]

4. Disarming the Batteries and Scrapping the Armament

The atomic bomb which hastened the surrender of Japan in August 1945, besides bringing World War II to a close, helped make seacoast fortifications, such as Batteries Kingman and Mills, obsolete. The development of carrier task forces and evolutionary changes in amphibious warfare also contributed to the demise of fixed coastal defenses mounting long-range guns.

Re-evaluating its strategic thinking in the immediate postwar years, the War Department determined to dispense with its fixed emplacements. Consequently, in June 1948 Batteries Kingman and Mills, having been declared surplus to the nation's defense needs, were disarmed. The four 12-inch guns and their carriages were turned over to the post salvage officer for sale as scrap.[60]

I. Recommendations

Batteries Kingman and Mills were among the first of the 1915 family of emplacements to be completed and armed. For a score of years, while the nation vainly sought to isolate itself from European and Asiatic problems and the losing struggle for collective security, those batteries and others like them were a vital part of our defense system. By 1941, when the United States was thrust into World War II, the aerial bomb had made these emplacements obsolete. To meet this threat from above, the batteries were casemated, an expensive operation which drastically altered their appearance.

Batteries Kingman and Mills should be stabilized and preserved, and entered on the List of Classified Structures as Third Order of Significance.

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59. Ibid.

60. Ibid.

XI. THE RAPID-FIRE BATTERIES: 1896-1940s

A. Structural History of Battery Engle

1. Rapid-Fire Battery Program Gets Attention

When work began on the Endicott System in 1890 the War Department gave priority to construction of mining casemates and other elements of the torpedo defense and to construction and arming of emplacements for the powerful 8-, 10-, and 12-inch rifles and 12-inch mortars. It was Fiscal Year 1896 before the Secretary of War allotted funds to commence work on the first rapid-fire emplacements. These batteries, as previously pointed out, would be sited to command the minefields and thus prevent their penetration and removal by high speed enemy destroyers and minesweepers.

By the end of Fiscal Year 1896 allotments had been made for only 12 rapid-fire emplacements, in comparison to allotments for 112 long-range gun and 156 mortar emplacements. In his annual report for Fiscal Year 1896, Colonel Gillespie informed his superiors that the defenses of the southern entrance to New York Harbor on Sandy Hook and Long Island included three Third System masonry forts, six 1870s batteries, and four new Endicott System batteries. The latter consisted of one emplacement for a 10-inch rifle on a disappearing carriage, two emplacements for 6-pounder rapid-fire guns, two emplacements for 12-inch guns on lifts, and a 16-gun mortar battery. The 12-inch guns and mortars at Sandy Hook were mounted, and the batteries ready for service. One of the masonry forts, with its outlying batteries, was garrisoned and its artillery cared for by troops; the armament of the others was taken care of by ordnance-sergeants and civilian employees.

With funds appropriated by the Act of June 6, 1896, four emplacements for 10-inch guns on disappearing carriages and two emplacements for 6-pounder rapid-fire guns were commenced.[1] By

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1. Executive Documents, Ser. 3479, pp. 14-15.

June 30, 1897, these emplacements (which included Battery Granger at Sandy Hook) had been completed but not armed.[2]

At the beginning of Fiscal Year 1898 the modern defenses on Sandy Hook and Long Island included 16 12-inch mortars, 2 12-inch guns on lifts, and 5 10-inch guns on disappearing carriages, with 2 12-inch guns and 4 10-inch guns on disappearing carriages under construction. During the year the four 10-inch emplacements, three of them constituting Battery Halleck, were completed and armed, and the two 12-inch emplacements (Battery Alexander) nearly finished and ready for their guns. Work had commenced at Sandy Hook on one emplacement for a 5-inch rapid-fire gun.[3]

2. Colonel Ludlow Builds a Battery

On June 29, 1896, almost six years after the first allotments had been made for the Endicott emplacements, Chief Engineer Craighill allotted $4,000 for construction at Sandy Hook of an emplacement for one 5-inch rapid-fire gun.[4] Plans for the emplacement to be sited about 100 yards northwest of the left flank of the five-gun battery and in front of the east face of the northwest bastion of the old fort were prepared by Colonel Ludlow, who had replaced Colonel Gillespie as superintending engineer.[5]

It was the summer of 1897 before the plans and specifications were approved. On September 5 Colonel Ludlow had the work force finally break ground. Construction was suspended for several months to await delivery of the mount, part of which was to be embedded

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2. Executive Documents, Ser. 3631, p. 14.

3. Executive Documents, Ser. 3746, pp. 19-20.

4. Executive Documents, Ser. 3631, p. 623.

5. "Emplacement for One 5-inch Rapid Fire Gun, Model 1896, on Balanced Pillar Mounting at Fort Hancock, Sandy Hook, N. J., 1897," NA, RG 77.

in concrete. The battery was completed on April 21, 1898, four days before Congress declared war on Spain, and it was turned over to the artillery by Colonel Ludlow on July 2 and assigned to the minefield defense.[6]

Mounted in the emplacement was a 5-inch breech-loading rapid-fire gun, Model 1897, No. 2. It was positioned on a 5-inch balanced pillar carriage, Model 1896, No. 2.[7] Both the gun and carriage had been manufactured by the Watervliet Gun Factory.

3. Altering the Platform to Accommodate Modifications to the Mount Introduced by the Ordnance Department

In Fiscal Year 1899 changes were made to the platform necessitated by modifications introduced into the mount by the Ordnance Department. These were completed in April and the gun remounted.[8] Within 12 months the Engineers returned to cut out and relay the platform to correspond to additional changes in the "mount adopted by the Ordnance Department."[9]

4. Emplacement Becomes Battery Engle

On May 25, 1903, the War Department issued General Order No. 78 designating the emplacement Battery Engle.[10] The battery would honor the memory of Capt. Archibald H. Engle of the 13th U.S. Infantry, who was killed at the Battle of Resaca on May 14, 1864.

Archibald H. Engle, a 20-year-old Missourian, had enlisted as a private in Company F, 17th Pennsylvania Infantry, on April 25,

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6. Executive Documents, Ser. 3746, p. 632.

7. Smith to Chief of Ordnance, NA, RG 156, Correspondence 1903-13.

8. Executive Documents, Ser. 3905, p. 779.

9. Executive Documents, Ser. 4089, p. 839.

10. General Order 78, War Department, May 25, 1903.

1861. On June 27, 1861, he was discharged to accept a 1st lieutenant's commission in the 13th U.S. Infantry. Promoted to captain on May 3, 1864, he was killed 11 days later.[11]

5. Colonel White Fails to Secure a Change in Armament

In mid-March 1910 Col. John V. White, who wore two hats as commander of Fort Hancock and the Southern Artillery District, suggested the replacement of the 5-inch gun, Model 1897, positioned on a balanced pillar mount, with a 6-inch gun on a barbette carriage. It would then, with the two 6-inch guns of Battery Peck, constitute a battery of three 6-inch guns under one commander.

The 5-inch gun and carriage of Battery Engle, Colonel White continued, had "never done satisfactory work." During the previous year's target practice, he had seen that the slightest movement of the detachment on the loading platform threw the piece off target.

His proposal, he argued, would greatly increase the efficiency of Battery Peck, "now the most important battery of the Mine Defense." Additional strength, however, was essential as Ambrose Channel, which in recent years had become the principal approach to New York Harbor, was too far away to be properly protected by the 3-inch guns of Batteries Morris and Urmston currently constituting the minefield defense. Elimination of the 5-inch gun from the defense would also simplify the ammunition service at the post by dispensing with one of the calibers in use.[12]

Maj. Gen. Leonard Wood, the commander of the Department of the East, called Colonel White's attention to the fact that all mine companies were assigned to 3-inch guns. As Battery Engle had been

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11. Francis B. Heitman, Historical Register of the United States Army . . . (Washington, 1890), p. 256; Compiled Service Records of U.S. Troops in the Civil War, NA, RG 94.

12. White to Adj. Gen., March 15, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

fired repeatedly in practice, General Wood saw no reason why Battery Peck could not be manned by a mine company.[13]

In reply Colonel White informed General Wood that the 136th Company's assignment had been changed from Battery Peck to a 3-inch battery in accordance with a request by his predecessor as District Commander in April 1909, because it was believed that the North Hook Beacon would interfere with target practice from Battery Peck. Colonel White, on checking with Capt. Joseph Wheeler of the 136th Company, now concluded that there would be no difficulty in having service practice from Battery Peck. He therefore desired permission to reassign the company to Battery Peck.[14]

Chief of Ordnance William Crozier, on reviewing Colonel White's request, found that the cost of the desired 6-inch gun, carriage, and shield would be between $18,000 and $20,000. Added to this would be the cost of remodeling Battery Engle.

Although General Crozier admitted that the 5-inch balanced pillar mount was not as efficient as the latest types of barbette carriages and the 5-inch rifle was not as powerful as the 6-inch gun, he questioned the wisdom of spending $20,000 for a new gun and carriage, when the cost of overhauling the present mount had been estimated at $1,500. In addition, it could not be justified by increased efficiency, especially as there were two modern 6-inch guns in Battery Peck. The 5-inch gun, General Crozier wrote, would cover the nearest part of Ambrose Channel with an elevation of 5-1/2 degrees, and therefore it did have sufficient range to protect the minefield.[15]

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13. Wood to White, March 19, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

14. White to Wood, March 23, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

15. Crozier to Chief Engineer, April 6, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

The Engineer Department concurred with Chief of Ordnance Crozier. Battery Engle, it was pointed out, was an early type of Endicott emplacement, and the cost of remodeling to adapt it to receive a 6-inch barbette carriage was out of all "proportion to the benefit to be derived." The result, Acting Chief Engineer Abbot observed, would be a "patched-up emplacement deserving of criticism and complaint."

It was the Corps' policy to recommend in all "cases of exceptional or partially obsolete caliber and definitely bad emplacements" that the status quo be maintained until such time as funds became available to replace them with a new battery. At this time the department did not have funds to allot for such a project.[16]

Colonel White accordingly did what he could. The 136th Company was transferred to Battery Peck. In mid-August the 5-inch rifle was dismounted from Battery Engle and its balanced-pillar carriage turned over to Sandy Hook Proving Ground mechanics. Within 30 days modifications and repairs were effected and the gun remounted.[17]

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16. Abbot to Adj. Gen., May 5, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Colonel Roessler meanwhile had made a study of the cost and feasiblity of modifying Battery Engle to mount a 6-inch gun en barbette. As the battery's crest was several feet below that of Battery Peck, in remodeling it to the level of Battery Peck, "nothing more would be necessary than to put on the necessary concrete on top of the present emplacement." Installation of an additional ammunition room and ammunition hoist would be simple. To the right of the existing powder room, which was too small, was ample space for construction of an ammunition room of proper capacity. The amount of concrete cutting would be exceedingly small. Nevertheless, the estimated cost of modifying the battery was $17,000, which was not far from the cost of a new emplacement. Roessler to Chief Engineer, May 6, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

17. Hurlbut to Roessler, Aug. 10, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

6. Battery is Disarmed and the Emplacement Receives a New Use

The 5-inch gun and its balance-pillar mount were declared obsolete and Battery Engle was disarmed in 1918. The emplacement, like Battery Potter more than a decade before, would be given a new mission.

In 1919 plans were prepared and approved for locating the plotting room for Battery Peck at the Battery Engle emplacement. On April 1, 1920, the Chief Engineer allotted funds amounting to $6,120 for constructing several battery commanders' stations and for converting one of Battery Engle's magazines into a plotting room for Battery Peck. The work on the plotting room was to be done by day labor.[18]

In converting the room into a plotting room there was installed: (a) two 110-volt D.C. exhaust fans, vertical delivery, discharging into two ventilator flues; (b) three side wall fixtures, for general illumination; and (c) six lamp fixtures mounted to the ceiling in two parallel rows over the area to be occupied by the plotting table. Both circuits were connected with a switch box in the oil room.[19]

For the next quarter century the emplacement was an intregal part of Battery Peck.

B. Structural History of Battery Urmston

1. Construction and Armament of Rapid-Fire Batteries Accelerates

By June 30, 1899, the War Department had taken advantage of public support for the military engendered by the Spanish-American War to secure increased appropriations from Congress

18. Chief Engineer to District Engineer, March 21, 1919, and April 1, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

19. Carruth to C.O., Sandy Hook Defenses, June 9, 1921, NA, RG 77, Ltrs. Sent & Recd., Chief Engineer.

for its coastal defense program. Attention was now being focused on the construction of rapid-fire batteries. Provision had been made for emplacement of 297 heavy guns, 308 rapid-fire guns, and 344 mortars. Within another 24 months projects approved by the Board of Ordnance and Fortifications had boosted the projected number of rapid-fire emplacements to 387.[20]

A review of the situation by the Board of Ordnance and Fortifications revealed that as of June 30, 1901, the program stood:

Type of gun carriage	Total Carriages Provided	Total Emplacements Provided
12-inch mortar carriages, Model 1896	(a) 306	296
12-inch mortar carriages, Model 1891	(b) 85	80
12-inch disappearing carriages, L.F., Model 1901	9	9
12-inch disappearing carriages, L.F., Model 1897	35	35
12-inch disappearing carriages, L.F., Model 1896	27	27
10-inch disappearing carriages, A.R.F., Model 1896	3	3

20. Executive Documents, Ser. 4279, pp. 5-11.

10-inch disappearing carriages, L.F., Model 1901		5	5
10-inch disappearing carriages, L.F. Model 1896		74	74
10-inch disappearing carriages, L.F., Model 1894		35	35
8-inch disappearing carriages, L.F., Model 1896		38	40
8-inch disappearing carriages, L.F., Model 1894		26	26
12-inch gun-lift carriages, altered to barbette		3	3
12-inch barbette carriages, Model 1891		2	2
12-inch barbette carriages, Model 1892	(c)	28	27
10-inch barbette carriages, Model 1893	(d)	11	9
15-inch smoothbore carriages, altered for 8-inch rifles		21	21 (e)
8-inch barbette carriages, Model 1892	(f)	9	9 (g)

6-inch disappearing carriages, Model 1898	29	29
6-inch rapid-fire pedestal mount, U. S. Ordnance	46	46
15-pounder rapid-fire carriages	142	142
6-pounder rapid-fire field carriages and rampart mounts	70	(h)
6-inch rapid-fire (Vickers Son & Maxim) pedestal mounts	8	8
5-inch balanced-pillar mounts, Model 1896	32	32
5-inch rapid-fire (navy pattern, Brown wire gun)	X	21
4.7-inch rapid-fire (Armstrong pattern) pedestal mounts	34	34
4.7-inch rapid-fire (Schneider pattern) pedestal mounts	1	1 (i)
4-inch Driggs-Schroeder rapid-fire	4	4
3-inch balanced pillar mounts	118	118
3-inch casemate mounts	2	2
3-inch pedestal mounts	74	74

a. The number of carriages of this type provided for exceeds by 10 the number which the Chief of Engineers has notified the Chief of Ordnance are required for the emplacements he has provided.

b. One in use at West Point. c. One in use at Sandy Hook Proving Ground. d. One at Buffalo Exposition and one at Sandy Hook Proving Ground.

e. Temporary, armament removed from 15.

f. One at West Point and one at Sandy Hook Proving Ground.

g. Five temporary. Armament removed from 3.

h. Moveable mounts.

i. Temporary.[21]

2. Building Emplacements Nos. 1 and 2

In 1899 Chief Engineer Wilson had allotted funds for two emplacements for 15-pounder rapid-fire guns on balanced pillar mounts at Fort Hancock. Plans and specifications for the emplacements were prepared and submitted by Major Adam in January. The battery would be sited near the beach, about midway between the Dynamite Battery and Battery Engle, from where its guns could command minefield 3.[22]

Plans were approved, and in February 1899 Major Adams ordered construction to begin. By June 30 work had been completed, with the exception of making and hanging one door, as far as possible until the gun carriages were received. The platforms were declared ready for them.[23]

Completion of the emplacements was suspended in Fiscal Year 1900, pending receipt of the mounts. Sand, which drifted in and

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21. Ibid.

22. "Emplacements for Two 15-pdr. Rapid-Fire Guns on Balanced Pillar Mounts, drawn under the direction of Major Henry M. Adams, Corps of Engineers, U.S.A, January 1899," NA, RG 77.

23. Executive Documents, Ser. 3905, p. 780.

over the battery during winter gales, was removed by workmen, and the slopes protected with "brushwood and ashes."[24]

3. Building Emplacements Nos. 5 and 6

On June 13, 1900, Chief Engineer Wilson made an allotment for construction of two additional emplacements for 15-pounder rapid-fire guns. Plans and specifications for these emplacements to be positioned 70 feet west of the two recently finished had been prepared by Major Marshall.[25]

With the project approved, construction began in July. By November 30, 1900, the concrete emplacements were completed, except for setting the base castings,[26] which were not received until Fiscal Year 1903.

4. Arming the Emplacements

In the winter of 1902-03 the Ordnance Department shipped to Sandy Hook and turned over to Major Marshall four Model 1898 15-pounder rapid-fire guns, Model 1898 (Nos. 89, 90, 101 and 102), and four Driggs-Seabury balanced-pillar mounts, Model 1898 (Nos. 89, 90, 101, and 102). By January 16 the guns and carriages had been mounted in emplacements nos. 1 and 2 and by February 5 in emplacements nos. 5 and 6. Three weeks later, on February 27, the four emplacements were turned over to the post commander by Major Marshall.[27]

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24. Executive Documents, Ser. 4059, p. 839.

25. "Fort Hancock, Sandy Hook, N.J., Proposed Emplacements for Two 15 pdr. Rapid Fire Guns drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., June 1900," NA, RG 77; Executive Documents, Ser. 4089, p. 840.

26. Executive Documents, Ser. 4279, p. 768.

27. Marshall to Gillespie, Jan. 16, Feb. 5, and March 2, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock; Smith to Crozier, Aug. 6, 1907, NA, RG 156, Ltrs. Recd., 1903-13. The guns and carriages were

5. Drainage Plans for Batteries Nos. 1 and 2 are Approved

Major Marshall, preparatory to turning the emplacements over to the garrison, prepared and submitted for approval by the Chief Engineer the prerequisite drainage plans. To insure proper maintenance, the troops were informed that: (a) All drain pipes led from strainers in rooms and gun platforms to handholes and manholes in rear of the battery. (b) All drain pipes, handholes, and manholes were to be carefully inspected and cleaned at least once a week. (c) Floors had been laid with a drip to the strainers, and water would not stand in them if they were properly cleaned. (d) All rooms were to be swept and all rubbish removed weekly, with care being exercised to insure that the strainers were kept open and free from dirt. (e) After a rain, the earthen slopes were to be carefully inspected, and any erosions corrected. Any serious sloughing was to be called to the attention of the Engineer's office in writing. (f) No one except those charged with making inspections or repairs was to walk on the earthen slopes. (g) Doors were to be opened for ventilation, whenever the temperature in the rooms was equal to, or higher than, that outdoors.[28]

6. Building Emplacements Nos. 3 and 4

In the spring of 1903 Chief Engineer Gillespie called on Major Marshall to prepare plans for two emplacements for two 3-inch rapid-fire guns on pedestal mounts. The site selected was in the interval between the 15-pounder emplacements constructed in 1899 and those built

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27. (Continued)
mounted:
Emplacement no. 1, Gun No. 89, carriage no. 89.
Emplacement no. 2, Gun No. 90, carriage no. 90.
Emplacement no. 5, Gun No. 101, carriage no. 101.
Emplacement no. 6, Gun No. 102, carriage no. 102.

The four guns had been manufactured by Driggs-Seabury. Battery Urmston Emplacement Book, Fort Hancock, NA, RG 392.

28. "Drainage Plan 15-pdr. R. F. Gun Battery No. 1, Fort Hancock, N.J., January 1903"; "Drainage Plan 15-pdr. R. F. Gun Battery No. 2, Fort Hancock, N.J."; NA, RG 77.

the following year. The masonry of the new emplacements would tie in on the left and right with that of the older ones.

On May 5 Marshall mailed to the department for approval plans and sections of the emplacements.[29] The plans were approved, and $24,000 allotted for construction of six emplacements for 3-inch rapid-fire guns on pedestal mounts.[30]

Construction was commenced in September on the six emplacements. Nine months later, in June 1904, Marshall (now a lieutenant colonel) inspected recently completed emplacements nos. 3 and 4 and turned them over to the post commander. Development and production of a pedestal carriage having lagged, more than five years would pass before these emplacements were armed.[31]

7. Naming the Battery

On December 27, 1904, the War Department published General Order No. 194, designating the six emplacements Battery Urmston in honor of Lt. Thomas D. Urmston of the 12th U.S. Infantry, killed in combat at Peebles Farm, Virginia, on October 1, 1864.[32]

Thomas D. Urmston, the only son of Nathaniel M. and Eveline Comstock Urmston, was born in Fairfield County, Connecticut, on August 16, 1837. He was commissioned a 2d lieutenant of Company F, 12th U.S. Infantry, on July 1, 1862, and promoted to 1st lieutenant on

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29. "Fort Hancock, New Jersey, Plan and Sections of Emplacements for Two 3-inch R. F. Guns on Pedestal Mounts, drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., May 1903," NA, RG 77.

30. Gillespie to Marshall, May 13, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

31. Marshall to Mackenzie, June 20, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

32. General Order 194, War Department, Dec. 27, 1904.

February 6, 1863. Urmston's command was assigned to the V Corps, Army of the Potomac.[33]

8. Difficulties With the Balance-Pillar Mounts Hasten the Armament of Emplacements Nos. 3 and 4

On March 5, 1908, the Fort Hancock commander requested that two mine companies be assigned to Batteries Urmston and Peck. The Adjutant General was agreeable, and the 157th Company (Mine) was assigned to the former and the 136th Company (Mine) to the latter.

In late August 1908 the 157th Company (Mine) fired the 15-pounders of Battery Urmston. These guns were mounted on Driggs-Seabury-Masking Parapet Mounts, Model 1898. To simulate combat conditions, Lt. Frank T. Hines had the entire battery manned, and firing was done from four guns. The ammunition was distributed by providing the ranging gun with four rounds and each of the others with three rounds.

The practice was highly unsatisfactory as to accuracy and rapidity of fire. Hines and his men found the sights and mountings defective. When the pieces were being fired on the 29th, one of the pointers had his eye so lacerated by the eye piece that stitches were required. The elevating clamps were ineffective, and at each discharge there was an "increased negative jump." The shield support of carriage no. 89 was sheared off near the shield and the other was cracked. On carriage no. 101 both the upper and lower shield supports were broken.[34]

Colonel Harris, after reviewing Hines' report, filed a complaint. The guns of Battery Urmston, he wrote, besides having

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33. Nathaniel Urmston, Pension Claim, Certificate No. 203122, NA, RG 94.

34. Hines to Harris, undated, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

unstable mounts, were provided with neither elevating nor traversing gear, which made accurate and consistent laying impossible. He urged that prompt action be taken to secure pedestal mounts, provided with elevating and traversing gear and the equipment of the sights with a suitable eye protector, for the battery. If this were impossible, he recommended that four guns be provided by the Ordnance Department for the emplacements of Battery Morris, then unarmed.[35]

His department, Chief of Ordnance Crozier acknowledged, was well aware of the defects in the balanced-pillar mount, and they were being corrected as rapidly as possible. It was expected that the 15-pounder carriages slated for emplacement in Battery Morris would be shipped to Fort Hancock from Watertown Arsenal in January 1909. If so, that battery would be ready for use during the summer's target season.[36]

In the late spring of 1909, besides providing armament for Battery Morris, the Ordnance Department sent to Fort Hancock from Fort Wadsworth two 3-inch rapid-fire guns, Model 1903 (nos. 75 and 76), recently removed from Battery Catlin. These guns in June were mounted in emplacements nos. 3 and 4.[37]

9. Construction of a BC and CRF Station

In the spring of 1918, with the nation at war with the Central Powers, plans were made for construction of a combined commander's and CRF station. The plans were approved, and by Armistice Day, the station was 98 percent completed. The station was

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35. Harris to Adj. Gen., Sept. 23, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

36. Crozier to Abbot, Oct. 13, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

37. Emplacement Book, Battery Urmston, Fort Hancock, NA, RG 392. Gun no. 75, mounted on carriage no. 59, was in emplacement no. 3 and Gun no. 76, mounted on carriage no. 60, was in emplacement no. 4. Both guns and carriages had been manufactured at the Watertown Arsenal.

soon finished, and on February 21, 1919, was transferred by the Engineers to the garrison.[38]

10. Emplacements Nos. 1, 2, 5, and 6 are Disarmed

In the summer of 1920 the four 15-pounder rapid-fire guns and their balanced-pillar mounts in emplacements nos. 1, 2, 5, and 6 were dismounted. The guns were stored for possible future use for antiaircraft defense, and the mounts were sold for salvage.[39]

11. Battery in the 1930s and 1940s

In the 1930s Battery Urmston, as one of the four Sandy Hook Mine Group Batteries, had as its primary mission protection of the minefield. Its two 3-inch guns, along with those of Battery Morris, covered the "water area from the entrance to Ambrose Channel to a point west of Sandy Hook."[40]

The magazines had space for the 400 rounds of fixed ammunition allotted to the battery, as well as 200 propelling charges for the 6-inch guns of Battery Peck.[41]

Under normal conditions the battery would "fire as a rapid-fire battery," the artillerists obtaining their ranges from a coincidence range-finder positioned in the CRF station behind the emplacements.[42]

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38. Post Engineer to Bingham, April 6, 17, 1918, and Bingham to Chief Engineer, Nov. 14, 1918, and Jan. 28, March 8, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

39. Battery Urmston Emplacement Book, Fort Hancock, NA, RG 392.

40. Annexes to Harbor Defense Project: Harbor Defenses of New York, NA, RG 407.

41. Ibid.

42. Ibid.

In September 1942, ten months after the United States entered World War II, the 3-inch rapid-fire guns and their pedestal mounts were removed from emplacements Nos. 3 and 4. They were remounted in a new battery being erected by the Engineers 100 yards northeast of Battery Gunnison. The new emplacements were turned over to the garrison in November. Here they would be in a better position to engage Axis motor torpedo boats.[43]

On October 7, 1942, relocated Battery Urmston, along with Battery Morris and Batteries 7 and 8 (each consisting of 4 90 mm guns) were constituted as a defense against motor torpedo boats.[44]

In September 1946, one year after V-J Day, the two 3-inch guns (nos. 75 and 76) and their mounts (nos. 59 and 60) were dismounted and transferred to the Fort Hancock Salvage Officer for disposition.[45]

C. Structural History of Battery Morris

1. Siting and Building the Emplacements

On April 16, 1903, Major Marshall notified Assistant Engineer Hurlbut that plans were to be prepared for emplacements for four 3-inch rapid-fire guns on pedestal mounts. The position to be occupied was between Batteries Engle and Urmston.[46]

Plans and specifications for the four-gun battery were prepared and transmitted to Washington by Major Marshall on May 5. Between each emplacement, protected by several feet of concrete, were

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43. Battery Urmston Emplacement Book, Fort Hancock, NA, RG 392.

44. Supplement to Harbor Defense Project: Harbor Defenses of New York, Sept. 1, 1944, NA, RG 407.

45. Battery Urmston Emplacement Book, Fort Hancock, NA, RG 392.

46. Marshall to Hurlbut, April 16, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

two rooms for magazines and storage. As soon as Chief Engineer Gillespie had approved the plans and allotted necessary funds, Major Marshall alerted Hurlbut to get the plant ready and line up the construction personnel.[47]

On staking out the battery, Marshall found that its left flank abutted on the right flank of Battery Urmston. More important, however, was the discovery that its construction would necessitate removal of the dwelling occupied by employees of the Postal Telegraph Company. The structure in question had been built under authority granted by the Secretary of War on January 9, 1900.

As the battery could not be constructed unless the dwelling was removed, Marshall recommended to General Gillespie that notice be served on the Postal Telegraph personnel to relocate it within 30 days to a site along or south of a line drawn between the Signal Service wireless telegraph station and the bell of the Lighthouse Service, near the extremity of the Hook. The Fort Hancock commander would have final say as to its exact location.[48]

Given the go-ahead by Chief Engineer Gillespie, Major Marshall on July 15 wrote the Postal Telegraph Company, notifying it that by August 22 their dwelling must be relocated to a site about 400 feet southwest of the Hook Beacon.[49]

The Postal Telegraph Company personnel did as requested. With the house and its dependencies out of the way, Assistant Engineer

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47. "Fort Hancock, New Jersey, Plans and Sections of Emplacement for Four 3-inch R.F. Guns on Pedestal Mounts, drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., May 1903," NA, RG 77.

48. Marshall to Gillespie, May 26, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

49. Marshall to Postal Telegraph-Cable Co., July 15, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

Hurlbut put his crew to work. To insure an efficient and economic use of the $24,000 allotted for construction of six emplacements for 3-inch rapid-fire guns on pedestal mounts, the labor force and plant were employed simultaneously on this battery and emplacements nos. 3 and 4 of Battery Urmston. Although compelled to suspend construction during the winter, the four emplacements were completed early in the summer of 1904. More than five years were to pass, however, before the Ordnance Department was able to provide the armament.[50]

2. Naming the Battery

On December 27, 1904, although the Ordnance Department had not yet provided guns and carriages, the War Department by General Order No. 194 designated the four emplacements, Battery Lewis Morris to honor Col. Lewis Morris of the 7th New York Heavy Artillery, killed in action at Cold Harbor, Virginia, June 4, 1864.[51]

Lewis Morris of New York was commissioned a 2d lieutenant in the 1st U.S. Artillery on March 8, 1847. He was promoted to 1st lieutenant in December 1847 and to captain on April 21, 1861. Eighteen months later, on August 1, 1862, the 38-year-old Morris was appointed colonel of a regiment of volunteers to be organized in the 13th Congressional District of New York and established his headquarters at Albany.

Morris and his regiment, designated the 7th New York Heavy Artillery, were mustered into federal service on August 14. The regiment was ordered to Washington in September, where Morris assumed command of the 2d Brigade, Defenses of Washington, North of the Potomac, with headquarters at Fort Pennsylvania. In April 1863 he moved his headquarters to Fort Reno. Morris and his regiment were ordered

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50. Battery Morris Emplacement Book, Fort Hancock, NA, RG 392.

51. General Order 194, War Department, Dec. 27, 1904.

into the field in May 1864, and assigned to the II Corps, Army of the Potomac.[52]

3. Arming the Battery

On July 5, 1905, Colonel Marshall notified Assistant Engineer Hurlbut that the pedestal mounts for 3-inch rapid-fire guns required a "duct leading under each pedestal, to carry illuminating wire from the nearest available main." For the Model 1902 the duct was to terminate at the center of the bolt circle foundation, and for the Model 1903 at a point on the circumference of a circle having a radius of ten inches and its center concentric with that of the bolt circle foundation and 90 degrees on either side of the diameter passing through the front foundation bolt. It was suggested that the end of the duct be left projecting about three inches above the top surface of the concrete. It was Marshall's understanding that a duct which would serve this purpose had been incorporated into the Battery Peck platforms and emplacements nos. 3 and 4 of Battery Urmston.[53]

Although Hurlbut soon positioned the ducts as directed, there was no need for haste. The Ordnance Department personnel were in no hurry to provide the necessary armament. Colonel Harris' outburst in September 1908, following the problems encountered by the 136th Company (Mine) with the balanced-pillar mounts of Battery Urmston, compelled Chief of Ordnance Crozier to take action.

In April 1909 four pedestal mounts, Model 1903 (Nos. 91-94) for emplacement in Battery Morris, manufactured by the Maryland firm of Detrick & Harvey, were shipped from Baltimore to Fort Hancock in April 1909. In early June four 3-inch rapid-fire guns, Model 1903, were transferred from Fort Wadsworth to Fort Hancock. By the middle of the month the guns had been mounted as follows:

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52. Compiled Service Records of Union Soldiers, NA, RG 94.

53. Marshall to Hurlbut, July 5, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

Emplacement no. 1, Gun No. 5 on carriage no. 91.
Emplacement no. 2, Gun No. 49 on carriage no. 92.
Emplacement no. 3, Gun No. 70 on carriage no. 93.
Emplacement no. 4, Gun No. 71 on carriage no. 94.

In the summer of 1909 the rapid-fire guns of Battery Morris were fired by Coast Artillery companies participating in the annual drill for units assigned to the New York Harbor Defenses.[54]

4. Construction of BC and CRF Stations

In 1918 plans were developed for construction of a battery commander's and CRF stations. Because of drifting sand, it was at first determined to combine the two in the same structure. As recommended by Chief of Coast Artillery Frank W. Coe, the station, unlike the one at Battery Urmston, would be a "closed type," and located in rear of the magazine.[55]

Plans were reviewed and approved in August 1919 by the Chief Engineer, and $1,400 allotted for construction of a separate CRF station. It would be equipped with one wall telephone to range setters and a second to the battery commander's station, a coincidence range-finder, and a time interval recorder.[56]

The CRF and battery commander's stations were built under contract and completed by late October 1920. On November 6 District Engineer Sanford directed Captain Carruth to transfer to the

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54. Hurlbut to Roessler, Nov. 9, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock; Battery Morris Emplacement Book, Fort Hancock, NA, RG 392.

55. Post Engineer to Bingham, April 17, Aug. 20, Nov. 20, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

56. Bingham to Chief Engineer, Dec. 12, 1918, and March 21, 1919, and Post Engineer to Bingham, July 29, Aug. 13, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Coast Artillery the two stations. The CRF station was inspected and transferred on November 10 and the battery commander's ten days later.[57]

5. Final Years: 1935-1946

In the 1930s and through World War II, Battery Morris was one of the four Fort Hancock batteries assigned to the Mine Command. Its primary mission was defense of the minefield. With Battery Urmston, it covered the "water area from the entrance to Ambrose Channel to a point west of Sandy Hook." Two of its guns (nos. 1 and 4) had 360-degree fields of fire.[58] The battery's magazines had space for 1,600 rounds of 3-inch fixed ammunition and 400 6-inch propelling charges for Battery Peck.[59] The battery, since 1920, had employed a CRF station, with coincidence range-finder, for fire control.[60]

In October 1942 Battery Morris was assigned a new mission. It, along with relocated Battery Urmston and Batteries 7 and 8 (each consisting of four 90 mm guns), was allotted to the defense of the approaches to New York Harbor against Axis motor torpedo boats.[61]

In September 1946 the guns (nos. 5, 49, 70, and 71) and their pedestal carriages (nos. 91-94), having been declared obsolete, were removed from the emplacements. They were turned over to the post salvage officer for disposition.[62]

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57. Carruth to District Engineer, Oct. 29, 1920, and Sanford to Carruth, Nov. 6, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock; Battery Morris Emplacement Book, Fort Hancock, NA, RG 392.

58. Annexes to Harbor Defense Project: Harbor Defenses of Sandy Hook, NA, RG 407.

59. Ibid.

60. Ibid.

61. Supplement to Harbor Defense Project: Harbor Defenses of New York, Sept. 1, 1944, NA, RG 407.

62. Battery Morris Emplacement Book, Fort Hancock, NA, RG 392.

D. Structural History of Battery Peck

1. Construction of Two 6-inch Barbette Emplacements

In Fiscal Year 1901 plans were prepared by Major Marshall for an emplacement for two 6-inch rapid-fire guns mounted on pedestal mounts. Chief Engineer Gillespie approved the plans, and the necessary funds were allotted.[63]

On July 11, 1901, the site, midway between Batteries Alexander and Engle, was staked out and ground broken. Workmen graded the site, excavated pits for foundations, and extended the narrow gauge railroad 1,200 feet from the concrete plant near the Dynamite Gun Battery. Concrete was hauled from the mixer to the construction site by cable cars. Derricks were positioned at each end of the battery to facilitate handling materials.

Great care was taken to insure that the magazine and shellrooms would be waterproof by employing a mixture of alum and soap in all vertical surfaces. Over ceiling beams, a finished mortar course was laid and allowed to dry before applying four courses of asbestos waterproof paper, each shingled eight inches and painted down, after which one inch of low grade mortar was spread and the concrete layers continued. A covering of asphalt was laid to prevent dampness arising through the floor.

The concrete work was completed in November. It consisted of 1,864 cubic yards of concrete, costing $9.06 per cubic yard.[64]

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63. "Fort Hancock, New Jersey, Plan of Emplacements for Two Six-inch Rapid-Fire Guns, on Pedestal Mounts, Model 1900. Drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., June 1901," NA, RG 77.

64. Executive Documents, Ser. 4444, p. 690-91.

The earthen slopes and ironwork were finished in the spring of 1902. But, before the armament was received, it was determined to extensively modify the battery.

On March 12, 1903, Major Marshall sent to Assistant Engineer Hurlbut a blueprint showing extensive changes to be made. Hurlbut was to convert the gun platform into a traverse with observation station in the middle.[65] New platforms were to be built on the flanks. To fund this work, Chief Engineer Gillespie made a $4,500 allotment.[66] By late summer new platforms had been built and were ready for their guns and mounts.

2. Arming the Battery

In mid-September the battery was armed. Positioned in emplacement no. 1 was a 6-inch rapid-fire gun, Model 1900, Serial No. 27, mounted on a barbette carriage, Model 1900, Serial No. 12; and in emplacement no. 2 a 6-inch rapid-fire gun, Model 1900, Serial No. 28, mounted on barbette carriage, Model 1900, No. 17. The guns had been cast at Watervliet, while the carriages had been manufactured at the Rock Island Arsenal.[67] On November 10, 1903, the battery was turned over by Major Marshall to the post commander.[68]

3. Naming the Battery

On May 25, 1903, the War Department had published General Order No. 78, designating the two emplacements Battery Peck in

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65. "Fort Hancock, New Jersey, Plan and Sections Showing Modification of Battery for Two 6-inch R. F. Guns on Pedestal Mounts, Model of 1900. Drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., February 1903," NA, RG 77.

66. Marshall to Hurlbut, March 12, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

67. Battery Peck Emplacement Book, Fort Hancock, NA, RG 392.

68. Marshall to Gillespie, Sept. 18, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

honor of Lt. Fremont P. Peck, who had been mortally wounded by a bursting gun at the Proof Battery on February 19, 1895.[69]

Fremont Peck of New York was graduated from the U.S. Military Academy as no. 17 in the Class of 1887. Commissioned a 2d lieutenant in the 1st Artillery, he was ordered to the San Francisco Presidio. While on the Pacific coast, he also served brief tours of duty at Forts Wright and Mason. In March 1891 he was transferred to the Ordnance Department and ordered to the Springfield Armory. Four months later, in July 1891, Lieutenant Peck was transferred to the Sandy Hook Proving Ground.[70]

4. Removal of the 4.7-Inch Armstrong

With Battery Peck now a unit in the Sandy Hook Defenses, the 4.7-inch Armstrong rapid-fire gun, emplaced as an emergency measure during the Spanish-American War, became expendable. In 1904 personnel from the Proving Ground dismounted and removed it from its "temporary concrete emplacement," 160 feet northeast of Battery Peck. A permanent battery at this site was impracticable, as the sea and sand had already destroyed the timber magazine.

As Battery Engle had been assigned to minefield defense, Colonel Marshall recommended construction of an emplacement for the Armstrong on its left in such a manner as to constitute with it a two-gun battery.[71] His proposal was vetoed as unnecessary and one that would compound rather than simplify the requisitioning of ammunition by permanently introducing another caliber to the system.

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69. General Order 78, War Department, May 25, 1903.

70. Cullum, Biographical Register, III, 408; IV, 444.

71. Marshall to Mackenzie, Feb. 11, 1905, NA, RG 77, Press Copies, Ltrs. Recd., Fort Hancock.

5. Maintenance of the Battery

In May 1910 Colonel Roessler advised the department that the Battery Peck platforms were too narrow, and that powder recesses should be built under the gun platforms and handrails.[72] Hurlbut was authorized to extend the platforms "in accordance with the print furnished him."[73] This project was completed by October 1910, and Hurlbut was supplied with paints of different colors for the purpose of experimenting with camouflage on the battery's concrete slopes.[74]

6. Construction of the BC and CRF Stations

During World War I plans and specifications were formulated for construction of a combined battery commander's and CRF station. The CRF station, unlike the one at Battery Urmston, would be a closed type. After considerable correspondence, it was decided to build separate facilities. On May 12, 1919, the department allotted $1,956 for construction of the CRF station and for completing the battery commander's station on the traverse between the two emplacements.[75]

The two stations, both built by day labor, were completed by July 1, 1920. Several months later, Captain Carruth notified the District Engineer that these structures should be formally transferred to the Coast Artillery. In accordance with orders from District Engineer Sanford, Carruth made a final inspection of the battery commander's and CRF stations in June 1921 and turned them over to the post commander.[76]

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72. Roessler to Chief Engineer, May 10, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

73. Roessler to Hurlbut, June 13, 1901, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

74. Hurlbut to Roessler, Oct. 17, 1910, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

75. Post Engineer to District Engineer, April 17, Aug. 20, 22, 1918, May 12, 1919, and District Engineer to Post Engineer, Aug. 15, 1918, March 21, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

76. Carruth to District Engineer, July 1, Oct. 29, 1920, July 1, 1921, and Sanford to Carruth, Nov. 6, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

In the spring of 1924 funds were expended for waterproofing the battery.[77]

7. Battery is Disarmed and the Guns Transferred

The 1930s found Battery Peck assigned to the Mine Command, with its primary mission to protect the minefield. Along with Battery John Gunnison, it had a secondary mission of defending New York Harbor against various forms of naval attack. Its guns being mounted en barbette, they possessed two advantages over those of Gunnison--they could be fired more rapidly and had 360-degree fields of fire.[78]

The fire-control system involved horizontal base end stations. Located between the emplacements was the concrete battery commander's station, while the plotting room was in Battery Engle. The primary station (B'), equipped with Swasey DPF and azimuth instrument M1910 was on the Battery Potter terreplein; the secondary station (B"), with Swasey DPF and azimuth instrument, was in the old group of secondary stations 1,500 yards south of Battery Gunnison; and the supplementary station (B"'), equipped with Swasey DPF, Type 1, and two azimuth instruments M1910, was in a frame structure near the extremity of the Hook.

For direct firing there was the 1920 CRF station.[79]

In April and May 1943 the battery was disarmed. Its two 6-inch guns (nos. 27 and 28) and their carriages (nos. 12 and 17) were transferred to Battery Gunnison, which was being converted into a

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77. Post Engineer to District Engineer, July 9, 1924, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

78. Annexes to Harbor Defense Project: Harbor Defenses of Sandy Hook, NA, RG 407.

79. Ibid.

barbette battery.[80] The battery's magazines were modified for use by Battery No. 8, which was armed with four 90 mm guns (two mobile and two on fixed mounts).[81]

E. Structural History of Battery John Gunnison

1. False Start

On April 25, 1898, the day Congress declared war on Spain, Chief Engineer Wilson allotted $16,000 from the appropriation for "National Defense" for construction of an emplacement for two 6-inch rapid-fire guns. A railroad spur to the site selected for the battery was built in May and June, and plans for the battery were approved by the Chief Engineer.[82]

Work on the emplacement began in July 1898. It soon became apparent that the site selected interfered with operations of the Proving Ground. When apprised of this, Chief Engineer Wilson on August 8 ordered a temporary suspension of construction. On August 20 Major Adams again turned his hands out. Once again the Chief of Ordnance protested, and on the 30th construction was stopped. By then the concrete work was about one-third completed. On September 7, 1898, the emergency having passed with destruction of the Spanish fleet followed by an armistice, General Wilson transferred the balance of the allotment to another project.[83]

2. Siting and Constructing the Emplacements

Five years later the project was revived. In mid-April 1903 Major Marshall was called upon by the department to prepare plans

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80. Battery Peck Emplacement Book, Fort Hancock, NA, RG 392.

81. Supplement to Harbor Defense Project: Harbor Defenses of New York, Sept. 1, 1944, NA, RG 407.

82. Executive Documents, Ser. 3746, pp. 632, 635.

83. Executive Documents, Ser. 3905, p. 779.

for a 6-inch rapid-fire gun emplacement to the left of the existing 15-pounder batteries.[84] Four weeks later, on May 13, Chief Engineer Gillespie telegraphed Major Marshall that $12,000 had been allotted for construction of the battery.[85]

On studying the situation, Major Marshall concluded that a better site for the battery was available. He urged that it be positioned to command the southern approach to Fort Hancock. This would be about 125 yards southeast of the site "indicated for 4 six-inch guns in the approved project for defense." This change was made to avoid interference with one of the Ordnance Department's magazines. The site was on the Proving Ground Reservation.

On August 2 Marshall transmitted to the department plans and sections of a proposed battery for two 6-inch rapid-fire guns on disappearing carriages. The difference in level between the interior crest and loading platform was 3 inches less than that required for horizontal firing, he explained, to provide for a slight depression of the guns. Recesses for reserve ammunition were provided in the rear walls of the loading platforms.

He estimated the cost of the battery, at the site recommended, to be $45,000. In explanation of this figure, Major Marshall pointed out that the site, as well as that of the railroad spur providing access, was wooded and would be difficult to clear. Materials also cost more at Fort Hancock than anywhere else in the New York area, while wages were 15 percent higher at the Hook.[86] The plans were

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84. Marshall to Hurlbut, April 16, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

85. Gillespie to Marshall, May 13, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

86. Marshall to Gillespie, Aug. 2, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock; "Fort Hancock, New Jersey, Plan and Sections of Emplacments for Two 6-inch R.F. Guns on Disappearing Carriages, Model 1903, Drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., August 1903," NA, RG 77.

approved, $45,000 allotted, and the recommended site cleared with the Ordnance Department.

In the autumn of 1903 the narrow gauge railroad system was extended 2,100 feet to the site selected for the emplacements, 1,600 feet southeast of the mortar battery. The area was cleared of underbrush, and preparations made for beginning construction in the spring of 1904.

As the six emplacements for 3-inch rapid-fire guns had been completed, the plant was positioned in March. Assistant Engineer Hurlbut pushed his crew hard. By June it was apparent that Marshall had underestimated construction costs. On the 23d he notified the department that he needed another $20,000 for the project. General Mackenzie, who had replaced Gillespie as Chief Engineer, made the additional allotment.[87] By late autumn the emplacements were finished and ready for their armament.

3. Arming the Battery

In January 1905 the Engineers made their plant, including the cars and track, available to Major Harris and his Fort Hancock soldiers to transport the guns and carriages from the wharf to the battery. Under no circumstances were Assistant Engineer Hurlbut or his men to assume responsibility for positioning the carriages or mounting the guns, unless ordered to do so by Colonel Marshall.[88]

The troops, on arming the battery, mounted in emplacement no. 1 a 6-inch gun, Model 1903, Serial No. 5, on a Model 1903 disappearing carriage, Serial No. 52; and in emplacement no. 2 a

87. Marshall to Mackenzie, June 23, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

88. Marshall to Hurlbut, Jan. 6, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

6-inch gun, Model 1903, Serial No. 34, on a Model 1903 disappearing carriage, Serial No. 57. The guns had been cast at the Army's Watervliet Gun Factory, while the carriages had been manufactured by Detrick and Harvey Machine Co.[89]

On December 5, 1905, Colonel Marshall made a final inspection and transferred the battery to the Coast Artillery.[90]

4. Naming the Battery

Twelve months before on December 27, 1904, the War Department had published a General Order, designating the emplacements Battery John Gunnison to commemorate Capt. John W. Gunnison, killed by Mormons and Indians, near Sevier Lake, Utah Territory, October 26, 1853.[91]

John W. Gunnison of New Hampshire graduated no. 2 in the Class of 1837 from the U.S. Military Academy. Commissioned a 2d lieutenant in the 2d U.S. Artillery, he was ordered to Florida, where until 1838 he participated in the Second Seminole War. In 1838 he assisted with the immigration of the eastern Cherokees to their new homes in the Indian Territory.

On July 7, 1838, Gunnison transferred to the Topographical Engineers, and in 1839 returned to Florida and the war against the Seminoles. Two years, 1840-41, were spent on the improvement for navigation of the St. Marys and Savannah rivers. The next seven years found Gunnison, now a 1st lieutenant, surveying Lake Michigan and the northwestern lakes. In 1849 and 1850 he explored in Utah and surveyed Great Salt Lake. He returned to his surveys of the

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89. Battery Gunnison Emplacement Book, Fort Hancock, NA, RG 392.

90. Marshall to Mackenzie, Dec. 14, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

91. General Order 194, War Department, Dec. 27, 1904.

northwestern lakes in 1851. Promoted to captain in 1853, Gunnison was placed in charge of a party with the mission of surveying a central route for a railroad to the Pacific Coast. It was while engaged in this duty that he was killed.[92]

5. Maintenance and Improvements: 1908-1918

During 1908-09 improvements were made to the battery. In the former year one of the guns was temporarily dismounted, while a niche for a terminal booth was cut in an emplacement wall. During the latter a plotting room was constructed below the battery commander's station.[93]

The post commander in September 1915 requested that the damaged retaining wall at Battery Gunnison be repaired and that a window, similar to the one in the guardroom, be installed. Funds were allotted and this work was quickly accomplished.[94]

In 1918 a shelter was constructed for the 15-inch Bausch & Lomb Coincidence Range-Finder recently transferred from Battery Urmston.[95]

6. Battery from 1930 to 1943

Battery Gunnison--like Batteries Urmston, Morris, and Peck--was assigned to the Mine Command of the Sandy Hook Defenses. In the 1930s and the early years of World War II, its primary mission was

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92. Cullum, Biographical Register, I, 520.

93. Hurlbut to Marshall, March 17, and Birnie to Marshall, May 19, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock; Battery Gunnison Emplacement Book, Fort Hancock, NA, RG 392.

94. Post Engineer to District Engineer, Sept. 9, 18, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

95. Bingham to Post Engineer, June 30, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

protection of the minefield. Its secondary mission was defense of New York Harbor against enemy naval forces. In accomplishing these tasks, its 6-inch guns, mounted on disappearing carriages, were not as efficient as the barbette guns of Battery Peck. Besides having limited fields of fire, they could not be served as rapidly.[96] Stored in the magazines of the battery was its unit of fire--600 projectiles and an equal number of propelling charges.[97]

The battery, as it had since 1907-08, employed a standard position-finding system, with a horizontal base. Located at the emplacements were the battery commander's station and plotting room. The primary station (B') was on the Battery Potter terreplein, and it housed a Swasey DPF and azimuth instrument MI910. The secondary station (B") was in a room in the 1907 secondary station, about 1,500 yards south of Battery Gunnison. Like other stations of this type, it was equipped with a Swasey DPF and an azimuth instrument M1910.

In 1938 it was proposed to construct a concrete shelter at the battery for mounting a CRF instrument for emergency use.[98]

7. Converting the Battery from Disappearing to Barbette Armament

In February 1943 it was determined, in the interest of efficiency, to convert the battery from one mounting disappearing guns to one employing guns *en barbette*. This would necessitate extensive alterations to the gun platforms, as well as other changes.

To enable work to begin, Guns Nos. 5 and 34 and their carriages, nos. 52 and 57, were dismounted. On May 10, 1943, the guns

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96. Annexes to Harbor Defense Project: Harbor Defenses of Sandy Hook, NA, RG 407.

97. *Ibid*.

98. *Ibid*.

were shipped to the Watervliet Arsenal, and on November 2, 1944, the carriages were dismantled and sold as scrap.[99]

As soon as the armament was out of the way, workmen swarmed over the emplacements. The gun platforms were altered to mount barbette carriages. This involved filling the gun wells with a concrete plug and cutting away several feet of masonry from the interior slope. Concrete stairways giving access from the platforms to the superior slope were removed and replaced by concrete stairways with 12 risers and 1-1/2-inch pipe railings. Access to each emplacement was provided by a concrete stairway, with 14 risers and 14 treads, and a platform. There were 1-1/2-inch iron pipe railings flanking these stairways, with a similar railing positioned along the retaining wall at the rear of the platforms. A concrete bridge, flanked by 1-1/2-inch iron pipe railings, provided access between the platforms and shell hoist sheds.

To make the interior rooms gasproof, three of the four windows in the west elevation of the central traverse were bricked in, as was the north doorway giving access to the new plotting room. In the upper right hand corner of the former doorway was positioned a 1- by 1-foot metal louver. The south doorway into the new plotting room was moved to the south 7 inches.

Within the traverse, the storeroom at the northwest corner was converted into a chemical warfare service room, with an air lock leading into the new plotting room. The new plotting room was established by demolishing part of the wall which had formerly divided it into an office and guardroom. A gasproof door was positioned in the air lock and a second one in the doorway in the south elevation of the new plotting room. The gasproofing system had two intake pipes, extending a number of feet above the traverse. There was a 1' 6" by 1' 6" concrete

99. Battery Gunnison Emplacement Book, Fort Hancock, NA, RG 392.

chimney and galvanized iron cap extending above the concrete ceiling at the northeast corner of the chemical warfare service room.[100]

By May 1943 the workmen had finished modifying and modernizing the battery. The two 6-inch guns and their barbette carriages were accordingly dismounted from Battery Peck and emplaced in Battery Gunnison. As rearmed, the emplacements were designated new Battery Peck. No longer assigned to the Mine Command, it, along with Batteries Morris, Nos. 7 and 8, and relocated Urmston, now constituted a defense against motor torpedo boats.[101]

In the late 1940s, when the other Sandy Hook batteries were disarmed, the two 6-inch guns of Battery Gunnison were retained. In 1948 they gave way to a pair of similar 6-inch guns (nos. 22 and 23) transferred from Fort Hamilton's Battery Livingston. The third set of guns remained in position until the 1960s, when they and their carriages were removed and taken to the Smithsonian Institution's Silver Hill, Maryland, facility.[102]

F. The Movable Armament: 1918-1944

During World War I, the Coast Artillery added a new dimension to the Sandy Hook Defenses--movable railway artillery. These guns were to operate on the railroad which paralleled the beach for a number of miles south of the Fort Hancock Reservation. They would have the mission of repelling amphibious attacks on the Jersey coast south of the Shrewsbury River, where there was deep water to within a few hundred feet of good landing beaches. A successful landing by the enemy in this area would enable him to bypass the fixed Sandy Hook defenses.

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100. "Harbor Defenses of New York, Battery Gunnison, Alterations & Additions," Fort Hancock, New Jersey, Feb. 16, 1943, 8 sheets, Files, Sandy Hook Unit, Gateway NRA.

101. Annexes to Harbor Defense Project: Harbor Defenses of New York, NA, RG 407.

102. Telephone interview, James Hutchins with Edwin C. Bearss, Feb. 18, 1976. Mr. Hutchins is on the staff of the Dwight D. Eisenhower Institute for Historical Research.

On December 18, 1918, there was received at Fort Hancock an armored car (No. 1001) manufactured by the Army Gun Factory. It was built of steel in the form of a box car, with hand-operated brakes. There were openings in the steel on each side for a machine gun. Emplaced on a platform, depressed 2 feet, 4 inches below the top of the car, was a 3-inch rifle.[103]

Three years later, in December 1921, there was added to the post's mobile armament four 12-inch railway mortars and an equal number of ammunition cars.[104] On March 2, 1923, the post ordnance officer receipted for two 155 mm G.P.F. guns, Model 1918, Serial Nos. 846 and 848. To pull these guns there had been sent to Sandy Hook, two 10-ton Holt tractors, Model 1917. In October 1926 there were received at the post for use as mobile armament two 155 mm guns, Model 1917 A1.[105]

In the 1930s the 3-inch rifle, Model 1905, was removed from the armored railway car for use as the Fort Hancock saluting gun.[106]

Four 8-inch railway guns (nos. 117 L2, 119 L2, 1316 L2, and 192 L2) and mounts (nos. 28, 6, 5, and 24) were added to the Fort Hancock armament in the late 1930s. On May 3, 1944, with the Allies on

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103. Fort Record Book, Fort Hancock, N.J., NA, RG 392. The car was 40 feet, 6 inches long, 11 feet 4-5/8-inches to top of car, and 14 feet 7-1/8-inches to top of shield. The armor was 3/4-inch.

104. Ibid. The mortars, Model 1890 M1, were numbered 5, 42, and 121 from the Watervliet Arsenal, and 105 from the Bethlehem Steel Co. The carriages, nos. 22-25, had been manufactured by Morgan Engineering Co. The cars on which the mortars were mounted (nos. 6-9) were manufactured by the Pullman Car Co., and the ammunition cars (nos. 504, 519, 520, and 521) by the American Car & Foundry Co.

105. Ibid.

106. Ibid.

the offensive on all fronts and "D-Day" less than five weeks in the future, these four railway guns were sent to the Aberdeen Proving Ground.[107]

G. Dynamite Gun Battery: 1893-1902

1. Installing the Three Guns

Employing funds appropriated by Congress in acts approved September 22, 1888, and March 2, 1889, contracts were signed by the Chief of Ordnance with the Pneumatic Torpedo & Construction Co. for development and installation of Dynamite Gun Batteries at Sandy Hook and Fort Winfield Scott, California. In the spring of 1893 three (two 15-inch and one 8-inch dynamite) guns "previously manufactured," but modified to conform to contract specifications, were positioned at Sandy Hook.[108]

2. Protecting the Site

The site selected for the Dynamite Gun Battery in 1891 was about 800 feet beyond the western limit of the jetties shielding the northeast beach. At that time the position was well inland, but by April 1894, the year after the battery was established, the encroachment by the sea in this area had progressed to where the surf was attacking the guns' foundations.

On August 1, 1894, President Cleveland signed into law a Fortifications Bill, containing $7,500 for construction of a seawall. Thirteen days later, Secretary of War Lamont approved a project prepared by Colonel Gillespie for this undertaking. It called for building a jetty in front of the Dynamite Gun Battery and for continuing eastward the shore protection to connect with the New York Harbor wall at jetty no. 11.

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107. Ibid.; "Post Diary, Fort Hancock, New Jersey," NA, RG 392.

108. Schuyler to Knight, March 7, 1893, NA, RG 77, Ltrs. Recd., Chief Engineer.

This project was completed during the autumn and involved extending the seawall 1,130 feet and construction of a 120-foot jetty. The wall was 13 feet at its base and 7 feet in height. It provided "everything to be desired in the way of protection." Colonel Gillespie advised the department in his annual report for Fiscal Year 1895 that the "high-tide line, which was very much broken, is now uniform and regular throughout."[109]

3. Spanish-American War Brings Protective Measures

In April 1898, with the nation girding for war with Spain, Colonel Ludlow prepared and submitted a project for protecting from hostile fire the three dynamite guns and their powerhouse. The protection was to consist of a sand parapet, with a superior slope 50 feet thick, and sustained in the rear by sandbags. Between the guns and the powerhouse would be a longitudinal traverse connecting with the parapet at each end. The traverse would likewise be 50 feet thick with sandbag walls on each side, allowing a 10-foot space behind the guns and in front of the powerhouse. At each end of the traverse there was to be a bombproof passage for communication and for access to the two bombproof magazines. Colonel Ludlow estimated the cost at:

37,380 cubic yards sand embankment	$ 7,460
26,000 sandbags, filled and sewed	2,060
17,000 feet B. M. yellow pine	510
15,000 feet B. M. spruce plank	300
1,500 pounds spikes, nails, etc.	60
230 linear feet track for ammunition car	230
	$10,640
Contingencies	1,360
Total	$12,000[110]

109. Executive Documents, Ser. 3479, pp. 482-83; "Map of a Portion of Sandy Hook, N.J., Showing condition of beach in vicinity of Dynamite Gun Emplacements, 1894," NA, RG 77.

110. Ludlow to Chief Engineer, April 5, 1898, NA, RG 77, Ltrs. Recd., Chief Engineer; "Sketch of Pneumatic Dynamite Gun Battery for Two 15-inch and One 8-inch Guns with Powerhouse," NA, RG 77.

On April 9 Chief Engineer Wilson approved the project and allotted $10,000 from the National Defense Act of March 9 to underwrite it. Colonel Ludlow was urged to push the work "to early completion, especially as to cover of the guns."[111]

Bids were called for on April 13 by Colonel Ludlow. On the 16th, nine days before the United States declared war on Spain, J. W. Hoffman & Co. of Philadelphia and New York was awarded the contract. Hoffman & Co., because the allotment was $2,000 less than the estimate, would limit the sand embankment to 30,000 cubic yards. The government would provide the materials--sandbags, lumber, tarpaper, twine, nails, and spikes.

Construction commenced on Tuesday, April 19, with a large labor force, 30 sand scrapers, and 60 horses on the job. The first lumber was delivered on-site by the United States on April 30. On May 4 a section of the traverse caved in, it being impossible to sustain it with a single row of sandbags. Major Adams, who had relieved Colonel Ludlow, told the Hoffman workmen to use a double row of sandbags. Two days later, they were directed to make the retaining wall three bags thick.

On May 17 the front parapet, between the 15-inch and 8-inch guns, caved in. Major Adams now called for positioning buttresses of bags between the guns, and for strengthening the rear traverse by placing planks vertically "between the rows of bags on each side and bracing them together with wire rope across and through the parapet."[112]

By June 30 the parapet and magazines were nearly finished. The work was completed on July 15.[113]

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111. Wilson to Ludlow, April 9, 1898, NA, RG 77, Ltrs. Sent, Chief Engineer.

112. Hoffman to Wilson, Aug. 4, 1898, NA, RG 77, Ltrs. Recd., Chief Engineer.

113. Executive Documents, Ser. 3746, pp. 632, 635; Executive Documents, Ser. 3905, p. 779.

Personnel from the Proving Ground overhauled the powerhouse during the same period. The four lofty smokestacks, projecting 40 feet above the battery and deemed to be dangerously exposed to fire from rapid-fire guns of the Spanish fleet in event of attack, were removed. They were replaced by blowers.[114]

4. Emplacements Become Permanent

In Fiscal Year 1899 a pillar was erected for an emergency range-finder, some shanties built by the contractor removed, and the exterior slope of the parapet covered with brush. In March, J. W. Hoffman's claim for $6,233 in extras having been approved, final payment by the government was made.[115]

When he inspected the battery in June 1899, Major Adams found the armament and platforms in good condition. The machinery, damaged by sub-freezing temperatures during the winter of 1898-99, was being repaired by Ordnance Department personnel. The sandbag revetment, positioned 12 months before, was in very poor condition, about 50 percent of the bags in its face being either "down, broken open, or rotten." The magazines were dry.[116]

The Fortifications Act of May 25, 1900, included $150,000 for the dynamite batteries. This sum would provide for construction of permanent magazines and protecting parapets for the Sandy Hook battery and for those being built at Fisher's Island, New York, and Port Royal, South Carolina.

On June 20 Chief Engineer Wilson allotted funds to accomplish this work at Sandy Hook. Major Marshall had a crew remove

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114. Executive Documents, Ser. 3637, pp. 39, 127.

115. Executive Documents, Ser. 3905, p. 779.

116. Adams to C. O., Fort Hancock, June 20, 1899, NA, RG 77, Ltrs. Recd., Chief Engineer; Executive Documents, Ser. 3911, p. 231.

the sandbag parapet and the timber magazines and begin construction of concrete retaining walls and bombproofs.[117] This work was completed in Fiscal Year 1901.[118]

5. Battery is Dismantled

Soon after this work on the battery had been accepted, the Board of Ordnance and Fortifications on June 5, 1901, reported, "It is the unanimous opinion of the Board that the pneumatic dynamite gun batteries have become obsolete . . ., and the Board does not consider these batteries . . . of sufficient utility to warrant further expenditures in their construction, or the extensive repair of those already installed."[119]

In Fiscal Year 1902 Ordnance Department personnel dismantled the battery, removing the guns and equipment. On August 8, 1902, Major Marshall reported that the guns and equipment had been removed and that sand had drifted against magazine doors, springing them.[120] The emplacements stood vacant until 1905-06, when the mining casemate was relocated to this site.

H. Recommendations

The rapid-fire batteries from 1898 through World War II constituted an essential component of the Sandy Hook Defenses. Batteries Engle, Urmston, Peck, and Morris are of Third Order of Significance and will be stabilized and preserved. Battery Gunnison will be rearmed and restored to its appearance, circa 1944. Although Battery Gunnison is

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117. Executive Documents, Ser. 4089, p. 839; "Fort Hancock, Sandy Hook, N.J., Plans and Sections of Pneumatic Dynamite Gun Battery, drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., March 1901," NA, RG 77.

118. Executive Documents, Ser. 4279, p. 768.

119. Executive Documents, Ser. 4285, pp. 49-50.

120. Marshall to Gillespie, Aug. 8, 1902, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

also of Third Order of Significance, the availability of its armament and the safety of the visitor dictates its restoration to a period when it mounted two 6-inch guns on barbette carriages.

The sites of new Battery Urmston and Batteries Nos. 7 and 8 should be identified and marked. The Dynamite Gun Battery, although on Coast Guard property, should be included within the Sandy Hook Historic District, as it is of Third Order of Significance.

All rapid-fire batteries, as well as their fire-control stations, will be included in the List of Classified Structures.

XII. SANDY HOOK SEARCHLIGHTS

A. Early Years: 1900-1912

1. Chief Engineer Gets Congress to Fund the Program

At the turn of the century another important element was introduced into the Endicott System. This was the searchlight. When he made his annual report for Fiscal Year 1901, Chief Engineer Gillespie noted that development of the system had reached a stage where "most of the heavy guns were in position, a considerable portion of the . . . rapid-fire emplacements and some of the rapid-fire guns" completed, and it was "becoming important to inaugurate the systematic installation of searchlight apparatus for night defense."

As security of the ports and harbors against night attack was dependent on prompt action, General Gillespie urged Congress to appropriate $500,000 for purchase and installation of searchlights. This sum, he continued, would be used to equip four more of the more important harbors with complete searchlight systems, "and would connect these searchlight plants and a number of already existing fortification electric plants with the electric lamps in the barracks and quarters," which was the responsibility of the Quartermaster Department. The sum would be in addition to the $150,000 Congress had included in the Act of March 1, 1901, for purchase and installation of searchlights for the defenses of New York Harbor.[1]

Congress responded to the Chief Engineer's request by appropriating another $150,000 for the searchlight program on June 6, 1902. Similar amounts were included in the fortifications bills of March 3, 1903, and April 21, 1904. Sums varying from a high of $210,000 in 1907 to a low of $25,000 in 1912 were made available by Congress to continue and expand the program in the period 1905-12.

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1. Executive Documents, Ser. 4279, p. 13.

2. Colonel Marshall Installs Two Searchlights

The troops at Sandy Hook, however, saw their first searchlight in 1900, the year before Congress began its annual appropriations for the program. Chief Engineer Wilson, on May 29, made a $3,000 allotment from the appropriation for Gun and Mortar Batteries to acquire parts for two searchlights to be assembled. Two 4-10-450 General Electric direct connected sets were purchased and mounted upon platform trucks pertaining to generating sets installed at Fort Hancock.[2] When assembled these sets, along with two other sets, were to be shipped to the four service schools at Willetts Point, New York; Fort Monroe, Virginia; and Forts Leavenworth and Riley, Kansas. This work was completed and the portable units transferred to the Quartermaster Department for shipment during the late autumn of 1900.[3]

On April 9, 1901, Chief Engineer Wilson allotted $67,700 from the $150,000 recently appropriated for the purchase of searchlights for the fortifications at the southern entrance to New York Harbor. Included under this authorization was the purchase of special trucks, reels, cables, etc.

The searchlights were ordered from the General Electric Co., whose bid of $26,750, was low.[4] In Fiscal Year 1902 the searchlights were finished, except for minor parts, and were shipped to the Newport and New London Engineer Districts for use in the joint Army-Navy maneuvers held in August 1902.[5]

Four 60-, four 36-, and one 30-inch searchlight projectors were purchased in the summer of 1904 for the defenses of New York Harbor. Of these, a 60- and a 36-inch were to be installed at Sandy

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2. Executive Documents, Ser. 4089, p. 840.

3. Executive Documents, Ser. 4279, p. 770.

4. Ibid., p. 769.

5. Executive Documents, Ser. 4444, p. 693.

Hook. At Fort Hancock, as at Forts Hamilton and Wadsworth, the searchlights were to be mounted on 40-foot steel towers. For protection of the generating plants, small powerhouses were necessary. They were to be built of brick or corrugated metal.[6]

Colonel Marshall selected a site for the 60-inch light 250 yards south of Battery John Gunnison. Here it would be more secure from fragments from the Proving Ground's range, and of more value to the defense than if positioned farther down range as originally suggested.

On November 21 Marshall directed Assistant Engineer Hurlbut to form a sand embankment 25 by 28 feet on top, with slopes of 2 to 3, on which to position its frame shelter. The powerhouse, for which he was sending plans, was to be on low ground among the trees, where it would be screened from view. The site designated was midway between the battery and the tower.[7] The 36-inch searchlight was positioned on the superior slope of the abandoned Dynamite Gun Battery.

The towers had been assembled, powerhouses constructed, and lights positioned and tested by May 1905, when they were transferred by Colonel Marshall to the post commander.[8]

In June 1912 Assistant Engineer Hurlbut notified Colonel Roessler that the 36-inch light needed reenameling. He wished to know whether this could be done by post labor or if the light would have to be

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6. Marshall to Mackenzie, Sept. 2, 1904, NA, RG 77, Press Copies, Ltrs. Sent, New York Harbor Defenses.

7. Marshall to Hurlbut, Nov. 21, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

8. Marshall to Harris, May 2, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

returned to General Electric. Colonel Roessler directed that two or three coats of black enamel be applied under Hurlbut's supervision.[9]

B. Searchlights Become Increasingly Sophisticated

1. Board Recommends a Program

In November 1911 the Board of Ordnance and Fortifications recommended that the fire-control project for the Southern Artillery District of New York be amended to include these searchlight systems:

(a) Light No. 1 to be 300 yards south of the group of secondary stations; Light No. 2 to be 100 yards north of Light No. 1. Light No. 1 was to have an elevation of 30 feet above high water and Light No. 2 to be 45 feet above high water. The controller for no. 1 was to be in a suitable lookout station about 250 yards south of the light, and the controller for no. 2 to be at the mortar battery secondary station. These lights were to be employed as searching lights.

(b) Light No. 3 was to be positioned midway between Batteries Engle and Morris. The axis of its light was to be about 80 feet above high water. The light was to illuminate Ambrose, Maine, and Swash channels for the guns.

(c) Light No. 4, to be located at the supplementary stations, was to have its light axis about 25 feet above high water. Its mission was to search the minefield and to illuminate targets for the secondary armament.

(d) Light No. 5 was to be at the extreme northwest end of the Hook. With its axis approximately 40 feet above high water, it was to illuminate targets in the various ship channels entering Sandy Hook Bay.[10]

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9. Hurlbut to Roessler, June 8, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

10. Board to Chief of Staff, Nov. 6, 1911, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

All five lights were to be 60-inch.

2. Installing Searchlights Nos. 1 and 2

Two years later, in October 1913, the Chief Engineer requested that plans be prepared and submitted for installation of these five searchlights.

It was determined by Chief Engineer Kingman to have experimental disappearing towers constructed for Lights Nos. 1 and 2. One of these, designated Type C Design, was the work of Assistant Engineer E. D. Cummings, while the other was designed by Strauss Bascule Bridge Co. of Chicago. The former was hand-operated, and the latter would be equipped for both hand and electric operation. Proposals for construction of one tower of each design were called for by the Second District Engineer Office in the autumn of 1915. The successful bidder was Penn Bridge Co., of Beaver Falls, Pennsylvania, with a price of $5,150 for the Type C Design and $4,345 for the Strauss electrical and hand-operated design. Penn Bridge agreed to complete the towers no later than October 28, 1916.[11]

Cummings, who had succeeded Hurlbut as assistant engineer at Sandy Hook, would oversee erection of the towers. As he had a vested interest in the Type C Design, he became overly involved. When parts for the towers arrived at Fort Hancock in March 1917, he complained to Penn Bridge Co. that they had failed to "ship adequate tools and appliances for erecting, thereby causing delay, annoyance, and sometimes damages in carrying out this work." He also complained of the failure to make provision for installing the counterweights.[12]

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11. Memorandum to the Files, New York Engineer Office, May 24, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

12. Cummings to Penn Bridge, March 30, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

On April 3, three days before the nation declared war on Germany, C. A. White of Penn Bridge Co. expressed regret that work on the towers was not progressing as it should. They had intended to send all the necessary equipment for erecting the towers, but through an error some had been overlooked. This was now being corrected. As for making counterweights, experience had demonstrated that it was much more "satisfactory to have blocks made up of the actual materials that were to be used on the job than to make them up here out of materials taken several hundred miles" from the site. In addition, it was the practice of Penn Bridge engineers to make their calculations of the counterweights after they had "gotten the actual weight of the structures," rather than employing estimated weights.[13]

This exchange of letters had the desired results. By April 7 the Type C tower was standing erect, partially rivetted, and its counterweight cast and hardening. The Strauss Tower, the lower layer of steel-mixed concrete hardened in the counterweight, had been pulled into a prone position and the top part of the tower bolted on.[14]

During the second week of April, the forms were removed from the Type C tower counterweight, the platform attached, and much of the machinery installed. The platform of the Strauss Tower was positioned and some of the machinery installed. It had been raised and lowered several times, with part of the counterweight used as an aid in balancing.[15]

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13. White to Cummings, April 3, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

14. Cummings to Abbot, April 7, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

15. Ibid., April 7, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

By April 21 both towers could be raised and lowered by hand cranks. The locking pins for both had not been received, nor had the parallel motion device of the Type C.[16]

On May 9 Cummings notified District Engineer Abbot that the Penn Bridge workmen had completed the project, except for a final coat of paint on the Type C tower. The 60-inch projectors, however, had not been installed on their platforms.[17]

Having been ordered to a new duty station in mid-May, Cummings wrote Colonel Abbot that the projector had been positioned on the Type C tower and the rheostat in the floor, with dial switch on the railing. One man on the crank could raise or lower the tower in 90 seconds. With two men on the cranks and one on the platform results were similar. The balancing was uniform at all points, while the brakes would hold the tower at an angle with two men on the platform.

As the projector for the Strauss Tower had not been installed, Cummings tested it with 4,200 pounds of sandstone, etc., on its platform. On being released from the foundation and brake, the tower rose to 30 to 40 degrees and stopped. It could than be cranked easily for some distance, but as it approached 90 degrees, the crank became very difficult to turn. Moreover, the balancing was not uniform.[18]

Colonel Abbot, on thanking Cummings for the information, commented that this justified Cummings' view "that the Type C is the better tower."[19]

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16. Ibid., April 14, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

17. Ibid., April 21, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

18. Ibid., undated, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

19. Abbot to Cummings, May 18, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

On June 2 Colonel Abbot notified Chief Engineer Black that, although both towers had been completed, the Strauss tower was without its projector.[20]

In early June Colonel Abbot traveled to Sandy Hook to inspect the towers. The Type C functioned satisfactorily, but considerable difficulty was experienced in raising the Strauss by hand. Two men had to work the crank and found it so exhausting that they had to stop and rest several times during the operation. With one person on the platform and a deadweight representing the searchlight, it took two men more than five minutes to raise the tower to its vertical position.

When operated by electricity, the Strauss functioned much better. But then it came into position with "a considerable jar."[21]

When he forwarded plans of the towers to the District Engineer at Charleston, South Carolina, Colonel Abbot cautioned him regarding the Strauss Tower's deficiencies.[22]

The Strauss people were understandably disturbed by the situation. By late September they had adjusted the counterweight of their tower, and it now operated satisfactorily, both by hand and with electricity. On advising Colonel Abbot of this, Professor Joseph B. Strauss complained that, when erected in April and May, the counterweight had not been placed properly. He suspected that Assistant Engineer Cummings, having designed the competing tower, may not have been too concerned with the manner in which Penn Bridge had assembled

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20. Abbot to Chief Engineer, June 2, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

21. Abbot to Penn Bridge Co., June 13, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

22. Abbot to District Engineer, Charleston, June 15, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

the Strauss Tower. Moreover, Cummings had prepared his design after the Strauss plans had been submitted for approval, "thus giving the Cummings tower the advantage of having a mark to shoot at." Except for the locking mechanism, Strauss charged, the general lines of his tower were followed in the Cummings design.[23]

On October 6 Captain Herkness of the Engineers monitored a test of the Strauss Tower. It worked satisfactorily. Two weeks later, Herkness notified the District Engineer that lights had been installed on both towers, and they had been operated by the troops for several months. He believed that both the Strauss (Light No. 1) and the Type C (Light No. 2) presented the best "solution for mounting searchlights" where they were to be in fixed positions.[24]

Ten months later, in August 1918, the two towers and a steel and concrete structure housing their 25-kilowatt power unit were transferred to the Coast Artillery.[25]

Before the end of the year, the troops were complaining that shelters were needed for the lights. Six hundred dollars were allotted by the Chief Engineer in March 1919, but four years were to pass before the shelters were built.[26]

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23. Strauss to Abbot, Sept. 29, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

24. Herkness to District Engineer, Oct. 8 & 24, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

25. Martindale to District Engineer, Feb. 14, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Col. B. B. Martindale commanded the 7th Coast Artillery Regiment.

26. Post Engineer to District Engineer, Dec. 11, 1918, and March 8, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

In 1922 an auxiliary power plant for Searchlights Nos. 1 and 2 was installed.[27]

3. Light No. 5 is Positioned

In 1916 a 60-inch searchlight was positioned by the Engineers on one of the frame supplementary stations. This was at the site designated in 1911 for Light No. 4. It was powered by a 25-kilowatt gasoline-electric generating set. When Colonel Skerrett accepted the searchlight on November 17, he pronounced the "installation satisfactory with exception that the building in which the searchlight is installed is entirely unprotected and being a frame building is not well suited for the installation of a gasoline engine," because of the danger from fire.[28]

4. Battery Gunnison Light Gets a New Power Plant

In 1915 the troops had complained that they were having difficulty with the power plant of the searchlight 280 yards south of Battery Gunnison. Although this light was scheduled to be relocated to position No. 3, the Engineers replaced the 1905 steam plant with a 25-kilowatt gasoline motor.[29]

5. 1917 Board Revises the Project

Two years later, in 1917, a board convened to review the Sandy Hook fire control project recommended that Searchlights Nos. 3 and 5, now "installed on very exposed mounts," be positioned on railway cars, for use "in any location desired." To facilitate this deployment, a standard gauge track would be laid parallel to the beach and in rear of the

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27. Carruth to District Engineer, June 14, 1922, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

28. Skerrett to District Engineer, Nov. 17, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

29. Ladue to Martindale, Feb. 14, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. In 1925 Col. W. B. Ladue was District Engineer.

batteries to the point of the Hook, connecting with existing standard gauge tracks of the Proving Ground.[30]

The Board also recommended acquisition of two additional 60-inch lights for mounting on railroad cars for employment along the Central Railroad south of the Highlands to illuminate targets beyond the effective range of Lights Nos. 1 and 2. The 36-inch light, installed in 1904 at the old Dynamite Battery, would be eliminated.[31]

As a result of this report, Major Herkness began developing plans for elevating towers mounted on flat cars. Their 25-kilowatt power units would be installed in a steel boxcar.[32]

6. Secretary of War Baker Approves a Revised Project

On November 26, 1919, no action having been taken on the 1917 Board's recommendations, the District Engineer urged that Searchlight No. 3, near Battery Gunnison, be replaced by a 60-inch High Intensity Light on railway mount to operate on a track laid parallel to the beach in rear of the batteries. Thirty-six-inch Searchlight No. 4 at the old Dynamite Battery would be abandoned, and its place taken by a 60-inch light, also on a flat car, to operate along the Central Railroad from Highland Beach.

The Chief Engineer, in forwarding this report to the Chief of Coast Artillery, recommended that only these changes be made: (a) replacement of Light No. 3 with a 60-inch H. I. light, retaining its present site south of Battery Gunnison; and (b) replace Light No. 4 with

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30. Ladue to Chief Engineer, Nov. 5, 1926, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

31. Ladue to Martindale, March 20, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

32. Herkness to District Engineer, Oct. 24, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

a 60-inch H.I. light. Chief of Coast Artillery Coe concurred, but requested that a "new 60-inch elevating light on railroad mount" be assigned to Sandy Hook. This report was approved by Secretary of War Baker on February 28, 1920.[33]

A further change was made in the project in October 1920, when the commander of the Sandy Hook Defenses recommended that a new 60-inch light not be placed in the position from which the 36-inch light was to be removed. He wished it replaced with a 60-inch automobile-type light. The refinement was sanctioned by the Secretary of War.[34]

7. Implementing the Project

A 60-inch Cadillac searchlight unit caused some administrative headaches. Its maintenance involved two branches of the service--the Engineers who oversaw its technical parts, and the Motor Transport Corps responsibile for it as a motor vehicle.

Two units were sent to Sandy Hook. The first arrived in the summer of 1920. It was housed in the garage recently erected by the Engineer Department behind Battery Peck. Because of the cold winters at the post, it was necessary to spend $600 to heat the garage.[35]

A second Cadillac searchlight power unit, with open type searchlight and accessories, reached Sandy Hook from General Electric's South Schenectady plant on December 28, 1920. The unit was assembled by the Engineers and transferred to the Fort Hancock commander on January 24. Soon thereafter, the 36-inch searchlight was removed from the parapet of the Dynamite Gun Battery.[36]

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33. Ladue to Martindale, March 20, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

34. Ibid.

35. Carruth to Sanford, Oct. 29, 1920, and Sanford to Chief Engineer, Nov. 11, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

36. Carruth to District Engineer, Dec. 29, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

In 1923 both Cadillac searchlight units were transferred to the Hawaiian Island command.[37]

The Engineer Department in March 1921 requisitioned from the Schenectady General Reserve Depot one 60-inch Sperry H.I. Light. On its receipt at Sandy Hook, the High Intensity Light was substituted for the old light at No. 3 position on the mound 250 yards south of Battery Gunnison. The old light was crated and placed in storage. On June 2, 1921, the new light was tested and transferred to the garrison.[38]

The railroad searchlight as proposed by Major Herkness, consisted of two units: a flat car with a 60-inch light, which could be elevated to a height of 60 feet; and a wooden boxcar with gasoline engines, 25-kilowatt generator, cooling fan, radiator, switchboard, and quarters. The searchlight and its flat car were received at Sandy Hook on August 18, 1920, and the boxcar containing the power unit was outfitted by the Engineers and transferred to the post commander in January 1923.[39]

The searchlight unit, when not in use, was parked under a shed on the Engineer Reservation. Whenever there was a drill, a locomotive backed onto the reservation and coupled onto the searchlight unit. The unit was returned after the drill.

C. Project Expands

1. Project in the 1930s

During the 1930s the searchlights assigned to the Sandy Hook Defenses included:

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37. Davis to Commanding General, Governor's Island, March 30, 1923, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

38. Carruth to C.O., Sandy Hook Defenses, April 26, June 2, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

39. Weaver to District Engineer, Jan. 16, 1923, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Capt. Theron D. Weaver was attached to the 2d Engineer District.

(a) Searchlights Nos. 1 and 2--These portable 60-inch lights, on 35-foot dismounted towers, would in event of war or national emergency be positioned north of Seabright. Their control station was at the lights.

(b) Searchlight No. 3--The two unit, 60-inch light on railroad cars would be positioned on the causeway, north of the bridge across the Shrewsbury River to the Highlands. It was controlled on-site.

(c) Searchlights Nos. 4 and 5 (nos. 1 and 2 under the old system)--These fixed 60-inch lights, on Bascule mounts, capable of being elevated to 70 feet, were positioned about 1,500 yards south of Battery Gunnison. They were controlled from the nearby Mine Group Command Post.

(d) Searchlight No. 6 (formerly no. 3)--This fixed 60-inch light, on a wooden building atop a mound, was 250 yards south of Battery Gunnison. It was controlled from the 100-foot Battery Harris supplementary (B''') station.

(e) Searchlight No. 7 (formerly no. 5)--A fixed 60-inch light, it was positioned on a wooden building with its axis 45 feet above mean high tide. It was controlled from the mine battery commander's station.[40]

The maximum dependable range of these 60-inch lights in clear weather was 8,000 yards.

2. Two Lights Added During World War II

During World War II two additional 60-inch lights were placed on the Fort Hancock Reservation. They were sited between Lights Nos. 6 and 7, one at the fire commander's station and the other at 90mm Gun Battery No. 8.[41]

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40. Annexes to Harbor Defense Project: Harbor Defenses of Sandy Hook, March 1938, NA, RG 407.

41. Supplement to Harbor Defense Project: Harbor Defenses of New York, Sept. 1, 1944, NA, RG 407.

D. Recommendations

The searchlights were a vital component of the Sandy Hook Defenses for more than 40 years. Bascule elevating towers were first positioned and tested at Fort Hancock. Sandy Hook also received the Army's first mobile searchlights. The railroad elevating light and its service unit were planned by Second District Engineers and assembled at Fort Hancock. The post was one of the first to receive the Cadillac searchlight mounted on a truck.

All the searchlights, as well as their towers, were disposed of by the Army in the years following World War II. The tower foundations and mounds should be identified, stabilized, and preserved. Accordingly they should be entered on the List of Classified Structures.

XIII. THE ANTIAIRCRAFT DEFENSE SYSTEM

A. Air Age Comes to Sandy Hook

1. Hydroplane is Based on the Horse Shoe

World War I brought danger from another direction--the air. German zeppelins, beginning in January 1915, bombed London and other British cities. They were followed by raids by giant Gotha bombers. The Allies struck back with their heavy bombers. Although a far cry from the terror raids and saturation bombing of World War II, they were a harbinger of what was to come. At sea, an airplane had taken off from the improvised flightdeck of the U.S. cruiser Birmingham in November 1910, and in January 1911 the first shipboard landing was made. Warships were soon carrying seaplanes, which could be launched and recovered by catapults. These craft were for reconnaissance and fire control. The aircraft carrier would not make her appearance for another decade.

Airplanes came to Sandy Hook shortly before the United States entered World War I. In February 1917 Colonel Ruggles of the Proving Ground notified the Fort Hancock commander, Colonel Skerrett, that a hydroplane had been ordered to the area to be employed in certain ordnance tests. With the hydroplane would come its portable hangar and other necessary equipment. The most favorable site for basing the plane was on the Horse Shoe, south of Battery Arrowsmith. Colonel Skerrett was agreeable, and the hangar was assembled on the beach at the site indicated.[1]

The hydroplane and its hangar were transferred to Aberdeen, Maryland, in 1918, as the Ordnance Department began to phase out its operations at Sandy Hook.

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1. Ruggles to Skerrett, Feb. 12, 1917, and Abbot to Chief Engineer, Feb. 17, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. At this time there was a proposal to base a squadron of hydroplanes near the end of the Hook, protected by a breakwater.

2. Dirigible Balloon Hangar Proves a Boondoggle

In 1920 the Construction Division erected "a standard dirigible balloon hanger and generator house" at the post. On completion, the $125,000 76- by 120- by 46-foot structure was transferred to the commanding officer, Harbor Defenses. This huge frame structure, standing northeast of the Horse Shoe, became a victim of the drastic cutback in expenditures for the military in the 1920s. It was never used for the purpose for which it was built. In January 1926 it was used by the Quartermaster Department for storage and garaging trucks.[2]

The hangar had received little or no maintenance since construction. One column at the northwest corner had separated from its footings, while one of the bays needed to be refloored. The interior steelwork of both the hangar and generator house needed to be painted.[3] The financially-strapped War Department had no funds to allot to a major and continuing maintenance program for the structure, and in 1941 the hangar and generator house were razed.

3. Sandy Hook Almost Gets an Airfield

In August 1924 the Fort Hancock commander requested that the War Department allot funds for construction of an air strip 1,500 feet in length and 150 feet in width. It would be surfaced with cinders. Provision would be made for a second strip at right angles to the first, with space available for sheltering aircraft.[4] Taking cognizance of the space factor at Sandy Hook, which would limit future expansion, it was

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2. Ladue to Chief Engineer, Jan. 26, 1926, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

3. Ibid.; Lyons to District Engineer, Jan. 18, 1926, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Capt. F. Russell Lyon was Engineer for the Sandy Hook Defenses.

4. District Engineer to Chief Engineer, Aug. 14, 1924, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. To undertake this project, funds were needed for clearing the site, relocating several small buildings, and laying 4,500 yards of cinders.

determined to enlarge Miller Field for which Congress had already made an appropriation.

B. Army Looks to the Sky

1. Antiaircraft Defense: 1921-1937

To guard against attack from the air four antiaircraft batteries were established at Sandy Hook in the early 1920s. Each was armed with two Model 1917 3-inch antiaircraft guns and mounts. Battery A was emplaced on the superior slope of the old Dynamite Battery; Battery B on the superior slope of the mortar battery; Battery C on the superior slope of Battery Arrowsmith; and Battery D 200 yards south of the Spermaceti Cove Coast Guard Station.[5]

2. War Department Beefs Up the Defenses

1. General Considerations

In 1937 with the breakdown of collective security in Europe and Asia and the growth of air power, the War Department revised and updated its antiaircraft defense project for Sandy Hook. Two three-gun batteries, instead of four two-gun, were called for, along with five antiaircraft searchlights, sound locators, and two batteries of .50-caliber antiaircraft machine guns. The latter were to include one of four platoons and one of three platoons, each platoon armed with four .50-caliber machine guns.

The elements of the Sandy Hook Defenses to be protected were divided into two sectors. In the southern sector of Fort Hancock were Batteries Kingman and Mills, important observation stations, excellent positions for mobile artillery, and igloo magazines for storage of high-explosives. The northern area sheltered Batteries Bloomfield, Richardson, Gunnison, Urmston, Morris, and Peck; the submarine mine shore installations; numerous command posts and observation stations; and other vital components of the defenses. As such, it would require

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5. Weaver to Swift, March 15, 1923, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

particular protection against low flying enemy aircraft, the approach of which could be masked by the hills in the vicinity of the Navesink Highlands.[6]

b. 3-Inch Batteries

The Fort Hancock antiaircraft defenses were organized into Group 3. Constituting Group 3 were:

(a) Gun Battery No. 1--This battery, emplacing three 3-inch guns, was 200 yards south of the Spermaceti Cove Coast Guard Station. A magazine was constructed 200 yards southeast of the battery, while an oil and toolroom were erected nearby.

(b) Gun Battery No. 2--This battery, armed with three 3-inch guns, was on the superior slope of the mortar battery. Ample space for ammunition storage and shelter for personnel was provided by the mortar battery's galleries and magazines.

The third gun and mount for each of these batteries was obtained from Batteries A and C, which were disarmed and abandoned at this time.[7]

c. .50-Caliber Machine Gun Defense

The seven antiaircraft machine gun platoons (each armed with four .50-caliber machine guns) were to be stationed: (a) one at Gun Battery No.1; (b) two at Batteries Kingman and Mills; (c) one at Gun Battery No. 2; (d) two at the nine-gun battery; and (e) one at the mining casemate.

Besides the areas of defense afforded by the machine gun platoons, 16 additional .50-caliber machine guns, with their mounts

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6. Annexes to Harbor Defense Project: Harbor Defenses of Sandy Hook, March 1938, NA, RG 407.

7. Ibid.

and necessary equipment, would be provided for defense of "individual searchlights (both seacoast and antiaircraft), and outlying and isolated fire control stations." These machine guns would be assigned by the harbor defense commander so as to provide the best supplementary antiaircraft defense.[8]

d. Antiaircraft Searchlights

The five antiaircraft searchlights at Fort Hancock would be organized into a single platoon. The platoon command post would be on the mortar battery's superior slope. The searchlights would be positioned: (a) at the Seabright Coast Guard Station; (b) at Atlantic Highlands; (c) at Gun Battery No. 1; (d) at Batteries Kingman and Mills; and (e) at the nine-gun battery.[9]

e. Terrestrial Observation Posts

Terrestrial observation posts would be established and manned at Elberon, Sugarloaf, Crawford Hills, and Wiley's Corners, New Jersey; and at Jones and Long Beaches, and Arverne, Long Island.[10]

3. World War II Brings an Increase in Firepower

During World War II a number of 37 and 40mm antiaircraft guns were sent to Sandy Hook to reinforce the antiaircraft defenses. Six 37mm guns, on mobile antiaircraft carriages, were positioned on the Navesink Highlands to protect Batteries Lewis and 219. Two 40mm guns, on mobile antiaircraft carriages, were emplaced at each of these batteries--Gunnison and Nos. 7 and 8.[11]

On September 28, 1943, three 37mm guns and carriages were received from Fort Totten and on October 27, 1944, a similar number

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8. Ibid.

9. Ibid.

10. Ibid.

11. Fort Record Book, Fort Hancock, New Jersey, NA, RG 392.

of these caliber guns and carriages arrived from Fort Moultrie. These weapons were turned over to Battery D, Harbor Defenses of New York, and stored in the garage at Battery 219.[12]

On March 15, 1944, 16 40mm guns and their carriages reached the post from the Aberdeen Proving Ground. Two each of these guns and carriages were assigned to Batteries C and F, 245th Coast Artillery Regiment, and the other 12 were stored in Ordnance Warehouse No. 100 at Camp Low.[13]

C. Recommendations

The antiaircraft guns and searchlights, which constituted an important element of the Sandy Hook Defenses from the early 1920s through World War II, were removed in the late 1940s. The remaining emplacements should be identified, stabilized, and preserved. They accordingly merit inclusion on the Service's List of Classified Structures.

Efforts should be made to secure a 3-inch antiaircraft gun, Model 1917, for emplacement in one of the antiaircraft batteries.

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12. Ibid.

13. Ibid.

XIV. CENTRAL POWERHOUSE: A STRUCTURAL HISTORY, 1901-1924

A. Lighting the Batteries and Post

1. Chief Engineer Gillespie Suggests a Program

In the autumn of 1901 Chief Engineer Gillespie recommended to Congress that it fund a comprehensive searchlight program. He also pointed out that experience had demonstrated that "economy in installation and the keeping of the electric plants in good order in time of peace" was "promoted by habitually using the fortification plants for post illumination." Efficiency and economy dictated that "the mains and conduits for both defensive and post lighting should be planned and supplied by the same department." With the concurrence of the Quartermaster General, he had included in his estimates for Fiscal Year 1902 funds for the post mains and conduits. Quartermaster General C. F. Humphrey would submit estimates for wiring the interior of the post buildings for quarters, barracks fixtures and lamps, and outdoor lights.

As the "proper coordination of the operations of two . . . departments, as well as the comfort of the troops," was involved in the systematic installation of these plants, "and as the security of the several harbors against night attack" depended on prompt and effective work, General Gillespie urged the appropriation of $500,000 for installation of mains and conduits and $500,000 for positioning searchlights.[1]

2. Central Powerhouse is Built and Cables Positioned

At Sandy Hook measures had already been taken to install an electric light and power plant. Plans and specificiatons had been prepared for a brick structure, 78 feet by 36 feet, with concrete floor and sheet metal roof. The principal equipment for the powerhouse included: two direct-connected steam engines and generating sets of 37-1/2- and 80-kilowatt capacity at 110 volts, each set to be supplied by an independent Worthington steam boiler, and a storage battery with switchboards. Lead-covered insulated cables, laid in vitrified conduit and

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1. Executive Documents, Ser. 4279, p. 13.

buried, would carry the current from the powerhouse to the batteries. When planned the powerhouse's primary mission was to supply energy for the searchlights and "incidentally for lighting emplacements and providing power for operation of the guns."[2]

To afford protection for the structure from enemy shell fire, it was positioned behind and perpendicular to Battery Potter. By June 30, 1902, the structure was completed, and the boilers, engines, etc., installed and ready for use.

The power plant was supplied with fresh water from eight well points, penetrating to low-water level. Water was drawn by a Worthington duplex steam pump and jet condenser, which, when required, could condense the exhaust.

A switchboard had been set up and connected with the dynamos. A storage battery was installed at the east end of the powerhouse with a 64-cell chloride accumulator, type G19, set up therein and connected with the switchboard. Some 19,941 feet of lead-covered insulated cable had been purchased and nearly all of it laid between the powerhouse and the seacoast and mortar batteries. Separate cables for light, power, and searchlights were laid. During Fiscal Year 1902 more than $53,000 had been spent on the project.[3]

3. Extending the Lighting System to the Post

In Fiscal Year 1903 the lighting system was extended from the powerhouse to Fort Hancock. To do so, two rotary transformers (80-

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2. Executive Documents, Ser. 4444, p. 691; Marshall to Chief Engineer, Aug. 22, 1901, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock; "Plan of Powerhouse and Details of Switchboard of Electric Lighting and Power Plant for Fort Hancock, New Jersey, designed and installed under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., April 1903," NA, RG 77.

3. Executive Documents, serv, 4444, p. 691; "General Plan of Electric Lighting and Power Plant at Fort Hancock, New Jersey, designed and installed under direction of Major W.L. Marshall, Corps of Engineers, U.S.A., March 1903," NA, RG 77.

kilowatt and 25-kilowatt) for converting 125-volt direct current into 2,200-volt alternating current were installed in the powerhouse. The distribution was effected by means of duplex lead-covered cables drawn through underground vitrified clay conduit. The principal feeders ran from the powerhouse to a manhole in the center of the parade ground. Connected with these feeders were two laterals for supplying current to self-feeders in the rear of the barracks.

Step-down transformers in underground manholes were positioned behind the officers' quarters. Current at a pressure of 110 to 116 volts was lead into the basements.

To conserve cable, the quarters were grouped by threes. Street lamps were fed from the nearest transformer, the current being transmitted by armored-lead cables.

The Quartermaster Department, as agreed to, funded the cost of the street lamps and posts, while the Corps of Engineers absorbed the other charges.[4]

The Quartermaster Department contracted the wiring of 38 buildings and 50 street lights at Fort Hancock to Tucker Electric Construction Co. The contractor completed his work by August 1902, and was ready to make the connections as soon as Corps of Engineers' workmen finished installing the conduits.

It was April 1903 before the electric plant was ready to be turned over by Major Marshall to the garrison for its use and care. Completion of the system, he pointed out, had been retarded by the necessity to provide for transforming the current and delivering it as an alternating current for lighting Fort Hancock.

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4. Marshall to Chief Engineer, July 23, 1902, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock; "General Plan of Electric Lighting and Power Plant," NA, RG 77.

With the work nearly completed, Major Marshall urged the Quartermaster Department to attach to each street light or exterior lamp a switch, whereby it could be turned off or on as necessary. Rules should also be adopted "for the lighting and duration of lighting these lamps." Outside lights left burning after 10 P.M. would drain the central powerhouse storage battery, either injuring it or requiring excessive hours of work and heavy expenditures for recharging. There was little need for outside lights after midnight, Marshall observed, unless the night was gloomy. It was impractical to put these lights on a separate circuit or increase the capacity of the storage battery because of the cost.[5]

The Quartermaster General was agreeable to this expenditure. This change was made, and on November 24, 1903, Major Marshall turned over the electric lighting and power plant to the Fort Hancock commander.[6]

4. Guns of Battery Potter Test the Construction

The siting of the powerhouse in lee of Battery Potter had one immediate disadvantage. When the huge 12-inch guns were fired with prismatic powder in mid-April 1902, the "shock communicated through the brick partition walls, separating the storage battery room from the toolroom and watchman's quarters, on which partition the roof purlins were . . . supported," causing the roof plates to "'jump' from the supports appreciably." No damage to the roof, however, was found.

Next, the guns were fired with smokeless powder, which caused the entire roof covering of corrugated iron to vibrate in "shallow waves from end to end" of the powerhouse. The shock broke the bond of a few bricks in which were set one of the roof purlins.

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5. Marshall to Gillespie, April 19, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

6. Ibid., Oct. 6, Nov. 24, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

No glass was broken, all sash having been removed previously from one side, and the windows on the other three elevations having been opened. At a distance from the battery many windows were broken, some as far away as 1,000 feet. Major Marshall accordingly had the weak brickwork taken down to the level of the eaves and rebuilt.[7]

B. Improvements and Maintenance: 1905-1912

1. Colonel Marshall's 1905 Report

In the spring of 1905 Colonel Marshall informed the Chief Engineer that the power plant, with addition of the 80-kilowatt unit on order, would suffice for defense and post needs, provided the Ordnance Department did not install traversing and elevating motors and confined the Ordnance installations at the batteries to retracting motors, firing devices, and lighting of carriages. This would permit a reduction of 45 kilowatts in demand for current.

The greatest immediate need at the powerhouse was pure water. That used in the boilers, as it was pumped up through well points in the sand, was brackish. Whenever there was heavy use, salt water infiltrated the points. To cope with this, Colonel Marshall recommended construction of cooling tanks to receive the water from the condensing plant to be reused either directly from the tanks or from the well points. If the latter method were employed, the water, after passing through the tanks, would be led through an overflow opening and returned to the pipes. By this method the water would be made "more and more pure and soft, due to distillation," instead of more and more brackish, as at present by excessive pumping from the well points.

Several large mains, separate from the lighting circuits, were required for the motors at the gun batteries. The cables now in use could not supply all the current needed without too great fluctuations in voltage.

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7. Marshall to Adj. Gen., Dept. of the East, April 17, 1902, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

Forty additional lights were required for Batteries Reynolds and McCook; platform lights were needed at Batteries Peck and Urmston; and the rooms of Battery Urmston should be lighted.

With the extension of electrical energy to Batteries Reynolds, McCook and Granger, and the nine-gun battery, the accumulators had been laid-up. In event of an emergency, they would have to be pressed into service, so they were kept in running order.[8]

2. Construction of the Coal Shed

A brick coal shed was erected by the Quartermaster Department in 1903-04 parallel to and north of the powerhouse. Its dimensions were 52 feet by 15 feet, and it had a shed roof.[9]

On April 21, 1909, Assistant Engineer Hurlbut notified the District Engineer that high winds had torn several sheets of corrugated metal roofing off the central powerhouse and coal shed. The roofing had been loosened previously by concussion from the firing of the big guns.[10] Funds were allotted from contingencies and the roofs repaired.

On September 6, 1912, the Chief Engineer allotted $600 for lighting the loading platforms of Batteries Granger, Halleck, Alexander, Bloomfield, and Richardson. Five days later, Colonel Roessler was authorized to proceed with the project, which was accomplished in Fiscal Year 1913.[11]

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8. Marshall to Mackenzie, undated, NA, RG 77, Press Copies, Ltrs. Sent, New York Defenses.

9. "Coal Bin at Power House, Fort Hancock, N.J., Sketch showing proposed location and arrangement," NA, RG 92.

10. Hurlbut to District Engineer, April 21, 1909, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

11. Chief Engineer to Roessler, Sept. 6 & 11, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

C. Limiting the Powerhouse's Mission

1. Engineer Corps Assumes Responsibility for Operation of the Fortification Power Plant

Chief Engineer Bixby in October 1912 informed the commanding general of the Eastern Division that Fort Hancock was currently lighted by two high voltage alternating current generators. These, along with their motors, were in the central powerhouse. Battery Arrowsmith and the secondary and supplementary stations southeast and northwest of the fort were also furnished current from this source as well as transformers positioned near Camp Low and these stations.

According to a report from Colonel Roessler, the Quartermaster Department planned to construct a second powerhouse on the reservation for lighting Fort Hancock. Once this occurred, Chief Engineer Bixby continued, the 1903 powerhouse plant would be utilized solely for the batteries and their auxiliaries. But to provide energy for Battery Arrowsmith and the stations southwest of the post, the two alternating generators installed in the central powerhouse by the Quartermaster Department for lighting Fort Hancock would either have to be continued in use or be replaced. It was his recommendation that these generators and their motors be transferred to the Corps of Engineers.[12] Maj. Gen. T. H. Barry approved the transfer to become effective as soon as the new powerhouse was accepted by the post commander.[13]

Almost two years passed before the Quartermaster Department completed the new Fort Hancock power plant. On June 17, 1914, Lt. Col. Morris K. Barrol transferred the central powerhouse to the Engineers. Secretary of War Garrison approved this transaction to take

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12. Chief Engineer to Commanding General, Eastern Division, Oct. 16, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. One generator was 75-kilowatt, 2,400 volts, and the other 25-kilowatt, 2,400 volts.

13. Barry to Chief Engineer, Oct. 21, 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

effect on March 27, 1915. At that time the facility was redesignated the Fortification Power Plant.[14]

There were now three electric plants at Fort Hancock--the Quartermaster Department pumping and lighting plant; the Fortification Power Plant; and a small 40-horsepower steam plant, south of Battery Gunnison, furnishing power for the 60-inch searchlight.

Installed in the Fortification Power Plant were three water tube boilers and three direct current generators. These boilers rated at 84-, 125-, and 125-horsepower; the generators had "normal ratings" of 80, 80, and 37.5 kilowatts, respectively. The plant also housed two motor generators, originally positioned for converting the 125-volt direct current into 2,400-volt single phase alternating current for general post lighting. One of these was for peak lighting loads and was rated at 120-horsepower for the direct current motor and 75 kilowatts for the alternator. The rating of the other was 30 horsepower for the motor and 25 kilowatts for the alternator.

The plant in 1914 supplied power and light for all elements of the defenses, except the searchlights and fire-control secondary stations. A separate 25-kilowatt steam plant powered the 60-inch searchlight south of Battery Gunnison.

The Quartermaster Department continued to supply coal and water for the plant, while civilian engineers and firemen saw to its operation and maintenance.[15]

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14. Roessler to Chief Engineer, June 17, 1914, and Secretary of War to Chief Engineer, April 14, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

15. Roessler to Chief Engineer, Aug. 11, 1914, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Colonel Roessler placed the requirements for defense needs, with all station and emplacement lights burning and all motors running at their normal speed, but not including searchlights, at:

Emplacement lights	60 kilowatts
Station, etc., lighting	25 kilowatts
Projectile hoist motors	41 kilowatts
Powder hoists	11 kilowatts
Retracting motors	33 kilowatts
Traversing motors	6 kilowatts
Total	176 kilowatts

All this power would, however, not be required at the same time. Under usual conditions, all the lights would not be burning, all motors would not be running simultaneously at top speed, and the retraction motors would not be running at all.[16]

2. Plant Gets a New Chimney

On September 15, 1914, Colonel Roessler notified the Chief Engineer that the smokestack of the Fortification Power Plant was in bad condition. The upper and lower sections were corroded so badly on the inside that fears were expressed that the next wind storm would send it crashing to the ground. The chimney was 55 feet in height, 48 inches in diameter, with 48-inch connections to breeching from the three boilers. Colonel Roessler estimated the cost of materials and labor for a new stack at $700.[17] Chief Engineer Kingman made the necessary allotment, and a new chimney was positioned in Fiscal Year 1915.

3. Decentralizing and Modernizing the System

In 1916 there was installed in Battery Bloomfield a 25-kilowatt gasoline generating set. Electric current from this unit was

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16. Ibid.

17. Roessler to Chief Engineer, Sept. 15, 1914, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

employed for operating hoists, gun motors, and lighting the battery. In emergencies the current could be fed into the switchboard of the Fortification Power Plant and the adjacent batteries.

Positioned in separate shelters near Battery Alexander were two more 25-kilowatt electric generating sets. Current from them was used for operating hoists, gun motors, and lighting Batteries Alexander and Halleck, and all the rapid-fire batteries, except Gunnison. Energy from these generators could also be led into the switchboard in the Fortification Power Plant and adjacent batteries through the distribution panel in Battery Bloomfield.[18]

The Battery Alexander powerhouse was transferred to the Coast Artillery in March 1921. Major Carruth, the following month, reported the installation of one 25-kilowatt power plant with auxiliary electrical equipment in the power-room of emplacement no. 1 of Battery Bloomfield; two 25-kilowatt sets with auxiliary electrical equipment in the power room of the battery's no. 2 emplacement; and an Ideal Arcola Heating plant in each of these rooms.[19]

D. Fortification Power Plant is Closed

Transfer of the Proving Ground to Aberdeen in 1919 added a third large steam generating power plant to Fort Hancock. As the post commander explained to Chief Engineer Lansing H. Beach, each of these plants served a different purpose, and each generated a different voltage--the Quartermaster pumping and lighting plant 110 volts alternating current; the Fortification Power Plant 110 volts direct current; the former Proving Ground plant 220 volts direct current. The latter plant now provided power for the former Ordnance machine shop, railway transportation, and the Eastern Department Vocational School. The

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18. District Engineer to Chief Engineer, Oct. 14, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

19. Carruth to District Engineer, April 4, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

operation of three power plants was uneconomical, as it called for large quantities of coal and several men at each facility.[20]

In 1921 the Fortification Power Plant was closed, and the batteries were henceforth provided with electric power by the 25-kilowatt gasoline generating units. The boilers in the 1901-02 facility, when last inspected, were listed as dangerous, while most of the other equipment was obsolete. As it was questionable whether there was any need for the plant, Lt. James C. Marshall, the Fort Hancock Engineer Officer, recommended the machinery be scrapped and sold at public auction.[21]

Post Commander Elijah Martindale concurred with Lieutenant Marshall. He urged that such funds as were realized from the sale of the plant be applied toward the installation of auxiliary 25-kilowatt gasoline power units for Searchlights Nos. 1, 2, 3, and 5. The Ordnance and Quartermaster Power Plants, with the 25-kilowatt generators, would be more than sufficient to meet any conceivable emergency.[22]

Lieutenant Marshall's proposal was approved. The machinery and equipment were removed from the brick powerhouse and turned over to the post salvage officer for sale.

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20. Commanding Oficer, Sandy Hook Defenses, to Chief Engineer, Sept. 7, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

21. Marshall to Oakes, Dec. 28, 1923, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

22. Martindale to Oakes, Jan. 18, 1924, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. The Ordnance Power Plant, currently operated by the post quartermaster, was employed to heat the post school, Roman Catholic Chapel, Motor Overhaul Park buildings, the Brick House, and several barracks and quarters. One 60-kilowatt direct current generator was operated from 8 A.M. to 9 P.M. to supply current at 250 volts to the shops of the Motor Overhaul Park, Ordnance Shops, Engineer Shops, and batteries where connections existed. The 60-kilowatt alternator was operated for the post power and lighting from 8 o'clock to 4 P.M. Marshall to Oakes, Dec. 28, 1923, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

E. Recommendations

The Fortification Power Plant from 1903 to 1914 provided electrical energy for most of the defenses and the post. After completion of the Quartermaster pumping and lighting plant in 1914, the Fortification Power Plant generators continued to supply the Sandy Hook Defenses with power. During the next seven years, the Corps of Engineers decentralized the sources of power for the defenses. A number of 25-kilowatt gasoline generators was positioned at various batteries and searchlights. This would negate the possibility of a single shell or an aerial bomb knocking out the entire power system of the Sandy Hook Defenses.

For almost a score of years the Fortification Power Plant was a vital element in the defenses guarding the approaches to America's largest city and most important port. Accordingly, the powerhouse and its brick coal storage house are of Third Order of Significance and should be stabilized and preserved. They will be entered on the area's List of Classified Structures.

XV. THE ENGINEER STRUCTURES AND THE RESERVATION

A. Improvements to the Engineer Wharf, 1891-1920

1. Fiscal Year 1891 Extension and Repair of the Wharf

With resumption of work on the fortifications in Fiscal Year 1891 it was necessary to repair and extend the Engineer Wharf westward 198 feet. A shoaling of the area in the years since construction of the wharf more than 30 years before made this necessary to facilitate docking of vessels with construction materials. The wharf extension was accomplished under contract by Waldo Danforth at a cost to the government of $4,434.34, which was charged against the appropriation for the gun-lift and mortar batteries.[1]

In extending the wharf Danforth workmen left the wing of the old structure in position. The old wharf wing was transferred to the Ordnance Department, which enlarged and rebuilt it in 1893. Railroad rails were positioned on both the Engineer and Ordnance wharves.[2]

2. 1903-04 Extension of the Wharf

In Fiscal Year 1893, piles were driven between the rock-filled cribs to strengthen the wharf and support the railroad tracks.[3]

Then, in Fiscal Year 1903 plans were finalized by the Corps for extending the wharf another 80 feet and providing it with a

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1. Gillespie to Chief Engineer, Annual Report of Operations at the Fort at Sandy Hook for Fiscal Year 1891, NA, RG 77, Ltrs. Recd., Chief Engineer. Materials used included: 1-foot bearing piles (4,451 lineal feet); 945.1 lineal feet of spring and fender piles; 195 lineal feet of yellow pine masts; 24,330 board feet of yellow pine timber (caps, stringers, and backing); 21,000 board feet of yellow pine deck planking; and 4,370 pounds of iron.

2. "Proposed Extension of Wharf at Sandy Hook, New Jersey, Engineer Office, U.S.A., New York, N.Y., Sept. 19, 1890," NA, RG 77.

3. "Sketch of Piles to be Driven to Strengthen Wharf at Sandy Hook Proving Ground, Jan. 6, 1893," NA, RG 77.

T-head, 320 feet by 44 feet. Major Marshall estimated the cost of the project at:

503	yellow pine bearing piles, creosoted	$10,563
108	white oak fender piles, creosoted	3,240
315,000	feet, board measure, beams, braces, floors, etc., not creosoted	13,230
50,000	pounds iron bolts, spiking, etc.	2,000
15,000	tons riprap, 20-10 150-pound stones	15,000
		$44,033[4]

Funds were allotted by Chief Engineer Gillespie and proposals invited. Charles B. Roderman, having submitted a low bid of $44,792.50, was awarded the contract on June 23, 1903.[5]

Difficulties were encountered in driving piles for the new dock. When plans and estimates were prepared it had been assumed by Major Marshall that the supporting power of the bottom would be uniform, and provision was made in the specifications for a 15-foot penetration. After 55 piles had been driven through a layer of mud into hard bottom, the 56th pile went through the sand bottom into mud. It was found that 28 to 30 feet of penetration was necessary rather than 15 feet. Experiments with piles lengthened to 70 feet demonstrated that with this penetration and a depth of 58 feet below ebb tide, the resistance of the bottom was as great as the ultimate strength of the piles.

Major Marshall found that the bottom at the outer part of the wharf consisted of mud overlaying sand. Under this sand was another stratum of mud 8 to 10 feet thick, and below this a layer of hardpan into which the pilings could not be driven more than several feet. The upper stratum of sand was thicker near the shore, and the 55 piles previously driven did not penetrate it. Subsequently, under loads,

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4. "February, 1903, Sandy Hook, N.J., Present Dock, Showing Proposed Extension," NA, RG 77.

5. Marshall to Gillespie, June 23, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

9 of them worked through and settled 2-1/2 feet. Consequently, Major Marshall observed, none of these 55 piles were safe.

He proposed to have Roderman take up these piles as well as all other bearing piles and lengthen them, to secure an effective length of 70 feet. This would be done by splicing on pieces of piling 20 feet long. The 70-foot piles would be required only for the bearing piles, the other pilings of the "close row" being for wave breaking.

The cost of this change order, which he was recommending, would be $4,850. As this would increase the cost of the contract to a figure in excess of available funds, Marshall would "leave off the north extension of the T, or so much of it as may be necessary on account of cost."[6] Chief Engineer Gillespie approved the change order.

On November 20 Major Marshall secured authority to position on the north end of the wharf a derrick for unloading and loading heavy materials and equipment. Cost of construction was paid by charges against various defense projects.[7]

The new pile wharf, while unfinished, was heavily damaged on the afternoon of January 22, 1904, by an ice floe driven into Sandy Hook Bay by a sudden shift of the wind from northwest to southwest. Crashing into the south end of the wharf, the floe broke 30 of the 503 piles, and damaged or destroyed 16 bents. Temporary braces were positioned to prevent further damage. To repair the structure would cost $2,200. No provision relating to damage by ice had been included in the

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6. Ibid., Oct. 12, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

7. Ibid., Nov. 20, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

specifications, because it had been anticipated that Roderman would complete the wharf before ice formed in the bay.[8]

The department accordingly allotted money to repair the damage. The repairs were effected and the extension to the wharf completed, and the new derrick was positioned by late spring.

3. Maintenance and Repairs, 1913-1916

Nine years later, in 1913, the Corps of Engineers repaired the wharf. The deck of the wharf was repaired. While this work was accomplished on the T-head, two fender piles were repaired, chocks between piles replaced, and the three dolphins replaced at the south end.[9]

During the years from 1904 until 1919, when the Sandy Hook Proving Ground was phased out, the outer wing of the wharf was used jointly by the Engineer and Quartermaster departments and the Mine Planter Service. The inshore wing served as a dock for the steamer Ordnance, and occasionally for boats of the other departments. Col. Edwin B. Babbitt, the Proving Ground commander, in the spring of 1913 informed Colonel Roessler that at low tide there was insufficient depth of water to float Ordnance, or to provide enough room for her to turn around. Colonel Roessler accordingly formulated plans to have the area dredged to make the sides of the inner wharf "available for berthing, and to provide proper maneuver room."

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8. Marshall to Mackenzie, Jan. 30, 1904, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock. At this time, 503 bearing piles had been driven, covering the length of the wharf front, 329 feet. Many of the bracing piles had been driven but not fastened. Part of the horizontal and diagonal bracing was on, but only partly fastened. "Cross-Section of New Dock Being Built at Sandy Hook, N.d., to show progress upon damaged section before it was injured, January 22, 1904," NA, RG 77.

9. Roessler to Chief Engineer, Nov. 1912, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

The amount of sand and mud to be removed to give a depth of 15 feet at mean low-water was about 29,000 cubic yards. The dredging would have to be done by a dipper or clam-shell dredge, because at ebb tide there was insufficient water to float loaded scows. This would lead to higher costs.

As the Engineer Department did not have the $9,640 needed to fund the project, Colonel Roessler urged that it be undertaken by either the Quartermaster or Ordnance departments.[10]

The project was accordingly undertaken by the Ordnance Department. About 24,000 cubic yards of silt and sand were removed from the approaches to the wharf.[11]

4. Engineer Wharf and Camp Low Dock During World War I

District Engineer Abbot in November 1915 informed the Chief Engineer that the outer section of the wharf, west of the storehouse, had been rehabilitated by the Engineers. In 1913 dolphins had been added to the south end of the Engineer wharf and the T-head reinforced.[12]

In March 1916 Colonel Skerrett, the Fort Hancock commander, asked the Engineers to reinforce the wharf with stone to a height sufficient to reduce wave action. District Engineer Abbot was familiar with the problem, having discussed the situation with Major Marshall as early as 1903. Marshall, at that time, had stated that he was

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10. Roessler to Chief Engineer, April 2, 1913, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

11. Executive Documents of the House of Representatives of the 2d Session of the 63d Congress, 1913-14 (Washington, 1914), Ser. 6608, p. 727.

12. Abbott to Chief Engineer, Nov. 26, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

afraid to drive the vertical piles on the outer side of the wharf any closer than they now were for fear that the shock of huge waves against a solid sheeting, during severe storms, would soon wreck the structure. He had therefore driven his piles about a foot apart, with the concept that they would break the force of the waves and still provide a sufficient "amount of cushioning" to protect the wharf. To afford additional stability, horizontal planks had been bolted to the piles about a foot below the low-water mark.

If they could position a line of heavy timber cribs under the wharf, resting on the high part of the stonework, and fill these cribs with rock, it would improve conditions on the inner side of the wharf. But, Abbot cautioned, with the structure already standing, this would be a troublesome and expensive operation.[13] Colonel Skerrett thereupon dropped the subject.

General Bingham, soon after he replaced Colonel Abbot as District Engineer in October 1917, was confronted by the problem of ascertaining who was responsible for maintenance of the wharf. On checking his files, he learned that it had been built by the Corps from funds provided jointly by the Engineer, Ordnance, and Quartermaster departments. From time to time allotments for its maintenance had been made by each of these departments and repairs made accordingly. The Ordnance Department had spent a considerable sum for dredging and repair of its section of the wharf in 1915-16. Consequently, the inner arm of the wharf was in good condition.

When the Engineer wharf was extended in 1903-04, Bingham explained to the Chief Engineer, the Corps' principal interest in the structure was as a facility for landing materials for use in construction of the Endicott batteries.

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13. Abbot to Skerrett, March 13, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

During the past year, the department had rebuilt the old New Jersey Central Railroad dock at Camp Low for use in construction of Batteries Kingman and Mills. Currently, the only supplies being received at the Fort Hancock wharf were those being handled by the Quartermaster Department.

The outer arm of the wharf and the approach thereto were used almost exclusively by the Coast Artillery in connection with the submarine mine defenses. Bingham therefore wished to know whether the Corps of Engineers was responsible for maintenance of that part of the wharf used by the mine defense companies.[14]

Chief Engineer Black advised General Bingham that as the department was charged with maintenance of fortifications and their accessories, it would maintain the Fort Hancock mine wharf.[15]

In September 1918 the Corps of Engineers had to guard against efforts by other branches of the armed services to trespass on their Camp Low facilities. On the 10th officers of the Aeronautical Branch called to discuss with General Bingham plans for expansion of the Horse Shoe hydroplane station. He told them that they could not use the Camp Low dock for their activities, because the Engineers needed it for support of Batteries Kingman and Mills.

Then, on the 24th, two officers of the Coast Survey called and showed Colonel Bingham a sketch, detailing a plan for three piers to be built near the Camp Low dock and a proposed channel to be dredged ending in a basin at the end of the piers. The object of this construction was to establish a shipping facility for the high explosives the Ordnance Department was storing in the new Sandy Hook Ordnance

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14. Bingham to Chief Engineer, Oct. 31, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

15. Winslow to Bingham, Nov. 9, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Depot.[16] The Armistice put a stop to plans for construction of the piers and basin, and the Ordnance Depot was soon phased out as the nation rushed to disarm.

Two months before, on July 26, 1918, Chief of Ordnance Clarence C. Williams requested authority to construct an extension to the Ordnance arm of the Fort Hancock wharf. This section was to be extended about 150 feet, retaining the same width and alignment as the present structure. The extension was to have an elevation of 9 feet, 10 inches above mean low-tide and be supported on wooden piles.[17] Secretary of War Baker approved this proposal on August 3, and it was promptly implemented.

B. Engineer Department Has its Housing Restricted

1. Quartering and Boarding the Engineers and Workmen in the 1890s

During Fiscal Year 1891 the Civil War barracks were rehabilitated to house the labor force recruited to work on the Endicott batteries. The quarters occupied by the ordnance-sergeant was repaired at a cost of $277.23.[18]

In Fiscal Year 1892, the seating capacity of the workmen's mess hall having proved inadequate, Colonel Gillespie had the old Sandy Hook Life-Saving Station, which had been turned over to the Corps of Engineers the previous year, relocated adjacent to the barracks and converted into additional mess facilities.

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16. Bingham to Chief Engineer, Sept. 28, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

17. Williams to Chief Engineer, July 26, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

18. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1891, NA, RG 77, Ltrs. Recd., Chief Engineer.

The need for an office was recognized, and Chief Engineer Casey on August 27 authorized construction of one. Built by hired labor with materials purchased under contract, the office was erected for $1,392.57 and furnished for $155.65. It was located about midway between the mining casemate and the workmen's barracks.[19]

It was often necessary for Colonel Gillespie and other Engineer officers to spend the night at Sandy Hook. Because of the area's isolation, they were compelled to seek quarters at the "Brick House." Although the Ordnance officers cheerfully extended every courtesy, their quarters, during certain seasons, were crowded. To alleviate this situation, Colonel Gillespie with approval of the department contracted with James Rudolph on May 31 to construct a frame Engineer quarters at a cost of $5,000. This structure, which was completed and occupied in late summer, was several hundred feet west of the mining casemate.[20]

According to Colonel Ludlow, poor accommodations were partially to blame for failure of contractor Malloy to progress more rapidly on the three-gun, 10-inch battery. Under the system adopted by Malloy, the Engineer boarding house was operated as a company store, where the men made their purchases. They did their cooking in their quarters. The Engineer employees at this time were boarded with the Ordnance personnel, whose accommodations were better but limited.[21] In the summer of 1898 a small frame barracks was built as quarters for Corps of Engineer employees, and the Engineer cottage was repaired.[22]

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19. Ibid.; Annual Report of Operations at the Fort at Sandy Hook for Fiscal Year 1892, NA, RG 77, Ltrs. Recd., Chief Engineer; "Map of Sandy Hook, N.J. . . . To accompany annual report, U.S. Engineer Office, New York, N.Y., June 30, 1892," NA, RG 77.

20. Executive Documents, Ser. 3199, pp. 607-08.

21. Executive Documents, Ser. 3631, p. 623.

22. Executive Documents, Ser. 3905, p. 789.

2. O'Sullivan Builds a Second Engineer Cottage

In Fiscal Year 1902 a second Engineer cottage was authorized. Its cost was not to exceed $4,500 of the $100,000 allotted July 16, 1901, for building two emplacements (Battery Richardson) for 12-inch guns. An architect was employed, plans prepared, and proposals solicited. The lowest bid was $4,650, which was in excess of available funds. This led to Major Marshall's decision to purchase the materials and contract for construction of the cottage. Michael O'Sullivan agreed to do all the carpentry for $940.

After completing the cottage, O'Sullivan presented the government with a bill for extras totalling $400.07. Responding to the claim, Major Marshall pointed out that the work done by the contractor was only such as could be reasonably required under the specifications. O'Sullivan had been repeatedly cautioned by Assistant Engineer Hurlbut that no extras would be allowed.[23]

3. Employees are Encouraged to Commute

Several major construction projects in Fiscal Year 1902 confronted Major Marshall and his staff with the problem of getting their temporary labor force to and from the job. With the post now garrisoned and the defenses a restricted zone, the quartering of day labor at Fort Hancock was discouraged. The only means of transportation for employees commuting from towns and villages south of the military reservation was the railroad between Highland Beach and Sandy Hook operated by the Ordnance Department for its employees. The one difficulty, however, was that there were only two passenger cars, with a seating capacity of 104 persons. To further complicate matters, the Ordnance Department was currently employing 120 civilian mechanics and laborers at the Proving Ground, and most of these took the train.

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23. Marshall to Gillespie, Sept. 9, 1902, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

As a courtesy, Capt. Edwin Babbitt, commanding officer of the Proving Ground, had been issuing passes for travel on the Ordnance Department railroad and the steamer Ordnance to the Fort Hancock officers and Assistant Engineer Hurlbut, who was supervising Engineer projects on Sandy Hook. But with the Engineer Department about to expand its operatons, Babbitt announced that, to reserve the limited facilities for his employees, he was curtailing the issuance of passes.[24]

As an interim measure, the steamer Engineer was assigned to Hurlbut on Saturday, August 17. The vessel left Sandy Hook that evening with men desirous of visiting their homes over the weekend, stopping first at Highland Beach, before continuing on to Pier 3, East River, New York City. On Monday, the 19th, Engineer sailed from Pier 3, put in at Highland Beach at 8 A.M., and continued on to Sandy Hook where she landed the workmen. During the week the steam launch Ingalls made a morning and evening run between the Hook and Highland Beach.[25]

To provide a permanent and less expensive answer to this problem, Major Marshall urged that he be allotted a sum not to exceed $7,500 for purchase of a passenger coach to transport Engineer employees to and from Highland Beach.

In justification of his request, it was pointed out that Sandy Hook was an isolated area, and it was desirable on security and "sanitary grounds" that as few workmen as possible be housed on-site. Drinking water came from the "sand at slight depths," and because of drifting sand permanent sewers were difficult to maintain. Typhoid was accordingly prevalent. In addition, most of his best workmen were married and had families living in and around Highland Beach.

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24. Marshall to Chief Engineer, Aug. 9, 1901, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

25. Marshall to Hurlbut, Aug. 16, 1901, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

If he were allowed to purchase the coach, Marshall would eliminate a number of temporary living quarters. It was his goal to see that all Engineer employees, except a few foremen and mechanics whose duties compelled late and early work, resided on the mainland. Once this was accomplished, the unsightly and "fire-inviting" sheds used for barracks and boarding houses would be demolished.[26]

The allotment was forthcoming, and Major Marshall purchased a passenger coach from Jackson & Sharp of Wilmington, Delaware, for use on the Ordnance Department railroad. The car was standard gauge, about 52 feet long, and 9 feet 8 inches wide, with double flooring, tin roof, and hood provided with deck windows. Its interior was natural wood veneer, and the outside was painted maroon and stenciled, "U.S. ENGINEER DEPARTMENT NO. 1."[27]

4. Engineers Lose Most of Their Housing

Establishment of the Ordnance Reservation at Sandy Hook in 1903 confronted the Engineer Department with a problem in providing quarters for key personnel at the Hook. Protesting this action, Major Marshall wrote the Chief Engineer that it was "absolutely necessary" for the Corps to provide quarters for 1 assistant engineer (Mr Hurlbut), 1 overseer, 2 foremen, 2 steam engineers, 2 stokers, 1 locomotive engineer, and 8 laborers at Fort Hancock. The last nine men were for handling freight delivered after working hours at the wharf.

The only housing available, other than that on the Proving Ground, was the quarters occupied by Assistant Engineer Hurlbut. The housing on the Ordnance Reservation must either be retained by the Corps for the time being, or equivalent quarters provided at other sites until such time as the Sandy Hook defenses were completed.

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26. Marshall to Gillespie, Sept. 3, 1901, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

27. Marshall to American Car & Foundry, Sept. 16, 1901, and Marshall to Jackson & Sharp Co., Sept. 23, 1901, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

The frame barracks, formerly used as a dormitory, could be removed and the laborers, except the eight on call for night work at the wharf, compelled to room at the Highlands and commute. If Corps supervisory personnel were compelled to vacate the four quarters being transferred to the Ordnance Department, equivalent housing would have to be erected.[28]

The situation was compromised. Quarters were found for the supervisory personnel on post and the 8 laborers were moved to Highland Beach.

Three years later, in June 1906, the housing problem returned to haunt Colonel Marshall. A number of workmen were heard to complain that they were experiencing difficulty securing board and room in and around the Highlands. Worse, with approach of the vacation season, many landlords were raising their rents. As a possible solution, Colonel Marshall called the department's attention to certain buildings on the Proving Ground belonging to the Engineers that might be utilized to alleviate this situation. Included were: (a) the post office, the north wing of which was being used as a boarding house by Ordnance Department employees; (b) a cluster of four houses occupied by the powerhouse engineer, Battery Potter engineer, powerhouse fireman, and Engineer enginemen; and (c) the building turned over to the Ordnance Department to be razed but retained and used as a church.

Marshall asked that these structures be transferred back to the Corps of Engineers at an early date for use as barracks and mess hall.[29]

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28. Marshall to Gillespie, May 2, 1903, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

29. Marshall to Mackenzie, June 28, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

No action was taken on this request, and more than a decade was to pass before steps were taken to provide the Engineers with adequate housing and a reservation of their own at Sandy Hook.

C. Improving the Grounds, 1899-1903

1. Construction of Boardwalks and Plank Roadways

In Fiscal Year 1899, to facilitate passage back and forth by the artillerists, boardwalks were built to the Dynamite Gun Battery, the Gun-Lift Battery, and Battery Halleck.[30]

Three thousand seven hundred feet of plank roadways, 8 feet wide, were built in Fiscal Year 1900, connecting the mortar battery, Battery Granger, and the fifteen-pounder battery with the post road network.[31]

2. Combatting the Drifting Sand

Drifting sand proved to be a nuisance at the turn of the century as it covered the areas in rear of the batteries and filled the ditch at the mortar battery, causing considerable trouble and expense as well as inconvenience and unsightliness.

In Fiscal Year 1902 Major Marshall employed an allotment of $2,530 from the Chief Engineer and $2,000 from the Quartermaster Department to grade these areas and cover them with cinders to prevent the sand from drifting. This greatly improved their appearance and muted complaints from battery commanders about sand drifts building up around the guns.[32]

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30. Executive Documents, Ser. 3905, p. 780.

31. Executive Documents, Ser. 4089, p. 840.

32. Executive Documents, Ser. 4444, p. 691.

3. Bringing Water to the Batteries

On August 22, 1900, Chief Engineer Wilson allotted $4,500 for supplying all the batteries with water. Work was commenced in September and completed by February 1901. A 3-inch main was extended from the Fort Hancock water system, with 2-inch branches and 1-inch delivery pipes to the various emplacements. Frost-proof hydrants were positioned at the rear of each 10- and 12-inch battery, at the lift-battery, in each pit of the mortar battery, at both 15-pounder batteries (Urmston), and at the Dynamite Gun Battery where two were installed.[33]

D. Demolition and Removal of Structures, 1907-1917

In the summer of 1907 a brick building belonging to the old masonry fort in rear of Battery Halleck was demolished.[34]

On August 20, 1908, Assistant Engineer Hurlbut requested and received permission to demolish the frame structure positioned on the scarp of the old masonry fort. As soon as the structure was out of the way, the northwest bastion and adjoining curtains were pulled down and the granite stockpiled for use as riprap.[35]

In December 1915 the frame Engineer stable near the cable tanks was removed. It dated to construction of the old fort. All that now remained of the 1859-68 masonry fort was the salient angle of the southwest bastion and a section of the northwest curtain shielding the west elevation of the cable tanks' shelter.[36]

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33. Executive Documents, Ser. 4279, p. 769.

34. Hurlbut to Marshall, July 30, 31, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

35. Hurlbut to District Engineer, Aug. 29, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

36. Abbot to District Engineer, Jan. 3, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

In March 1916 Post Commander Skerrett complained that the Sandy Hook Beacon obstructed the field of fire of Battery Peck.[37] Before forwarding Colonel Skerrett's communication to the Department of Commerce, Secretary of War Baker added his comment that the "interference is serious enough in the view of the War Department to warrant remedial action at the earliest practicable date."[38]

Secretary of Commerce William C. Redfield informed the War Department that the current session of Congress had been requested to appropriate $20,000 for improvements of aids to navigation at Sandy Hook. This estimate had been submitted, because of complaints by the military that some of the Lighthouse Service structures at the north end of the Hook were positioned to obstruct fields of fire of several batteries guarding the entrance to New York Harbor.[39]

On November 20, 1916, the Lighthouse Service advised the Army that it was relocating the Sandy Hook Beacon and fog bell from the vicinity of Battery Engle to near the tip of the Hook. The new bell would be operated in conjunction with the flashing acetylene beacon.[40] The beacon and fog bell were moved during the winter of 1916-17.

E. Engineers Erect Two Storehouses, a Magazine, and Locomotive House

1. Construction of Engineer Storehouse No. 1 (Building No. 122)

District Engineer Abbot, one month after the United States entered World War I, asked the Chief Engineer for an allotment for

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37. Skerrett to Redfield, March 21, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

38. Baker to Redfield, April 16, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

39. Redfield to Baker, April 27, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

40. Yates to CO, Fort Hancock, Nov. 20, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

construction of a fireproof warehouse for storage of Corps property and supplies. Present facilities, he noted, were "grossly inadequate," consisting of old frame structures, erected for temporary use when the batteries were being built. Besides failing to protect valuable public property stored within, they constituted a fire menace to permanent buildings belonging to the Ordnance and Quartermaster departments. If there were money available, Colonel Abbot proposed to build his storehouse of hollow tile, with 150- by 30-foot dimensions.[41] On August 1, 1917, Chief Engineer Black allotted $10,000 for construction of the desired storehouse.[42]

Having staked out a site midway between the southwest bastion of the old masonry fort and the wharf, Colonel Abbot contacted Colonel Ruggles of the Proving Ground. In the near future, Ruggles was informed, the Engineers would build a spur extending north from the main line of the Ordnance railroad to where they proposed to locate the storehouse. With Colonel Ruggles' permission, Abbot would position the switch in front of the frame Engineer storehouse. Colonel Ruggles was agreeable.[43]

Fierce winter storms which blew down sections of the partially completed walls slowed construction and added to the cost. On January 29, 1918, the department allotted another $2,000 to fund the project.[44]

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41. Abbot to Chief Engineer, May 7, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

42. Chief Engineer to Abbot, Aug. 1, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

43. Abbot to Ruggles, Aug. 10, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

44. Chief Engineer to District Engineer, Jan. 29, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

The storehouse was finished by early spring. On May 21 District Engineer Bingham complained that the 150- by 30-foot hollow tile structure, with timber framing, had been found inadequate to meet the Corps' expanded wartime needs. What was required was a similar storehouse, somewhat differently constructed. A site for the new structure was available on the spur north of the new storehouse.[45]

2. Construction of Engineer Storehouse No. 2 (Building No. 123)

Authority to construct a second fireproof warehouse was given by the department in August 1918. Funds to defray the undertaking were to be drawn from the unexpended balance ($26,000) of the allotment for construction of Batteries Kingman and Mills.[46]

The second storehouse was built of hollow tile, with a steel roof supported on metal columns. It was 201 feet 9 inches in length, 50 feet in width, and 23 feet 2 inches in height. The railroad spur passed through the structure, the cars being admitted through sliding doors in the north and south elevations.[47]

3. Construction of the Detached Magazine

On April 29, 1918, Colonel Harris, commander of the Sandy Hook Defenses, asked District Engineer Bingham to approve the site selected for a shell storehouse on a little-used siding near the seacoast batteries. To justify need for the storehouse, Harris reminded the Engineers that within the past year two new 12-inch batteries (Kingman and Mills) and the mortar battery at Navesink had been completed.

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45. Bingham to Chief Engineer, May 21, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

46. Bingham to Swift, Aug. 20, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. A. C. Swift was Junior Engineer for the Sandy Hook Defenses.

47. "Storehouse, U.S. Engineers Department, Fort Hancock, N.J.," NA, RG 77.

Moreover, the defenses were now receiving their war allowance of projectiles and powder charges, and their proper storage was becoming a problem.[48] General Bingham was agreeable to his department undertaking the project.[49]

On October 8 District Engineer Bingham notified Junior Engineer A.C. Swift that the Corps had allotted $11,000 for construction of the detached magazine.[50] Swift, when he visited the site near Battery Potter discussed in May for location of the magazine, found that in the intervening months Proving Ground personnel had built a large frame garage nearby. As this structure was inflammable and the Battery Potter area already congested, Swift suggested a new site for the detached magazine. His proposed location was on the spur northeast of the bakehouse.[51]

On January 12, 1919, District Engineer Bingham approved Swift's alternate site choice and issued instructions to proceed with construction with as little delay as practicable.[52]

The detached magazine, a concrete structure with a masonry slag roof supported by steel trusses, was completed in the summer of 1921. The structure, with doors in its east and west elevations, was 73 feet 6 inches in length, 30 feet in width, and 16 feet to the apex of the gable. Positioned inside for handling shells were two

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48. Harris to Bingham, April 29, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

49. Bingham to Chief Engineer, May 1, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

50. Jervey to Acting Secretary of War, undated, and Bingham to Swift, Oct. 8, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

51. Swift to District Engineer, Nov. 8, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

52. Bingham to Swift, Jan. 12, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

traveling handpowered I-beam cranes. Each crane was equipped with one hand-operated Reading multiple-gear block of 3,000-pound capacity.[53]

4. Construction of a Locomotive Store and Repair House

On January 18, 1919, District Engineer Bingham informed Chief Engineer Black that one of the "most necessary things for preservation of government property" at Sandy Hook was a shelter for the locomotives, cranes, etc. This structure could also be employed to shelter the "plant," while parts were laid up for repairs during the winter. Enclosed the Chief Engineer would find a drawing of the projected "locomotive house," which was designed to be constructed as economically as possible, and still be permanent. Bingham placed its cost at $11,411.[54] It would be positioned on a spur about 200 feet east of Storehouse No. 2.

Before an allotment was made, the Corps of Engineers, with the Sandy Hook Proving Ground being phased out, sought to secure for its use certain Ordnance Department structures. The Engineers were especially interested in the locomotive roundhouse. When this was denied, the Chief Engineer allotted $12,000 for construction of a locomotive shed to shelter the Corps' three locomotives and three railway cranes. An air of urgency now confronted the Engineers, because it was early September, and they wished to get this expensive equipment indoors before winter.[55]

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53. Carruth to District Engineer, July 24, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock; "Proposed Shell Storehouse for Fort Hancock," drawn by J. H. Pearson, Civil Engineer, April 19, 1918, NA, RG 77. The I-beam cranes were manufactured by New Jersey Foundry & Machine Co.

54. Bingham to Chief Engineer, Jan. 18, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock; "Fort Hancock, N.J., Engineer Department, Locomotive Store & Repair House," NA, RG 77.

55. Crawford to District Engineer, Sept. 9, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Lt. Col. R. W. Crawford was Engineer for the Sandy Hook Defenses.

On September 22 the District Engineer, the Proving Ground having transferred to the Corps its large crane, submitted a revised drawing for the locomotive house to accommodate this equipment. The revised plan called for an increase in the height from the top of the rails to the bottom cord of the truss of 3 feet 6 inches, as well as an increase of its length by 10 feet. The extra work and material would boost the cost of construction to $14,000.[56] The Chief Engineer approved this change on October 1.

In January 1920 Capt. R. W. Crawford, the officer in charge of Corps activities at Sandy Hook, called for placing a heating plant, to cost about $2,148, in the structure. He justified the request on the severity of the winters, which would make it difficult to overhaul the locomotives and cranes. In addition, lack of heat would make it impossible to store the heavy equipment unless boilers were drained and fires drawn.[57]

District Engineer W. C. Langfitt vetoed Crawford's proposal. Captain Crawford accordingly agreed to get along as rapidly and cheaply as possible with the terra cotta walled and corrugated steel roofed structure. He would endeavor to save sufficient funds to bring the heating up again on completion of the structure.[58]

On July 2, 1920, Captain Crawford reported the locomotive house nearly finished. The only work remaining was the hanging of four doors, putting flashing on the roof, painting the ironwork, and installing

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56. Langfitt to Chief Engineer, Sept. 22, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

57. Crawford to District Engineer, Jan. 24, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Crawford, when the Army was cut back, lost his wartime rank of lieutenant colonel.

58. Crawford to Carman, Jan. 31, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

a heating plant. These items were estimated at $700.[59] Within two weeks the project was completed along with a heating plant.[60]

F. Improvements to the Engineer Reservation, 1917-1929

1. General Bingham Documents the Need for an Engineer Reservation

In October 1917 Congress approved legislation and appropriated funds for establishment of a new Proving Ground at Aberdeen, Maryland. The Sandy Hook Proving Ground would be phased out as facilities were developed at the Maryland site.

District Engineer Bingham was unable to secure information on the timetable established by the Ordnance Department to complete the move from Sandy Hook to Aberdeen. So far as the defenses and the care and training of troops were concerned, he wrote Chief Engineer Black, it was "highly desirable that the Ordnance Department remove entirely from Sandy Hook."

In unofficial discussions with Proving Ground officers, Bingham had learned that their department intended to retain possession of the Sandy Hook Proving Ground for many years. But, if so, they had already shifted much of their railroad rolling stock from Sandy Hook to Maryland. This had seriously hampered railroad communications between Fort Hancock and Highland Beach.

Colonel Harris, commander of the defenses, had complained to General Bingham that his troops were unable to hold small-arms practice. Although little firing was currently taking place on the proof range, the Ordnance Department always stated that it was about to occur.

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59. Crawford to Chief Engineer, July 2, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

60. Lyon to District Engineer, July 12, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Capt. T. R. Lyon had replaced Crawford as Engineer, Sandy Hook Defenses.

The work program scheduled by the Corps for the year, General Bingham complained, made it necessary to learn something definite concerning the Ordnance Department's plans. As he reminded Chief Engineer Black, the Corps was charged wth repair of the wharf, and arrangements must be made for servicing Batteries Kingman and Mills and care of the locomotive, cars, and "plant" associated with their construction. Space was also needed for drill with such sophisticated new weaponry as armored cars and searchlights mounted on trucks. It was hoped to employ these vehicles on the beach south of the proof battery.[61]

Chief Engineer Black, to seek an answer to Bingham's questions, met with the Acting Chief of Ordnance. From him, Black learned that the Ordnance people were "at present moving little by little from Sandy Hook" to their Aberdeen Proving Ground. It was anticipated that it would require at least four more months to complete the transfer. At that time, and not before, the Ordnance Department would abandon its Sandy Hook facility.

The Acting Chief of Ordnance suggested that the Engineers hold discussions with the Coast Artillery, with a view to obtaining for their use sections of the Proving Ground needed to support Corps activities. Similar action should be inaugurated with the Quartermaster Department to secure desired transportation facilities.[62]

As this was a sensitive issue, General Bingham did not at this time pursue the subject. He also learned from his local informants that there was no urgency, because it would be the summer of 1919 before the Ordnance personnel completed the move and would be ready to

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61. Bingham to Chief Engineer, Feb. 16, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

62. Chief Engineer to Bingham, Feb. 19, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

turn over to other branches of the service their Sandy Hook installations.[63]

General Bingham, in support of his position, pointed out that in the New York City area the Engineers, during the last 75 years, had spent more than $20,000,000 on improvements. Yet, when he took charge of the district office in October 1917, he found that the Corps did not have a dock at which its boats could tie up. They had to "go around, hat in hand, and ask either private parties or the City . . . for permission to tie up to a dock." For years, there had been no Engineer Depot or repair shops. Finally, General Black had secured construction of a little storehouse on a rocky island in the Hell Gate.

At Sandy Hook, after much opposition, the Corps had finally succeeded in getting a tract set aside for an Engineer Reservation. Already, General Bingham complained, the Quartermaster and Ordnance personnel were encroaching on this area as well as the Engineer wharf.[64]

2. Reservation is Expanded and Fenced

On April 6, 1918, General Bingham notified the commanding officer of the Sandy Hook Defenses that his department had at Fort Hancock a large quantity of lumber, machinery (hoisting engines, derricks, steam boilers, locomotives, flat cars, etc.) for which the allotted storage area was too small. In addition, there were a number of structures belonging to the Corps scattered about the Hook.

To concentrate this property in one convenient area, General Bingham requested that additional acreage be transferred to the Engineers. The desired land was bounded on the north by North Bragg

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63. Bingham to Harris, April 6, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

64. Bingham to Winslow, Oct. 17, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Drive and on the south by the triangular-shaped Engineer Reserve.[65] Transfer of this acreage from the post to the Engineers was approved on April 20.

In the summer of 1918 the Engineers fenced their reservation with an 8-foot cyclone fence. The fence was no. 9 galvanized wire, woven in 2-inch mesh, with barb wire above and a strand of barb wire 8 inches below. The metal supporting posts were 2-1/2 inches in diameter, set in concrete.[66]

3. Construction of a Paint and Oil Storehouse

On February 23, 1918, the department had allotted $1,000 for construction of a paint and oil storehouse. This 12- by 20-foot structure, built of hollow tile, with asbestos shingles, was positioned about 256 feet south of Storehouse No. 1.[67]

4. Old Engineer Office and a Lighthouse Board Building are Relocated on the Reservation

In May 1917 the Ordnance Department had transferred to the Corps of Engineers a frame 8-room cottage.[68] Although this helped, it did not solve the wartime shortage of quarters confronting the Engineers. On July 19 District Engineer Abbot contacted the post commander regarding the structure erected by the Corps for accommodation of men assigned to the old wireless station. Since the station's deactivation, the building had stood vacant. If possible, the

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65. Bingham to Harris, April 6, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

66. Bingham to Chief Engineer, July 29, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

67. Bingham to Chief Engineer and Chief Engineer to Bingham, Feb. 16, 23, 1918, respectively, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

68. Abbot to Ruggles, July 9, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Engineers would like to have possession of this structure for use of their watchman and other employees required to live on Sandy Hook.[69] The post commander was agreeable to the Engineers using the building for quarters.[70]

On July 20, 1918, Junior Engineer Swift inquired into the ownership of the 2-story frame dwelling, painted white with blue trim, on the Engineer Reservation in rear of Batteries Urmston and Morris. Currently, the building was occupied by a Coast Artillery lieutenant. Nearby was a 50-foot tripod steel tower built by the Weather Bureau and formerly employed for displaying weather signals. This use had been discontinued in June 1915. Since then the tower had been used on occasions by the Coast Artillery, but Swift had been unable to ascertain if these structures had been formally transferred to that arm of the service.[71] District Engineer Bingham, after reviewing the files, advised Swift that this dwelling, which had formerly belonged to the Lighthouse Board, had been transferred to the Quartermaster Department.

In October General Bingham, in accordance with his plan to position all Engineer structures on the department's reserve, proposed to move from the Proving Ground and rehabilitate for occupancy by Foreman Simpson the 1892 office. The estimated $2,300 for underwriting this project was allotted by Chief Engineer Black on October 5.[72]

Before this was accomplished, District Engineer Bingham broached to the Chief Engineer the possible acquisition of the two-story

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69. Abbot to C.O., Sandy Hook Defenses, July 19, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

70. C.O., Sandy Hook Defenses, to Abbot, July 24, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

71. Swift to Bingham, July 26, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

72. Bingham to Chief Engineer and Chief Engineer to Bingham, Oct. 2, 5, 1918, respectively, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

dwelling formerly occupied by Lighthouse Board personnel and transferred to the Quartermaster Department in 1917. This structure was between Batteries Peck and Morris and within their fields of fire.

Junior Engineer Swift had been told by the commander of the Sandy Hook Defenses that he was agreeable to transfer of this vacant structure to the Corps. Bingham reminded the Chief Engineer of his continuing efforts to position all Engineer buildings on the reservation. After being relocated, the structure would be rehabilitated as quarters.[73] Its new site would be adjacent to and southwest of the 1892 Engineer dwelling, which now served as quarters for the assistant foreman. The Quartermaster General approved the transfer on February 26, 1919, and the Chief Engineer allotted $2,000 for implementation of the project.[74]

More than 10 months passed before the old Lighthouse Board dwelling was relocated and repaired. On January 20, 1920, it was occupied by General Foreman Simpson as his residence.[75] Meanwhile, the Engineer Office had been moved onto the lot southwest of the general foreman's quarters.

5. Engineers Acquire a Detached Area of the Proof Battery

a. Captain Crawford Calls for Transfer of Several Proving Ground Structures

On July 1, 1918, Junior Engineer Swift, to further General Bingham's scheme to relocate all Engineer structures on the reserve, prepared and submitted necessary estimates for moving the buildings. His figures read:

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73. Bingham to Chief Engineer, Feb. 6, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

74. Chief Engineer to Bingham, Feb. 8, 26, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

75. Carruth to District Engineer, Jan. 17, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Old office	$ 600.00
Blacksmith and carpenter's shop	650.00
General Foreman's house	500.00
Garage	200.00
Paint and oil house	350.00
Lumber shed	500.00
Total moving costs	$2,800.00
New cellar to general foreman's house	375.00
Total	$3,175.00
Contingencies	320.00
Total	$3,495.00

The cost of relocating the red shed and small engine pumphouse had not been computed, because Swift did not deem them worth moving.

He had included in his estimate the cost of new sills. The sills of all these structures, except the general foreman's house, were badly decayed. He had likewise included the cost of new post foundations.[76]

General Bingham--having received separate allotments for relocating the old office, general foreman's house, and garage--revised the estimate submitted by Swift. On March 10, 1919, he asked for $1,400 to move the blacksmith and carpenter's shop, plumber's shop (former paint and oil house), and lumber shed to the new shop area. The Chief Engineer approved this expenditure on March 15.[77]

In the autumn of 1919, the new engineer assigned to Sandy Hook questioned the desirability of relocating this trio of old frame buildings. This was especially true as several Proving Ground structures

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76. Swift to Bingham, July 1, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

77. Bingham to Chief Engineer and Chief Engineer to Bingham, March 10, 15, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

were to be transferred to the Engineers, which would make all but the blacksmith and carpenter's shops superfluous. He urged that they be torn down, the lumber salvaged, and a new blacksmith shop erected on the reserve. The $1,400 allotted for relocating these buildings could then be spent for "general preservation and repair work."[78]

On July 25, 1919, Captain Crawford had learned that upon transfer of the Proving Ground to Aberdeen, the Ordnance railroad would be assigned to the Transportation Service. As traffic would be reduced with a corresponding reduction in rolling stock, there was a possibility the Engineer Department might be authorized to avail itself of the Proving Ground roundhouse, as well as certain sidings for storage tracks. If the roundhouse were assigned to the Corps, it would obviate the necessity of building a roundhouse for which $12,000 had been programmed.

Of the buildings to be vacated, Captain Crawford listed two others as very "suited to our needs." These were Building No. 70, a 150- by 30-foot structure, housing paint, plumbing, and carpenter shops, and Building No. 27, a small square structure outfitted as a lavatory. Both were "fairly new, well constructed of brick, and well equipped."[79]

Crawford's correspondence was endorsed and forwarded to Chief of Ordnance Clarence C. Williams. On August 14 General Williams informed the Chief Engineer that the entire question of the disposition of Proving Ground buildings, improvements, and reservation, had been referred to the Adjutant General. He therefore recommended that the Engineers take up with the Adjutant General the transfer of the buildings in question.

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78. Crawford to District Engineer, Oct. 14, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

79. Ibid., July 25, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

As the Ordnance railroad had been transferred to the Transportation Service, General Williams presumed they would require the roundhouse.[80]

b. Bailey Board Meets to Consider the Engineers' Needs

On September 6, 1919, the commander of the Eastern Department constituted a three-man team (Maj. Gen. Charles J. Bailey, U.S. Army; Col. R. D. Coemer, Corps of Engineers; and Lt. Col. S. H. Frank, Ordnance Department) to proceed to Fort Hancock to make a study and such recommendations as "may be necessary for the transferring of the . . . Proving Ground and property pertaining thereto to the jurisdiction of the Department commander."[81]

The board met at 11 A.M., on the 9th, and inspected the Proving Ground facilities. They found that the Ordnance Department was removing such items as were desired to Aberdeen, and that "such other material has been reported to the Stores & Scrap Board . . . as is considered suitable for disposition" by that agency. An Ordnance officer was preparing a list of other gear, which fell into neither of these categories. The board believed that when this list was completed it should be forwarded through the Coast Defense and Coast Artillery District commander and the District Engineer, to give them an opportunity to acquire articles which they needed.

It was learned by the board that all Proving Ground structures were to be transferred. Of those to be turned over to other branches of the service, the board recommended that Buildings Nos. 12 and 13 be assigned to the Engineers for shops and storehouses in connection with their mission at Sandy Hook, and that Building No. 27 be transferred to the Corps as requested by Captain Crawford.

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80. Williams to Chief Engineer, Aug. 14, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

81. Special Order No. 215, Sept. 6, 1919, Eastern Department, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

The board opposed transfer to the Engineers of Building No. 70 and the roundhouse (Building No. 17). It recommended, however, that the Engineers be allowed temporary use of Building No. 70 and its machinery, until such time as they were needed for the vocational school. The remainder of the structures were to be turned over to the post commander, and would be utilized as a vocational school, with the goal of training enlisted men and junior officers for short periods in "practical artillery work." The board described "the situation and equipment of the Proving Ground, with its extensive machine shops, barracks and electrical" apparatus as particularly adaptable to this purpose.

The Sandy Hook Railroad, the Board found, with all its rolling stock, locomotives, roundhouse, and other facilities, had been taken over by the Transportation Service. Continued railway service was deemed essential to Fort Hancock and this arrangement was approved. The needs of the Engineer Department were to be recognized and given consideration in the operation of the railroad.

In the interest of economy and efficiency, the commander of the Sandy Hook Defenses was to consolidate the power and lighting needs of the post.

The board agreed that a work force of about 25 civilians would be required for caretaking and operations necessary for preservation of materials. This force, or as many as were suitable and available, should be transferred from the Ordnance Department's payroll to the Coast Defense commander's, pending a decision by higher authority on establishment of the vocational school. Lt. William Ross of the Ordnance Department was to remain on post for the time being, reporting to the Fort Hancock commander.

The board recommended that these guns (one 1908 mortar and quick return carriage, one 6-inch Maxim gun, one 6-inch Bofors gun, one 6-inch Armstrong gun, and two 4.72-inch Armstrong

guns), with projectiles and cartridge cases, be retained for use by the projected vocational school.[82]

Colonel Frank accordingly notified the Chief Engineer that it was proposed to turn over to the Corps Buildings No. 12 valued at $8,000 and No. 13 at $24,000, instead of Building No. 70 appraised at $50,000 with its equipment.[83]

On October 18 Captain Crawford asked the District Engineer to take steps to secure transfer of Building No. 22, the former chemical and electrical laboratory, to the Corps for use as offices. At present, it was being employed as an office by personnel of the Ordnance Depot, whose activities at Sandy Hook would be closed down before the end of the year.[84]

This correspondence was referred to General Bailey. Replying, he noted that Building No. 22 had not been discussed by the board. It would, however, be a valuable adjunct to the proposed vocational school and should be reserved for such use, particularly as the board had recommended giving the Engineers more than they had asked for. But, if the former Proving Ground facilities were not utilized as a vocational school, the former chemical and electrical laboratory, as well as other structures, could be turned over to the Engineers or other arms of the service that could employ them advantageously.[85]

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82. Report of Board, Sept. 9, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

83. Frank to Chief Engineer, Sept. 23, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

84. Crawford to District Engineer, Oct. 18, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

85. Bailey to Adjutant General, Nov. 19, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Buildings Nos. 12 and 13, General Bailey pointed out, formed "practically" one structure. They were modern, fireproof buildings, well adapted for the purpose desired. They contained storage rooms and offices sufficient for present, as well as probable future, needs of the Engineers.[86]

The War Department, before the week was over, approved the report of the Bailey Board, excepting the recommendation for establishment of a vocational school.[87]

On February 13, 1920, Maj. Gen. Robert L. Bullard, as commanding general, Eastern Department, formally transferred to the Corps of Engineers Buildings Nos. 12, 13, and 27.[88]

c. Engineers Lose Buildings Nos. 12 and 13

The transfer of these structures would provide sufficient additional space to enable the Engineers to dispense with certain wooden structures used for storage and shops. Captain Crawford accordingly recommended that Buildings Nos. 61, 64, 64-A, 65, 66, and 128 be razed. Building No. 61, he explained, was a three-story dwelling that, besides being vacant, was in very poor condition; Nos. 64, 64-A, and 65 were small frame sheds used for storage; No. 66 was a one-story frame blacksmith and carpenter shop; and No. 128 a two-story frame structure formerly housing the Engineer office. Such lumber as could be reused would be salvaged and the remainder burned.

Before demolishing these structures, Crawford proposed to relocate the blacksmith shop in Building No. 121; the

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86. Ibid., Nov. 19, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

87. Adj. Gen. to Commanding General, Eastern Dept., NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

88. Bullard to District Engineer, Feb. 13, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

carpenter shop in Building No. 122; the machine, plumber and paint shops, and garage in Building No. 122; the supplies stored in Buildings Nos. 64, 64-A, 65, and 122 into Buildings Nos. 12 and 13; and the office from Building No. 22 to No. 12.

The concentration of the shops in Building No. 122 would necessitate these alterations: (a) relocation of one rolling lift door from partition to end wall; (b) moving one window from end wall to side wall; (c) cutting small door in partition wall; (d) construction of a concrete ramp at end of structure for automobile entrance to garage; (e) erecting timber ceiling; and (f) installing work benches. The only changes proposed to Building No. 121 were to "sheath up the inside and erect a few racks for steel."

Captain Crawford estimated the cost of tearing down the six buildings at $1,000; moving and storing property at $400; and alterations to Buildings Nos. 121 and 122 at $600.[89]

Before the Chief Engineer could act on Crawford's request, several officers from Headquarters, Eastern Department, visited Sandy Hook, and discussed with personnel on-site a proposal to transfer Buildings Nos. 12 and 13 to the Motor Transport Corps for use as a motor pool. When he learned of this, Captain Crawford urged District Engineer Sanford to take up this subject with the Chief Engineer to insure that the department's interests were not being sacrificed.

Buildings Nos. 12 and 13 were jammed with supplies and stores being transferred by the Ordnance and Engineer departments as salvage. The stores consisted primarily of supplies removed from sheds scheduled for demolition.

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89. Crawford to District Engineer, March 8, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Building No. 122 still held some property, but it had been converted into shops. Preparations had been made to locate a garage in one end of the structure, so the Corps' motor transport could be kept under cover. Under no circumstances, Crawford cautioned, could Buildings Nos. 121 and 122 hold more than one-half the property now stored in Buildings Nos. 12 and 13.[90]

District Engineer Sanford met with Col. W. B. Wallace at the Eastern Department and learned that the rumor was correct. Proving Ground Buildings Nos. 12 and 13, together with Buildings Nos. 14 and 16, had been assigned to the Motor Transport Corps. Sanford was directed to order Captain Crawford to relinquish control of Buildings Nos. 12 and 13 and to remove the Engineer property therein with as little delay as possible to such other structures as he might select from among those at the proof battery (Buildings Nos. 38, 41, 42, 43, 45, 79, and 89).[91]

Colonel Sanford relayed these instructions to Captain Crawford. As soon as he had removed the stores from Buildings Nos. 12 and 13 to either Building No. 122 or elsewhere, he was to contact the Fort Hancock commander, advising him as to the date the Engineers would turn them over to the Motor Transport Corps.[92]

d. Engineers Secure a Second Reservation

This change in plans compelled the Engineers to reevaluate their demolition program. After checking the fabric, it was determined to retain Buildings Nos. 64, 65, 66, and 128. The status of

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90. Crawford to Sanford, April 10, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

91. Adj. Gen., Eastern Dept., April 24, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

92. Sanford to Crawford, April 28, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Buildings Nos. 61 and 64-A remained unchanged and they were razed for salvage.[93]

The removal of Engineer activities from Buildings Nos. 12 and 13 resulted in Captain Crawford employing proof battery Buildings Nos. 38, 39, 79, 89, and 100 for storage of equipment and supplies that were either surplus or seldom used. Buildings Nos. 38 and 79 were brick and afforded safe storage, while Buildings Nos. 89 and 100 were "well constructed wooden" structures and suitable for storage of non-inflammable material. The reason these former proof battery structures had been selected for dead storage was their remoteness from the Engineer Reservation.

All seldom used material stored in Building No. 123 would be transferred to Buildings Nos. 38, 39, 79, and 89. Supplies for which there were frequent calls in storage in Buildings Nos. 12 and 13 were to be shifted to Buildings Nos. 64, 65, 66, and 123. Before moving the property, Buildings Nos. 64, 65, and 66 were rehabilitated.

Property awaiting salvage was stored in Building No. 108, a wooden shack in fair condition, and Building No. 100.

The office would be relocated from Building No. 12 to Building No. 128, where it had been housed from the 1890s until the previous year.[94]

By June 30, 1920, all the gear had been removed from Buildings Nos. 12 and 13, and the next day they were transferred to the Motor Transport Corps.[95]

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93. Sanford to Adj. Gen., Eastern Dept., May 29, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

94. Crawford to Sanford, April 29, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

95. Sanford to Chief Engineer, July 28, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

By mid-June the Engineer office had been returned to Building No. 128. In the summer of 1919 Building No. 128 had been moved to the Engineer Reservation and positioned southwest of General Foreman Simpson's quarters. It had been placed on a temporary cedar post foundation, preparatory to converting it into quarters for the general foreman. When Building No. 126 was transferred from the Lighthouse Service and relocated, this project had been dropped and Building No. 128 listed for salvage. But wth the office again therein, District Engineer Sanford called for $2,365 to rehabilitate the structure and provide it with heat, water, and a sewer system.

To rehabilitate Building No. 122, which now housed the carpenter and machine shops, paint shop, and garage, would cost another $1,700. To remove the partitions from Building No. 79 and erect storage bins to receive property removed from Buildings Nos. 12 and 13 involved the expenditure of $360. To construct a lumber shed adjacent to Building No. 123 would cost $800. To repair and rehabilitate the old lumber shed (Building No. 64) as a heavy equipment storage area would cost $650. One hundred and eight dollars were needed to extend and complete railroad spurs near Buildings Nos. 79 and 89 to facilitate transfer of supplies from Buildings Nos. 12 and 13. To clean up the Engineer Reservation and rearrange material in open storage at the proof battery would necessitate the expenditure of $500.[96] The requested sums were allotted by the Chief Engineer and work commenced immediately.

Captain Crawford, however, questioned the desirability of the Corps accepting the entire proof battery area, because many of the structures were small and in poor condition. In addition, the entire area was covered with "shells, guns, projectiles, and debris," which would necessitate the expenditure of a considerable sum to remove and "place in respectable condition."[97]

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96. Ibid.

97. Crawford to Sanford, May 13, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

When Captain Crawford met with Colonel Brady, it was determined that the interest of both the post and Engineers would be served best by assigning a limited area to the Engineers. This would eliminate the necessity of removing the large quantity of property the garrison had stored in Buildings Nos. 40, 41, 42, 43, 47, etc., to make them available to the Engineers. Moreover, these structures were in very poor codition, and unless rehabilitated were unsuited for permanent storage.[98]

On May 26 General Bullard of the Eastern Department assigned to the Engineers the section of the former Proving Ground which included Buildings Nos. 36, 38, 39, 45, 46, 48, 79, 82, 88, 89, 91, 93, 98, 99, 100, 101, 108, 109, and 114. Five weeks later, Secretary of War Baker approved the transfer.[99]

The southern boundary of the new area for which the Engineers assumed responsibility was the line of concrete butts in rear of the proof battery, the western boundary the second railroad track west of the battery, with the reservation extending north and east of these lines to the ocean.[100]

e. Engineers Surrender Their Detached Reservation

On February 8, 1922, Major Carruth, Crawford's replacement, informed District Engineer Winslow that Buildings Nos. 64, 65, and 66 on the old Engineer Reservation had been repaired and supplies stored, making additional space available. Experience had demonstrated that the storage area at the proof battery was inconveniently situated in respect to Engineer activities and could not be

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98. Sanford to CO, Eastern Department, May 22, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

99. Chief of Staff, Eastern Department, to District Engineer, May 26, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

100. Carruth to C.O., Sandy Hook Defenses, Jan. 26, 1922, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

properly guarded. There had been two recent break-ins. This had caused Major Carruth to transfer all Engineer property stored in these buildings to the Engineer Reservation warehouses and Buildings Nos. 64-66.[101]

Colonel Winslow accordingly recommended to the Chief Engineer that the section of the Proving Ground transferred to the Corps in 1920 be "relinquished" to the commanding officer, Sandy Hook Defenses, as of March 1. Secretary of War John W. Weeks approved this proposal on March 23.[102]

6. Engineers Gain a Latrine

On July 7, 1922, Major Carruth asked the commanding officer of the Sandy Hook Defenses to transfer to the Engineers the small cantonment lavatory, near the northeast corner of the Engineer Reservation, for use of employees who were now required to use earth latrines. The troops had little use for this structure as the World War I cantonment buildings serviced by it had been torn down. Colonel Joseph B. Douglas agreed and approved the transfer.[103]

7. Engineers Lose a Storehouse

The Engineers lost a building in mid-August 1929, when fire destroyed a storehouse and the tidal gauge station on the submarine mine wharf.[104] The tidal gauge was promptly replaced.

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101. Carruth to Winslow, Feb. 8, 1922, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

102. Winslow to Chief Engineer, Feb. 10, 1922, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

103. Carruth to C.O., Sandy Hook Defenses, July 7, 1922, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. In October 1919 Captain Crawford's request for the lavatory's transfer had been vetoed.

104. District Engineer to Chief Engineer, Aug. 20, 1929, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

G. Corps and the Sandy Hook Roads

1. Road is Constructed in Rear of the Batteries

Building of roads for use by the troops was a function of the Quartermaster Department. The Corps of Engineers, however, was responsible for opening roads to support the construction activities. After the construction was completed and turned over to the garrison, the Quartermaster Department, if these roads were retained, assumed responsibility for their maintenance. Occasionally, these rules were altered by special circumstances, as was the case in 1907.

On July 30 a board was convened in New York City to review certain questions pertaining to the protection of the Sandy Hook batteries from attack by land. The board agreed that at the Hook construction of certain roads was essential to defend the batteries against this danger.[105] These roads were (a) from the secondary stations across the peninsula; (b) from the post water supply station southwest to Battery Arrowsmith; (c) in rear of the batteries from Morris to Richardson; and (d) across the Sandy Hook Proving Ground from Battery Engle to connect with the main post road near Battery Potter.

The board deemed the first two roads especially important, while the other two were to be built in time of peace, so the Coast Artillery "supports may maneuver quickly against any small landing parties attempting to attack the batteries from the rear." Without these roads, the dense underbrush and sand would make it difficult to redeploy artillery and machine guns from one side of the peninsula to the other.

When consulted, the Chief Quartermaster was agreeable to funding the road from the pumping plant to Battery Arrowsmith in the near future, and the road from the secondary stations across the peninsula in Fiscal Year 1909. The Chief of Ordnance was willing to open

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105. Duvall to Secretary of War, Aug. 13, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. William P. Duvall was a brigadier general and the Acting Chief of Staff.

the road from Battery Engle to Battery Potter, while the Chief Engineer was to fund construction of the road in rear of the batteries.[106]

That autumn the Corps of Engineers constructed the surfaced road in rear of the batteries. Eighteen feet in width, the road began behind Battery Morris and tied in with the post road network southwest of Battery Richardson. It was built of 6 inches of rolled stone with a one-inch stone dust surface.[107]

2. Concreting the Road South from the Post to the Reservation Boundary

Seven months after the United States entered World War I, the post commander began pressuring the District Engineer to surface with concrete the road linking Fort Hancock with Highland Beach. When General Bingham visited Sandy Hook, he saw that the road was of light construction. Until April 1917 traffic over this road had been minimal and the gravel had served its purpose. Since then traffic had increased, and the road was showing evidence of wear thorughout its length. General Bingham foresaw that the coming winter would accelerate its deterioration.[108]

Chief Engineer Black reminded General Bingham that construction of roads on military reservations was the responsibility of the Quartermaster General.[109] The Quartermaster Department accordingly

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106. Ibid.

107. Marshall to Chief Engineer, Sept. 4, 1907, and Harris to Marshall, Nov. 28, 1907, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. The cost of the road was: grading $300; broken stone, 800 cubic yards in place, $1,600, steamroller, with employees, 20 days, $500; curbing, 3" by 12", 4,000 feet, in place, $1,800; and contingencies, $400. Total cost of the project was $4,600.

108. Bingham to Chief Engineer, Nov. 22, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

109. Black to Bingham, Dec. 6, 1917, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

prepared plans and specifications for a concrete road from the south boundary of the reservation to connect with the post road system at the hospital. The roadway was to be 23,500 feet in length, with the straightways 15 feet wide and the curves 18 feet. It was to consist of one course of reinforced concrete, 8 inches at the crown and 6 inches at the shoulders.

In building the new road, the old roadway, consisting of clay and gravel, was removed, widened as required, and the concrete slab placed on a rolled sand base. The concrete consisted of a mixture of 1-1/4-inch grated crushed trap rock; clean, course sand; and Portland cement, mixed in a mechanical batch mixer. The concrete was 1 part cement, 1-1/2 parts sand, and 3 parts crushed stone mixture. The concrete road, when completed and opened to traffic in the summer of 1918, cost more than $75,000.[110]

H. Corps and the Reservation Railroad System

1. General Bingham Wins a Battle

During World War I General Bingham urged that the Engineers construct a standard gauge railroad to accommodate their activities. This could be accomplished by changing the 1890 narrow gauge railway from the Engineer wharf to the mortar battery to 4' 8" gauge. The existing gap in rail communications between the mortar battery and the standard gauge track connecting the Camp Low dock and Batteries Kingman and Mills would then be bridged by rails.[111]

When this proposal was referred to the Chief Engineer it encountered opposition. General Bingham was informed that policy dictated that when a construction project was completed railroads built for

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110. McLean to District Engineer, March 1, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Crushed stone for construction of the road was landed from scows at the Camp Low dock, while sand was dug from the bay side of Sandy Hook at the pit used the previous year for construction of Batteries Kingman and Mills. Three mixers were used.

111. Bingham to C.O., Sandy Hook Defenses, Aug. 1, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

its support by the Corps were turned over to the Quartermaster Department for operation and maintenance.[112]

General Bingham felt there should be exceptions to this policy. The basic mistake had been made many years before, when the Quartermaster General, instead of attending "to mules, forage, wagons and transportation, had been permitted to become the great construction corps of the Army." At Sandy Hook despite much opposition, the Engineers had finally succeeded in getting a tract set aside as their reservation. They were building storehouses and had been compelled by circumstances to construct standard gauge switches, etc., to secure access by rail to their reserve. All the while, the Quartermaster and Ordnance personnel were encroaching on both the reservation and the Engineer wharf. To finish Batteries Kingman and Mills and "go off quietly," leaving construction of the railroad to the Quartermaster Department, would be repeating an old mistake. To reverse this policy and to maintain control over present and future Engineer activities at Sandy Hook had led General Bingham to recommend construction of the railway.[113]

If the Engineers failed to follow through on his recommendation, General Bingham cautioned, it was "perfectly certain that in a few years you will have an Engineer reservation nicely arranged and with good facilities for Engineer work" throughout New York Harbor, but dependent for access on the "good nature" of Quartermaster and Ordnance officers.[114]

Bingham's arguments bore fruit. On November 16, five days after the Armistice put a stop to the fighting, Chief Engineer Black approved construction of storage tracks on the Engineer reservation,

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112. Winslow to Bingham, Oct. 13, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

113. Bingham to Winslow, Oct. 17, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

114. Ibid.

along with the necessary connections to the wharf and other tracks. For the time being, no funds were allotted for conversion to standard gauge of the narrow gauge track connecting the wharf with the mortar battery.[115]

On December 26 General Bingham advised the department that 5,300 feet of rail would be required for the reservation project. While at Sandy Hook on a recent visit, he had been told that some of the Ordnance Department railroad consisted of 67-pound rail, originally consigned for use in Russia.

Having learned that in testing the Hall-Scott and General Electric armored cars at the Hook that there had been a number of derailments, Bingham recommended that the Engineers employ 90-pound rail. This would be justified by the heavy service required on the Engineer wharf and reservation in handling armored cars, cars loaded with freight, and locomotive cranes, etc.[116]

Chief Engineer Black was agreeable to use of 90-pound rail. The 67-pound rail would be returned to the Russian mission.[117]

On January 2 General Bingham had requested and received permission to extend his standard gauge railroad to the site where the new shell storehouse was to be erected.[118]

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115. Winslow to Bingham, Nov. 16, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. The estimate submitted by Bingham had called for 5,650 feet of track, of which 3,300 feet would be involved in converting the narrow gauge railroad to standard.

116. Bingham to Chief Engineer, Dec. 26, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

117. Black to Bingham, Jan. 4, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

118. Bingham to Chief Engineer, Jan. 2, 1919, and Chief Engineer to Bingham, Jan. 9, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

2. Connecting the Mortar Battery with the Post Railway System

On October 25, 1919, with the 12 remaining mortars and carriages scheduled to be removed from Batteries McCook and Reynolds, Fort Hancock Commander Brady contacted the District Engineer. He asked that to facilitate this operation the narrow gauge railroad either be repaired or a standard gauge track be laid for a distance of 125 yards to connect the battery with the post railroad system.[119]

Colonel Crawford of the Second District Office rejected repair of the narrow gauge railroad in favor of construction of a connecting standard gauge spur. Although it would cost only about $200 to fix the two turntables at the mortar battery, the spur would be useful in contemplated projects at the battery, which included conversion of the bombproofs and galleries into switchboard and plotting rooms. Construction of the standard gauge spur would necessitate tearing down temporary barracks EE, cutting out a 25-foot section of the counterscarp, and laying 600 feet of track, at a cost of $1,500.[120]

Colonel Brady embraced Colonel Crawford's proposal, but District Engineer Langfitt had reservations.[121] He reminded Crawford that Chief Engineer Black had not approved construction of the switchboard room, while work on the plotting room was being held in abeyance.[122]

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119. Brady to District Engineer, Oct. 25, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

120. Crawford to Brady, Oct. 28, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

121. Brady to Crawford, Oct. 29, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

122. Langfitt to Crawford, Nov. 3, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Colonel Crawford, after briefing Langfitt on the route of the narrow gauge track,[123] pointed out that the available equipment for removing the mortars, carriages, and base rings consisted of 7 small narrow gauge flat cars. He questioned whether they were of sufficient size to do the job.[124]

Satisfied with Crawford's reply, the construction of the standard gauge spur was approved and necessary funds allotted. Construction of this spur made the narrow gauge railway connecting the mortar batteries with the Engineer wharf superfluous. The tracks were taken up and the rolling stock disposed of.

3. Engineers' Attempt to Secure Control of the Proving Ground Railroad is Rebuffed

Upon discontinuance of Proving Ground activities at Sandy Hook on August 1, 1919, control of the Ordnance railroad would be turned over to the Army Transportation Service. At that time an inventory of rolling stock on the reservation included:

Second District Engineers--3 saddle tank locomotives, 1 flat car, and 2 locomotive cranes.

Fort Hancock Quartermaster--1 combination passenger and baggage coach.

General Ordnance Supply Depot--2 40-ton saddle tank locomotives, 3 box cars, and 10 flat cars.

Sandy Hook Proving Ground--one 75-ton Forney-type locomotive, 1 50-ton Mogul-type switch engine, 2 Buda gasoline inspection cars, 6 dump cars, 4 flat cars, 2 workmen coaches (unserviceable),

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123. The tracks extended from the entrance to Battery Reynolds, past the entrance to Battery McCook, through a gate in the counterscarp, to the proximity of the detached magazine, south of Battery Gunnison.

124. Crawford to Langfitt, Nov. 5, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

1 passenger coach (unserviceable), 4 iron trucks for moving guns, 1 40-ton Industrial Works crane, 1 160-ton Bucyrus crane, 3 25-ton Industrial Works cranes, 4 30-ton Ohio Cranes, and 1 175-ton Industrial Works crane.

As the Proving Ground cranes and iron trucks were deemed integral parts of that facility, they would be sent to Aberdeen.

There were at that time approximately 22.7 miles of track on the military reservation. Of this, the Proving Ground held title to 61,200 feet, of which 37,000 feet constituted the main line between Highland Beach where it connected with the Central Railroad and the northern end of Sandy Hook. The Ordnance Depot controlled 39,272 feet of switches and sidings; the Engineers 7,113 feet of permanent track and about one mile of construction track; and the Quartermaster Department 7,340 feet of sidings and switches.

Other than Proving Ground facilities, the railroad served these warehouses:

General Ordnance Depot--50 corrugated iron magazines, 2 frame storehouses, and 48 fulminate tanks.
Engineer Department--2 large hollow tile storehouses, searchlights, generators, etc.
Quartermaster Department--3 temporary storehouses, 1 brick commissary storehouse, 3 brick storehouses, 1 frame storehouse, 1 icehouse, and 1 coalhouse.[125]

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125. Beckman to Beard, July 12, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Lt. Henry M. Beckman and Capt. Theodore H. Beard were officers in the U.S. Transportation Service.

Colonel Crawford, in view of this development, urged that steps be taken to assure the Engineer Department necessary transportation. The Corps' requirements, depending upon projects, would vary from year to year. In calendar year 1918 about 200 cars of freight had been received. Then there were the passenger needs. Currently, 40 employees were commuting daily from Highland Beach to the Engineer Reservation.[126]

Crawford urged that steps be initiated to secure 4 flat cars for hauling materials for storage and general construction, 1 box car as a movable storehouse, and 1 60-ton Vulcan locomotive.[127]

Chief Engineer Black, on reviewing the situation, recommended that the department assume responsibility for the reservation railroad system "as an adjunct" to its various activities. Cost of operation would be apportioned among the various departments in proportion to the service rendered.[128]

General Black's recommendation was vetoed. The post commander was directed "to take over all the acitivities in connection with the operation of the Sandy Hook Proving Ground railroad." He would make such "arrangements as will properly care for the activities of the Engineer and Ordnance Departments," for which they would be assessed proportionately.[129]

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126. Crawford to District Engineer, July 25, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

127. Ibid.

128. Black to Adj. Gen., Aug. 2, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

129. Hines to Adj. Gen., Aug. 4, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Brig. Gen. Frank T. Hines was Chief of Transportation Service.

4. Ordnance Depot is Closed but Some of its Tracks are Retained

Ordnance personnel in the spring of 1920 were turned to removing and salvaging the tracks from the deactivated Ordnance Depot grounds. Captain Crawford, on being apprised of what was happening, requested that the Ordnance people not remove the tracks used as a siding to permit north- and southbound trains to pass and spur "I". His reasons were threefold: (a) 60 or 70 tons of soft coal were stored on the siding and used to coal cranes and locomotives working at the south end of the reservation; (b) it was desirable as a sand track from which locomotive cranes and dump cars could readily secure sand from adjacent dunes for fill; and (c) it provided access to a small-arms target range.

The local Ordnance Department representative explained to Crawford that he believed no objection would be made to leaving the siding in position, provided trackage to replace it was furnished to the Savanna, Illinois, Proving Ground.[130]

The Ordnance Department was agreeable. The siding and spur "I" were left in position, when the other tracks were removed. To compensate the Ordnance personnel the Engineers shipped to the Savanna Proving Ground 25 kegs of railroad spikes and 3 kegs of track bolts.[131]

Within nine months, the Sandy Hook garrison received several thousand rounds of battle allowance ammunition. Hard-pressed to find storage for it, the Fort Hancock Quartermaster secured and relaid spur tracks "G," "H," and part of "J," and the projectiles were stored in the corrugated metal magazines fronting on them.[132]

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130. Crawford to District Engineer, June 21, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

131. Sanford to Chief Engineer, July 23, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

132. Winslow to Chief Engineer, April 28, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

5. Repairing the Railroad Servicing Batteries Kingman and Mills

In Fiscal Year 1925, $6,210 was allotted to repair the railroad tracks servicing the Batteries Kingman and Mills traverses. The only other access to these batteries was a wagon road that was not designed for heavy traffic.[133]

I. Recommendations

Most of the structures and facilities erected by the Corps of Engineers to support the construction and maintenance of the Sandy Hook Defenses have been dismantled or demolished. The few remaining Engineer structures are on the Coast Guard Reservation. These include the Engineer wharf (Structure No. 535), Locomotive House (Structure No. 503), General Foreman's Quarters (Structure No. 526), Assistant Engineer's Cottage (Structure No. 504), and latrine (Structure No. 52). All these, except the wharf, were on the 1918 Engineer Reservation. Since assuming jurisdiction over the former Engineer Reservation, the Coast Guard has razed four of the former Engineer structures--Nos. 501, 502, 505, and 506--all more than 50 years old.[134]

Because of the key role played by the Corps of Engineers at Sandy Hook and the intimate identification these few surviving structures had with this mission, they should be nominated for inclusion on the National Register of Historic Places.

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133. Ladue to Chief Engineer, Jan. 14, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

134. Under the old numbering system, these structures were identified:

Name of Structure	Old Number	New Number
Engineer Storehouse No. 1	122	501
Engineer Storehouse No. 2	123	506
Paint and Oil Storehouse		505
General Foreman's Quarters	126	526
Engineers' Office	128	500
Assistant Engineer's Cottage		504
Locomotive House		503

In the years between the submission of this report in 1976 and its publication in 1983, the U.S. Coast Guard demolished the Engineer Wharf. On its site, the Coast Guard has constructed a wharf to service its Sandy Hook facility. The new wharf's style and appearance are compatible with the structure that it replaced.

XVI. PROTECTING THE SITE: 1890-1930

A. Colonel Gillespie Constructs a Rubble Seawall to Protect the Northeast Beach

The area constituting the Sandy Hook Reservation had been created by sand migrating up the New Jersey shore. The Corps of Engineers, beginning in the late 1860s, had been involved in a continuous struggle to preserve the site of the masonry fort, the proof battery, and other governmental installations at the upper end of the Hook.

In February 1890 the Chief Engineer allotted $10,000 from the appropriation for Improving New York Harbor for site protection. Colonel Gillespie proposed to employ this sum to build a rubble seawall along the north shore of the Hook from jetty no. 4 to jetty no. 10.[1]

In Fiscal Year 1891 work began on this wall, and by November 1 some 5,784 tons of stone had been built into this structure at an average cost of $1.89 per ton. This seawall, Colonel Gillespie reported, had been "very beneficial" in protecting the high-water line of the north beach against further encroachments by the sea.

Encouraged by this success, Chief Engineer Casey on February 11, 1891, authorized Gillespie to extend the recently built rubble wall 375 feet to the southeast and 400 feet to the west. He would also strengthen the wall throughout with additional stone. This supplemental work would be charged against the appropriation for Improving New York Harbor, signed into law by President Benjamin Harrison on September 9, 1890.[2] This was accomplished in Fiscal Year 1892, about 12 months before the Dynamite Gun Battery was positioned in this area.

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1. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1890, NA, RG 77, Ltrs. Recd., Chief Engineer.

2. Gillespie to Chief Engineer, Annual Report of Operations at Fort at Sandy Hook for Fiscal Year 1891, NA, RG 77, Ltrs. Recd., Chief Engineer.

B. Battling the Sea in the First Years of the Twentieth Century

1. McNeal Builds a Riprap Wall to Shield the Hook

During the 1890s the focus of the fight against the sea shifted southward to the narrow neck connecting Sandy Hook with the Jersey shore. A violent nor'easter in the winter of 1896-97 broke through the narrow spit separating the Atlantic and the Shrewsbury River. Sand bars soon obstructed the channel of the Shrewsbury, while swirling tides threatened to destroy the trestle over which the Ordnance railroad passed.

Congress, in accordance with a request by the War Department, on March 3, 1897, appropriated $75,000 "for construction of a riprap wall for protection of the eastern beach of United States lands at Sandy Hook," and closing the breach, which at flood tide was 2,700 feet across.

On July 25 Colonel Ludlow advertised for proposals for positioning a seawall of riprap. The low bidder was Frank W. McNeal. For $1.19 per ton he would position 47,500 tons of riprap. A contract was signed with McNeal by Colonel Ludlow, which was approved by the Chief Engineer on October 25.

McNeal put his men to work on November 19 and completed his contract on June 1, 1898. To properly finish the project, it was found that another 12,000 tons of riprap were required. An open market agreement was made by Colonel Ludlow with McNeal for delivery and depositing this amount of stone.[3] By September McNeal had placed the last of the additional 12,000 tons of stone in the riprap wall.[4] McNeal's seawall was three feet wide on top, with a slope of one to one. The railroad trestle was so close to the western edge of the riprap that the stones were lodged against the pilings.

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3. Executive Documents, Ser. 3746, pp. 632-33.

4. Executive Documents, Ser. 3905, p. 780.

In 1901 it was reported by Ordnance personnel that the surf was beginning to undermine the riprap. An investigation revealed that, although three years had passed, it was in "fair condition." It had settled up to 2 feet in places, with many large voids, as a result of the various size stones used. Considerable quantities of sand had accumulated so that instead of a maximum depth of 12 to 13 feet at high tide, the greatest depth over the sand was little more than 4 feet at flood tide, while the average depth for the 2,700 feet would not exceed one foot.

There were three sections of McNeal's seawall, each about 400 feet in length, where the sand on the outside of the riprap was below flood tide. In these sections the surf crashed through large interstices between the stone where the water had "cut out troughs under the railroad trestle" to a depth of several feet. At the most northerly of these, the Quartermaster Department was erecting six pile jetties, about 150 feet apart and extending outward into the surf about 100 feet. These were to be covered with a double row of creosoted sheet piling.

The most economical method of preventing a new breach, Assistant Engineer Henry N. Babcock reported, was to reinforce McNeal's seawall, raising it where it was too low and employing smaller stone on the wall's interior slope. Involved would be about 3,500 tons of stone, including those the Quartermaster personnel were about to place. Depending on the action of the sea, this work would have to be repeated at one- to five-year intervals.[5]

If, however, a permanent remedy was desired, a $75,000 appropriation was required. With this sum, the seawall would be converted into a barricade--about 8 feet above flood tide with a 8-foot width at the top. Such a structure could also serve as a causeway for the railroad.

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5. Babcock to Marshall, Sept. 26, 1901, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

After the appropriation was made, it was found that sufficient sand had accumulated to make the riprap wall secure, with "a fairly deep foundation" which would require a large amount of excavation. The beach itself was becoming broader and higher. In addition, the Ordnance Department proposed to realign its track by relocating it upon a trestle some distance west of the seawall. This made it expedient for the Corps of Engineers to defer its project until the new trestle was built. Then, the old one could be used exclusively for construction work, without interfering with railroad traffic.[6]

2. Protecting the Dynamite Gun Battery Site in 1901

Meanwhile, the struggle to preserve the site had shifted back to the beach between jetty no. 11 and the northwest extremity of the Hook. In Fiscal Year 1901 the Chief Engineer allotted $2,000 for shielding that section of the shore with a seawall. The barrier would be extended westward "about on the high-water line for a distance of 450 feet . . . to protect the shore along and near the front slopes of the dynamite-gun battery." By June 30, 1901, 157 linear feet of wall had been built. Stone for the project was purchased by contract, and the work done by hired labor supervised by Major Marshall.[7] The project was completed in August 1901 at a cost of $2,975.44. It consisted of a 480-foot seawall on the north shore, with a jetty built near the Dynamite Gun Battery.[8]

3. Brown & Fleming Reinforce the Riprap Seawall

The Sundry Civil Appropriations Act, signed into law by President Roosevelt on March 3, 1905, provided another $40,000 for construction of a seawall for "protection of the northern beach of the United States lands at Sandy Hook." To date, Colonel Marshall reminded

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6. Marshall to Mackenzie, Aug. 2, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

7. Executive Documents, Ser. 4279, p. 768.

8. Executive Documents, Ser. 4444, p. 692.

Chief Engineer Mackenzie, there was no comprehensive scheme to protect the northeast shore of the Hook. Heretofore, several abbreviated barriers had been constructed as stopgap measures from general appropriations.

The estimate upon which the $40,000 had been voted had resulted from his report of the serious erosions caused by storms during the previous winter. To prevent the seas from breaching the Hook, Colonel Marshall proposed to build a stone seawall along the north beach, near the flood tide line, leaving a narrow opening at the east end through which to pass cables from the mining casemate. Spurs would extend out from the wall to the ebb tide line at 250-yard intervals. The wall was to be built by hired labor, employing in part stone from the foundations and walls of the 1860s fort. Should it become necessary, additional stone would be purchased under contract.

Construction would begin near the former Dynamite Battery and extend westward to cover all the beach threatened by erosion; thus, it would extend nearly to the west point of the Hook. Work would commence as soon as the appropriation became available.[9]

Chief Engineer Mackenzie approved the project, as proposed, on March 30. But, before Colonel Marshall could implement this decision, the fight to preserve the site again focused on the neck.

By 1905 the railroad had been relocated, where it crossed the spit, and the old trestle and right-of-way were left in position. The situation being favorable, Colonel Marshall called for an allotment of $75,000 from the Fortifications Act, approved June 6, 1902, "for the construction of a riprap or stone wall and causeway for the protection of the eastern beach of the United States lands at Sandy Hook, New Jersey, and the Government railroad thereon."

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9. Marshall to Mackenzie, March 28, 1905, NA, RG 77, Press Copies, Ltrs. Sent, New York Defense.

Although there was no existing emergency requiring expenditure of the appropriation, Colonel Marshall believed that now was the time to construct the permanent wall, because it would be more economical to do so before the old trestle deteriorated. In addition, the Fort Hancock commander had proposed building a wagon road along the beach west of McNeal's riprap and desired a more substantial wall to shield his road during storms.

If he could have foreseen in 1901 the present condition of the beach, Colonel Marshall explained, he would not have submitted such a high estimate for repair of the seawall. But to defer further such work as was necessary or advantageous to strengthen the seawall would be to assume a responsibility for the effects of future storms which he could not justify.

With the department's concurrence, he would solicit proposals from the lowest responsible contractors for "supplying and placing riprap stone upon the wall, laying them with care so as to make the voids as small as possible." It was estimated that from 25,000 to 30,000 tons of stone could be placed with advantage.[10]

Chief Engineer Mackenzie, on assessing the priorities, determined to employ all available funds in both appropriations to reinforce McNeal's riprap wall protecting the neck at the south end of the reservation.[11]

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10. Marshall to Mackenzie, Aug. 2, 1905, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock. Cross-sections of the beach taken at frequent intervals by the Corps showed that its general width was from 150 to 250 feet, with heights from 5 to 10 feet above ebb tide. Occasionally, after storms, the beach frontage shrank, but it soon recovered and continued to slowly build up.

11. Marshall to Mackenzie, Feb. 13, 1906, NA, RG 77, Press Copies Ltrs. Sent, Fort Hancock.

In October, Colonel Marshall called for proposals for furnishing riprap and enlarging McNeal's seawall. Brown & Fleming, whose bid of $1.75 per ton was low, was awarded the contract.

Work commenced immediately. Although good progress was made, Brown & Fleming was compelled to ask for an extension. Satisfied of its good intentions, the extension was granted by Chief Engineer Mackenzie.[12]

When the contractors finished positioning 34,132 tons of stone, the seawall extended 4,510 feet north from station no. 1 at the south end of the reservation. Between stations nos. 1,080 and 4,300, where it closely paralleled the old trestle, the wall was built 18 to 22 feet wide on top and 16 feet above mean low-water.

Even so, storms during the winter of 1907-08 sent surf sweeping across the neck, washing out at three places the recently completed wagon road. These cuts averaged 10 feet in width and 5 feet in depth. They were repaired by troops from the post. This, however, was only a stopgap measure, because the riprap wall afforded insufficient protection.

There were several places along the 16-foot wall, where only two or three stones protruded above the sand. At other points, during storms, water cascaded through interstices in the riprap, and washed across the narrow isthmus. The Quartermaster General called this situation to the Chief Engineer's attention.[13]

Inspecting the riprap wall, Colonel Marshall found that from stations nos. 1 to 1,080 the wall had suffered no damage from the

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12. Brown & Fleming to Marshall, June 5, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

13. Post Quartermaster to Quartermaster General, Dec. 26, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

battering. Between stations nos. 1,080 and 2,100 the top of the wall was only 2 feet above the old trestle, with no notable width. From station no. 2,100 to station no. 3,100 the top of the wall and trestle coincided with a width of 3 to 4 feet. Less than three years before, the wall had stood 2-1/2 feet above the trestle. Between stations nos. 3,100 and 3,600, the wall was in better condition, averaging 3 feet higher than the trestle, with a top width of 6 to 8 feet. From station no. 3,600 to station no. 3,900, the wall was in good condition. North of the latter station, the beach widened to 400 feet at flood tide. Above station no. 4,300, stones had been laid along the railroad track but did not form a continuous or regular wall. North of station no. 3,600, the sea had washed over the beach and had cut away the clay wagon road bed in places and in other areas had undermined the railroad grade.[14]

Marshall estimated that repair of the seawall would require about 18,000 tons of stone and cost $40,000. To protect the railroad north of the seawall, a plank fence 5 feet in height would be built of 2-inch planking, driven 3 feet into the sand. The base of the fence was to be covered with brush facines, wired together.[15]

No funds were forthcoming from Congress for preservation of the site at this time.

C. Engineers Request and Receive More than $500,000 Dollars

1. Colonel Black Outlines a Plan

The 1905 decision to employ all available resources in reinforcing McNeal's riprap wall had momentary repercussions. A storm on January 14, 1906, seriously damaged the Dynamite Gun Battery parapet. As the parapet, besides affording cover to the new mining casemate, supported the 36-inch searchlight, it was repaired with a reinforced wall of concrete. No effort could be made at this time to

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14. Marshall to Mackenzie, Feb. 26, 1908, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

15. Ibid.

strengthen the seawall protecting the northeast shore of Sandy Hook because of commitments elsewhere.[16]

The calculated risk, however, proved successful. But, by the autumn of 1914, the sea was again seriously encroaching on the northeast beaches. Unless something was done to curb this threat, winter storms would again damage the exterior slope of the old Dynamite Gun Battery.

In the winter of 1914-15 Col. William M. Black, soon to become Chief Engineer, visited the area and saw that recent storms had "materially" damaged the "beach protection works," not only at the south end of the Sandy Hook Reservation, but also along the beach to a point below Seabright, causing great loss of private property. The channel of the Shrewsbury River had been obstructed by sand bars. Unless massive action was taken, Colonel Black forecast, there would be "a recurrence of the old breaches of the Shrewsbury River" through the spit to the sea.

At the south end of the reservation, Black saw that the seawall had been seriously damaged south of station no. 93 and needed repair. Surf driven over low points in the wall by howling gales had rolled across the narrow spit from the ocean to the Shrewsbury, washing out the roadway south of station no. 93.[17]

Repair of the damage and implementation of measures against its repetition called for a massive joint-effort by local, state, and federal agencies. On the federal level, this would involve the Corps of Engineers, the Ordnance Department, and the Quartermaster Department. Arrangements had already been perfected between Colonel Abbot and local

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16. Ibid., Feb. 13, 1906, NA, RG 77, Press Copies, Ltrs. Sent, Fort Hancock.

17. Black to Dept. Quartermaster, Jan. 23, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

and state governments for uniting available funds for reopening the Shrewsbury to navigation. At Colonel Black's suggestion, it was decided by the concerned War Department agencies to pool their limited funds, and place Colonel Abbot in charge of the work pertaining to Sandy Hook.

On the reservation these projects would be given priority: (a) repair of the seawall; (b) if feasible a solid fill would be made between the railroad trestle and the riprap, with a slope toward the wall to stop drainage across the neck; and (c) atop this fill should be placed the railroad and highway. The fill could be "cheaply made by hydraulic pipe line dredging in the mouth of the Shrewsbury."[18] Meanwhile, the Quartermaster Department would temporarily repair the washed out roadway.[19]

Colonel Black's plan was approved, and Colonel Abbot was directed to prepare a comprehensive project for protection of the eastern shore of Sandy Hook south to Seabright against the sea. In accepting this assignment, Colonel Abbot promised to submit his estimates as soon as possible. There was $13,509 available for the undertaking.[20]

2. Colonel Abbot Repairs the Wall Fronting the Old Dynamite Gun Battery

The sea was again threatening to breach the Hook near the Dynamite Gun Battery. In August 1914 Colonel Roessler had reported that the seawall shielding this area had sunk for a distance of 450 feet, and it was five feet lower than sections of wall adjoining it to the east and west.[21]

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18. Ibid.

19. Ibid.

20. Abbot to Chief Engineer, March 19, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

21. Roessler to Chief Engineer, Aug. 14, 1914, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

No repair work was undertaken, and a winter's storm cut away part of the slope in front of the 36-inch searchlight. To repair the breach would necessitate overhauling the "plant railroad" and extending the track to the work site. Dunes, beach erosions, and accretions would require some relocation of track.

Colonel Abbot, in closing the breach, would put in a spur jetty midway between the existing spurs. It would, he hoped, prevent this section of the seawall from again being undercut.

This project would be undertaken in conjunction with removal of the 1874-1901 proof battery. Stone and concrete salvaged from these platforms would be used in repair of the seawall, which Colonel Abbot estimated would cost $7,000.[22]

The requested funds were made available on July 23.[23] By mid-September 1915, with the project under way, Colonel Abbot reported that it was impossible to determine whether it could be accomplished for less than the sum allotted, because he could not learn how much riprap could be secured from the old proof battery platforms. So far, the work had consisted of repairs to and extension of the railroad to the site and getting out stone.[24]

The project was slowed and costs zoomed as "unexpected settlement" caused the rebuilt section of wall to sink 2 feet below high-water. Recent surveys also revealed that 200 feet of adjacent riprap had settled to a similar degree. The cost of raising the wall (both old and new portions) to the planned height was placed at $400.

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22. Abbot to Chief Engineer, June 4, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

23. Winslow to Abbot, July 23, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

24. Abbot to Chief Engineer, Sept. 18, 1915, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

This sum was made available, and by winter the project was completed and the plant removed.[25]

3. Engineers Turn Back a Threat to the West Beach

Meanwhile, Colonel Abbot's attention had been called to a new danger point. On May 31, 1916, Colonel Skerrett, the post commander, reported that the shore line, beginning about 100 yards south of the Fort Hancock wharf and extending southward an equal distance, was caving rapidly. The bank had advanced to within 5 feet of the concrete walkway, where it turned north, opposite the Sandy Hook Coast Guard Station.

Colonel Skerrett asked that measures be taken to stop this erosion with either a seawall or by filling. Otherwise, he warned, the caving would soon reach the walk and the nearby roadway.[26]

Colonel Abbot, on visiting the site, found that the erosion was caused by pounding waves during nor'westers. In addition to the threat to the walk and road, the line carrying cable for lighting the supplementary stations was threatened.[27]

To protect the beach and preserve these communications would necessitate extending the riprap wall northward 105 feet to the line of piles at the approach to the wharf. A riprap wall, with a 14-foot base and 6 feet in height, could be built for $400 with stone from the old fort.

This expenditure was approved by the Chief Engineer. Like the work on repair of the breach in the wall fronting the old

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25. Ibid., Sept. 11, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

26. Skerrett to Abbot, May 31, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

27. Abbot to Chief Engineer, June 17, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Dynamite Gun Battery, it was done by day labor, supervised by Captain Andery of the Corps of Engineers.[28]

4. Congress Makes an Appropriation and Plans are Approved

a. General Abbot's Testimony

The comprehensive plan prepared by Colonel Abbot called for $678,250 to secure the spit. When the House Military Affairs Committee was considering this request in 1918, one of the witnesses was Abbot, who was now a brigadier general and assigned to the Chief Engineer's Office. When questioned about the need for such a large appropriation for this work, Abbot explained that it was necessary for maintaining rail and road connections with Sandy Hook. And, he added, the only way it could be held was by "main force and considerable stone." The proposed improvements, he told the Congressmen, would consist of a heavy walk of large riprap and some wooden groins in front to retrain what sand there was, and sand filling behind the wall to reinforce and support. A 30-foot apron would be positioned over the surface of the fill in rear of the wall so that surf driving over the riprap would not wash away the fill. The wall, which would be about 5,000 feet in length, Abbot was willing to guarantee for 10 years.

The railroad paralleling the coast, although the Proving Ground at Sandy Hook was being phased out, was an important increment to the Sandy Hook defenses. Plans called for deployment of heavy movable guns to repell an amphibious attack on the New Jersey coast south of the Highlands.[29]

b. Storms Force the Army to Take Emergency Action

The sea meanwhile had continued to pound away at the spit. A storm on October 24, 1917, caused heavy damage to the

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28. Ibid., June 22, 1916, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

29. "Extract of General Abbot's Testimony in Support of Fortifications Appropriation Bill, 1919," found with Ltr., Bingham to Abbot, Jan. 18, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

beach as waves swept over "the longitudinal riprap wall falling upon the sand inside and scooping up and loosening it for a distance of a mile north and south, producing disturbances and currents which finally broke through at one or two points into the Shrewsbury River." The scouring effect of the surf coming over the wall left a hollow extending north-south for about one mile.

To reinforce the longitudinal wall, General Bingham (Abbot's successor as District Engineer) urged that the hollow be filled with hydraulic fill pumped from the Shrewsbury. This would be followed by riprapping the inner side of the seawall. To be successful, however, the fill and riprap should be preceded by construction of a longitudinal bulkhead, shielding the shore side of the railroad embankment. At right angles to this longitudinal bulkhead, and about 100 feet apart, would be positioned perpendicular bulkheads to divide the space between the present seawall and the railroad track and wagon road into boxes.

At the same time, the riprap wall as built by McNeal and reinforced by Brown & Fleming would be extended and reinforced. It should be maintained at a height of 20 feet above mean low-water, with a stone apron at its foot not less than 25 wide.[30]

In 1918 storms compelled the Ordnance Department, while waiting for Congress to fund the Engineers' program, to take emergency measures to protect railway and road communications. Erosion of the breach north of the McNeal seawall had become a serious problem.

With approval of the Chief Engineer, Ordnance personnel raised an "extemporaneous" rubble wall to check the relentless advance of the sea at this point. In the spring of 1919 the commander of the Proving Ground urged the Engineers to extend their rubble wall

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30. Bingham to Chief Engineer, March 8, 1918, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

northward several hundred yards and construct a 100-yard stone groin at its northern terminus.

This recommendation was founded on the observation that the erosion resulted from strong and persistent southeast winds and currents. The groin, it was believed, would deflect these currents away from the shore line farther north.[31]

In addition to the railway and road, the magazines and tracks constructed north of the Spermaceti Coast Guard Station by the Ordnance Department in 1918 for storage of explosives would be endangered unless the erosion was checked.[32]

In 1918 the Corps of Engineers expended $50,000 in emergency funds to reinforce 800 feet of wall north of the old trestle. Riprap was placed upon the old wall, which had been flattened out and battered down. The height of this section was raised to 19 feet above mean low-water and given a width of 12 feet on top.[33]

Meanwhile President Wilson had signed into law the Fortifications Bill for Fiscal Year 1919, which included $544,000 for protection of the Sandy Hook shore.[34]

c) Colonel Roessler Submits a Proposal

Colonel Roessler, who had been recalled to active duty during World War I, was assigned to prepare the project for expenditure of the $544,000. An Engineers' board in 1918, after an

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31. C. O., Sandy Hook PG, to District Engineer, May 3, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

32. Ibid.

33. Roessler to Chief Engineer, May 19, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

34. Winslow to Chief Engineer, March 4, 1919, NA, RG 77, Ltrs. Sent & Recd, Fort Hancock.

exhaustive study, had concluded that the extant wall should be enlarged to a height of 20 feet above mean low-water with a top width of 15 feet and with a slope on the oceanside of 1 to 1-1/2 and on the landside of 1 to 1.

The height established for the wall was governed by two factors--that first it be high enough to prevent a breach, and second to keep surf from going over it in storms and washing out the railway and road as had been "repeatedly done in the past."

It was estimated that it would require 120,000 tons of stone to raise the wall from the south boundary of the reservation north as far as the work being done by the Ordnance Department. At $4 a ton, the contract would cost not less than $480,000. Allowing $20,000 for contingencies, there would be a reserve of $44,000 out of the appropriation to meet emergencies.

No allowance was made in Roessler's estimate for construction of groins. In the past groins had been employed, but, in Colonel Roessler's view, they had been of "insufficient length" and too far apart to be of much value. For the same reason he opposed construction of the jetty called for by the Ordnance personnel. It would be difficult to maintain and the money it would cost could be employed more advantageously to continue the longitudinal riprap wall northward.[35]

General Bingham, however, remained convinced that his bulkhead method was the answer to the problem. But, as he had confidence in Colonel Roessler's judgment and was about to retire, he forwarded the project for final decision by the department.[36]

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35. Roessler to Chief Engineer, May 19, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

36. Bingham to Chief Engineer, May 21, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

d. Roessler's Proposal is Amended and Approved

The Chief Engineer approved Roessler's plan subject to several changes. The section of the breakwater to be extended north of its present terminus was to have a sheet piling core, driven to a minimum depth of 30 feet and reinforced with concrete, steel, or creosoted timbers "at the option of the District Engineer." This sheet piling core was to prevent the washing out of sand seaward by the backlash of the waves.

In addition, there was to be a sand-filled sheet piling crib positioned 100 feet west of and parallel to the breakwater from the vicinity of the tower northward. The space between the breakwater and bulkhead would be divided by "cross-connections of sheet piling at 200-foot intervals." This, it was hoped, would prevent the surf, which came over the wall during storms, from sweeping across the spit into the Shrewsbury River and washing out communication lines.[37]

Colonel Roessler revised the project to include a "timber sheet piling core" in the northward extension of the riprap wall. Lack of funds, however, precluded inclusion in the plan of construction of sheet piling cribs with "cross connections back of the new wall."[38]

D. South Reservation Wall is Reconstructed and Extended

1. Jesse Howland Contracts to Build the Seawall

The concurrence of the Chief Engineer and General Bingham secured, the project was advertised. On opening and abstracting the proposals on August 27, 1919, it was determined by Col. W. C. Langfitt, who had relieved General Bingham, that Jesse Howland's bid was low. Howland's price for furnishing, delivering, and placing about 120,000 long tons of riprap stone was $3.98 per long ton, and for

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37. Sherrill to Bingham, May 29, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Col. C. O. Sherrill was assigned to the Chief Engineer's Office.

38. Roessler to Chief Engineer, June 7, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

furnishing materials and building about 1,500 linear feet of timber sheet piling $12 per linear foot. This made his price $495,600, which would insure completion of the operation, with enough left over to meet emergencies and any change orders that might be written.[39]

The Chief Engineer approved the acceptance of the Howland proposal, and on September 17, 1919, the contract was signed for repairing and extending the existing seawall near the southern boundary of the Sandy Hook Reservation.[40]

2. Wall is Built Despite Manifold Problems

A number of unlooked-for problems harassed the Howland workmen. Early in November coal consigned to the project was seized by the U.S. Government in accordance with the embargo imposed by the U.S. Railroad and Fuel Administration. At this time there was only two weeks' supply of coal at the quarry. To conserve fuel, the contractor slashed operating hours at the quarry by one-half. It was the end of November before the Engineer Department was able to get two car loads of coal released for use at the quarry. By February 11, 1920, this coal was nearly exhausted, and it was the end of the month before the Corps of Engineers could get more coal.

The coal shortage had also caused difficulties on-site. On November 4 the Railroad and Fuel Administration seized a car load of coal at Highlands. Howland thereupon closed down one-half his plant and furloughed 50 percent of his labor force. On November 13 a car of coal was delivered at Highlands and Howland recalled his hands.[41]

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39. Langfitt to Chief Engineer, Sept. 3, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

40. Langfitt to Howland, Sept. 15, 1919, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Jesse Howland's firm was headquartered at Seabright, New Jersey.

41. Mayhew to District Engineer, March 3, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. C. D. Mayhew was an assistant engineer with the Second District office.

On February 4, 1920, there was a savage nor'easter which sent the sea sweeping over the wall along a 5,900-foot front. By this date, Howland workmen had raised much of the wall to the desired height, but at no place had the riprap been built to its required width. The contractor's plant and coal, as well as the right-of-way of the Sandy Hook and Central Railroad, were sheeted with ice and snow.

North of the 5,900-foot station, where there was no seawall, the situation was worse. The surf surged across the new concrete road and eroded the beach front opposite the target butts.[42]

Contractor Howland had his men back on the job on the 9th, clearing away ice and snow and placing riprap. He, however, was hindered by failure of the Central Railroad to clear its right-of-way, which was blocked by 15-foot drifts.[43] It was the 13th before trains were again operating over the Central Railroad. Three more working days were lost by the contractor during February because of storms.[44]

A strike by employees of the Central Railroad, lasting from April 13 to 17, stopped all movement of cars from the quarry, at Hibernia, New Jersey, to Highlands.[45] More delays were traceable to emergency orders of the U.S. Interstate Commerce Commission, which took effect on June 21, 1920, and continued in force for 90 days. The purpose of these orders was to divert all possible empty coal cars to the mines for transporting coal. Instead of the anticipated 7 or 8 cars daily received on-site from the quarry, only 3 or 4 arrived. During this

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42. Styles to District Engineer, Feb. 5, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Harry Styles was the government inspector on the project.

43. Ibid., Feb. 9, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

44. Mayhew to District Engineer, March 3, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

45. Ibid.

3-month period, Howland's plant was limited to about two-thirds capacity.[46]

On August 25 the contractor encountered another type of problem. The Central Railroad notified him that it was increasing its price for hauling stone, which had been $1.20 per short ton, by 40 percent. To enable him to seek relief by an appeal to the New Jersey Board of Utility Commissioners, Howland asked the Corps of Engineers to permit him to suspend construction until the next hearing of the board on October 27.[47]

In recommending approval of the suspension, the District Engineer, on October 25, pointed out that as of October 15, 79 percent of the stone required under the contract had been positioned. Howland, despite delays caused by weather, strikes, and governmental regulations, was nearly on schedule. The entire length of the old wall had been raised, widened, and strengthened, while the new wall had been extended 500 feet.[48]

The Chief Engineer was agreeable. Work stopped for several days, while the Board of Utility Commissioners mediated the dispute.

His contract called for Howland to have the 120,000 tons of stone placed by March 7, 1921. In view of his difficulties and good

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46. Ibid.

47. Howland to Sanford, Oct. 16, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

48. Snell to Chief Engineer, Oct. 25, 1920, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Howland's schedule called for him to position 5,000 tons the first two months and 8,000 tons per month thereafter.

workmanship, it was determined by the Corps to grant a 76-day extension to May 22.[49] This enabled Howland to successfully fulfill his contract.

3. Series of Storms Test Howland's Wall

A nor'easter, with 70-mile-an-hour winds, tested Howland's wall on January 11, 1922. When Major Carruth inspected the riprap, he saw that from station no. 0 to no. 30 the wall had suffered no damages. Between stations nos. 31 and 42, a distance of 1,100 feet, the wall had been injured. This included a settling of the interior slope between stations nos. 31 and 36, and from stations nos. 37 to 43 and erosion of the superior slope. North of station no. 43 to its northern terminus, the seawall was in good condition and up to grade. At the northern end of the wall, there was about 600 feet of rock fill which had not been chinked up to the finished grade. At the height of the storm, surf in the form of spray had been thrown over the low section of the wall, between stations nos. 41 and 43, but nowhere else.[50]

A second storm hammered the Jersey coast on January 28-30. Major Carruth found additional damage between stations nos. 39 and 43. The rock fill, loosely piled, north of the finished wall had been battered.[51]

E. Fight Against the Sea Returns to the Northeast Beach

1. The 1926 Work

For a number of years, until 1922, the northeast beach on the Hook had been building up until it was 500 feet in front of the 1890-91 seawall. Beginning in June 1922 this phenomenon had been reversed, and by October 1925 this beach had closed to within 325 feet of

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49. Mayhew to District Engineer, March 3, 1921, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

50. Carruth to District Engineer, Jan. 12, 1922, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

51. Ibid., Jan. 31, 1922, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

the wall and was eroding at the rate of more than 30 feet per month. The erosion of the northeast breach was accompanied by a slight accretion to the southwest beach and a continued westward migration of the point of the Hook.[52]

On July 13, at the west end of the seawall near the abandoned derrick, the shore line had sloped gradually out to a sunken barge. Within less than two months, this had become a vertical drop of 9 feet at the old shore line, and the fire-control cable to Fort Tilden was exposed. Fears were voiced that the next nor'easter would sever the point of the Hook.[53]

A November nor'easter eroded the bank 15 feet nearer Searchlight No. 5. Capt. F. Russell Lyons, on inspecting the site, warned that a nor'wester, at high tide, might break through the low spot in the dunes toward the light. As an emergency measure, he had the low spot barricaded with sandbags.[54]

To protect the beach and check the erosion, District Engineer Ladue formulated a project. A 350-foot timber bulkhead, costing $6,667 for materials and labor, would be built. If the value of the defense components (the old supplementary station building housing Searchlight No. 5 and ducts) were deemed insufficient to justify this expense, they would have to be relocated.[55]

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52. Lyons to District Engineer, Oct. 24, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Capt. F. Russell, Lyons was attached to the District Engineer's office.

53. Ibid., Sept. 7, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

54. Ibid., Dec. 5, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. The barge, which had partially shielded this beach, had broken up on November 4.

55. Ladue to Chief Engineer, Dec. 9, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Chief of Coast Artillery Coe considered the retention of Searchlight No. 5 in its present location necessary and asked that construction of the bulkhead be given high priority.[56] Necessary funds were allotted, and District Engineer Ladue on January 21, 1926, directed Captain Lyons to proceed with the project.[57] By late April work had progressed to a point where another $970 was allotted to complete the undertaking.[58]

2. Emergency Repairs of 1929

Three years later, in March 1929, the post engineer was authorized to spend not more than $500 for emergency repair of the inshore end of the bulkhead and positioning broken concrete at points along the Hook's northeast shore. Winter storms had eroded the beach at these points. The repairs were made.[59]

F. February 1927 Storm Generates Another Study

1. The Storm

A severe storm on February 19-20, 1927, accompanied by record high tides, caused heavy damage to the Jersey Coast. Opposite the Batteries Kingman and Mills secondary station the surf cut out the sand banks at the shore end of three of the timber groins positioned by the Ordnance Department in World War I.[60]

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56. Jones to Chief Engineer, Dec. 18, 1925, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock. Maj. Clifford Jones was an assistant to the Chief of Coast Artillery.

57. Ladue to Lyons, Jan. 21, 1926, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

58. Ibid., May 1, 1926, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

59. District Engineer to Lane, March 26, 1929, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

60. Perry to Chief Engineer, May 1, 1927, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

2. Perry Report

As a result of this storm, Maj. C. R. Perry of the Corps of Engineers undertook a comprehensve study and report on the beach erosion and protective measures of the past 57 years. The point of the Hook, he found, in the period 1871-97 had by accretion of sand migrated westward 2,500 feet. During the same years the beach fronting the Dynamite Gun Battery had been cut back about 500 feet. To arrest the advance of the ocean, a seawall had been constructed to shield this shore in 1890-91 and was reinforced on several occasions. In 1926 a bulkhead had been erected to check beach erosion threatening Searchlight No. 5. This had led to a filling in of the outer bar from a point opposite the Dynamite Gun Battery to near the supplementary stations, a distance of 1,400 feet.[61]

In the area from the extremity of the Hook to a point opposite Battery Gunnison, Major Perry found that in recent years storms had washed out sand, but that favorable winds soon restored it, and there had been no "detrimental progressive change in recent surveys."

South of the Sandy Hook Light, the shore, between 1897 and 1926, had eroded a distance of from 100 to 300 feet opposite the secondary stations. Since construction of the groins by the Ordnance Department during World War I, this situation had stabilized. South of this sector to a point 2,000 feet north of the Spermaceti Cove Coast Guard Station, there had during this period been an accretion of from 100 to 300 feet of beach. Between the latter point and the seawall there had been erosion. Opposite the Coast Guard Station, there was no perceptible difference in the 1897 and 1926 mean high-water marks. But south of the station, near the north end of the seawall, the beach between 1897 and 1922 had been cut back about 400 feet, while another 150 feet had been lost since 1922.

In the area back from the beach, from the north end of the seawall to a point 1,500 feet north of the Spermaceti Coast Guard

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61. Ibid., May 31, 1927, NA, RG 77, Ltrs. Sent & Recd., Fort Hancock.

Station, there were no structures which would justify a considerable expense for defense against further erosion, while the isthmus was of sufficient width there not to jeopardize communications.[62]

G. Recommendations

The Corps of Engineers, with assistance at various times from the Lighthouse Board, the Ordnance Department, and the Quartermaster General, has been engaged since the 1860s in an expensive struggle to protect Sandy Hook from the sea. In the fight against the surf and winds, the relative inexpensive jetties of the 1860s, 70s, and 80s, gave way in the 1890s to riprap seawalls. The latter, as the nation's investment in and dependence on the Sandy Hook defenses increased, became more expensive and sophisticated. Although the sea's encroachments have been contained by a combination of jetties, groins, and seawalls, a wild storm, such as that of 1962, can erode and sweep away hundreds of feet of valuable unprotected beach and batter and displace riprap.

The Sandy Hook seawalls, jetties, and groins were and are important structural resources, vital in interpreting man's endless struggle with the elements. Closely identified with this is the constantly changing configuration of the Hook, as the land mass, through accretion, moves to the northwest. The subject structures are of Third Order of Significance and should be included on the Service's List of Classified Structures.

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62. Ibid.

APPENDIXES

Appendix A

Installation of 12-Inch Taylor-Raymond Hoists for

Long-Point Projectiles, 1917-1918

EMPLACEMENT #2. BATTERY RICHARDSON.

Hoist No. 66.
Motor No. 642534,--Shunt wound, Type R.C.10, Form G.I, Volts 110.
Open continuous H.P. 7-1/2, Amp. 61.5, Speed 800.
Closed H.P. 5-1/2, Amp. Speed 800. G. E. Co.
Controller #192652, D.L. 1899280, C.R. 5541
For use with 7-1/2 H.P. Motor, Volts 110, Amp. 62
D.C. Contactors, C.R. 2800 - 398 - A 3
D.C. Contactors, C.R. 2800 - 398 - A 4
Push button station, D.L. 1898383, B.S. 4W., C.R. 2943
Push button station, D.L. 1898384, B.S. 8G., C.R. 2943

EMPLACEMENT #2. BATTERY BLOOMFIELD.

Hoist No. 67.
Motor No. 642530,--Shunt wound, Type R.C.10, Form G.I, Volts 110.
Open continuous H.P. 7-1/2, Amp. 61.5, Speed 800.
Closed H.P. 5-1/2, Amp. 45, Speed 800. G. E. Co.
Controller #192664, D.L. 1899280, C.R. 5541
For use with 7-1/2 H.P. Motor, Volts 110, Amp. 62
D.C. Contactors, C.R. 2800 - 398 - A 3
D.C. Contactors, C.R. 2800 - 398 - A 4
Push button station, D.L. 1898383, B.S. 4W., C.R. 2943
Push button station, D.L. 1898384, B.S. 8G., C.R. 2943

EMPLACEMENT #2. BATTERY ALEXANDER.

Hoist No. 68.
Motor No. 644664,--Shunt wound, Type R.C.10, Form G.I, Volts 110.
Open continuous H.P. 7-1/2, Amp. 61.5, Speed 800.
Closed H.P. 5-1/2, Amp. 45, Speed 800. G. E. Co.
Controller #192655, D.L. 1899280, C.R. 5541
For use with 7-1/2 H.P. Motor, Volts 110, Amp. 62
D.C. Contactors, C.R. 2800 - 398 - A 3
D.C. Contactors, C.R. 2800 - 398 - A 4
Push button station, D.L. 1898383, B.S. 4W., C.R. 2943
Push button station, D.L. 1898384, B.S. 8G., C.R. 2943

EMPLACEMENT #1. BATTERY RICHARDSON.

Hoist No. 93.
Motor No. 654982,--Shunt wound, Type R.C.10, Form G.1, Volts 110.
Open continuous H.P. 7.5, Amp. 60.5, Speed 800.
Closed H.P. 5.5, Amp. 45, Speed 800. G. E. Co. Continuous Speed 40° C.

Controller #192686, D.L. 1899280, C.R. 5541 25% overload 53° C
For use with 7.5 H.P. Motor, Volts 110, Amp 62 2 hours
D.C. Contactors, C.R. 2800 - 398 - A 4
D.C. Contactors, C.R. 2800 - 398 - A 3
Push button station, D.L. 1898383, B.S. 4W., C.R. 2943 V
Push button station, D.L. 1898384, B.S. 8G., C.R. 2943 V Receiving table
Circuit Breaker 325, M7.

EMPLACEMENT #1. BATTERY BLOOMFIELD.

Hoist No. 94.
Motor No. 652236,--Shunt wound, Type R.C.10, Form G.1, Volts 110.
Open continuous H.P. 7.5, Amp. 60.5, Speed 800.
Closed H.P. 5.5, Amp. 45, Speed 800. Continuous Speed 40° C.
Controller #192695, D.L. 1899280, C.R. 5541 25% overload 55° C
For use with 7.5 H.P. Motor, Volts 110, Amp. 62 2 hours
D.C. Contactors, C.R. 2800 - 398 - A 4
D.C. Contactors, C.R. 2800 - 398 - A 3
Push button station, D.L. 1898383, B.S. 4W., C.R. 2943
Push button station, D.L. 1898384, B.S. 8G., C.R. 2943 Receiving table
Circuit Breaker 325, M7.

EMPLACEMENT #1. BATTERY ALEXANDER.

Hoist No. 95.
Motor No. 654079,--Shunt wound, Type R.C.10, Form G.1, Volts 110.
Open continuous H.P. 7.5, Amp. 60.5, Speed 800.
Closed H.P. 5.5, Amp. 45, Speed 800. Continuous Speed 40° C.
Controller #192893, D.L. 1899280, C.R. 5541 25% overload 55° C
For use with 7.5 H.P. Motor, Volts 110, Amp. 62 2 hours
D.C. Contactors, C.R. 2800 - 398 - A 4
D.C. Contactors, C.R. 2800 - 398 - A 3
Push button station, D.L. 1898383, B.S. 4W., C.R. 2943
Push button station, D.L. 1898384, B.S. 8G., C.R. 2943 Receiving table
Circuit Breaker 2800 - 325, M7.

Appendix B

Date of Transfer of Batteries, Etc., to the Garrison

FORT HANCOCK, N. J.

BATTERY	DATE OF TRANSFER	BUILT UNDER CONTRACT, OR NOT	
Battery Reynolds	Mar. 22, 1898	Not	Col. G. L. Gillespie
Alexander McCook	do	"	do
Battery Granger	do	"	do
Battery Potter	do	"	do
Thomas Urmston	Feb. 27, 1903	"	Lt. Col. W. L. Marshall
2 Empls. for 3" R. F. Guns	June 7, 1904	"	do
Lewis Morris	do	"	do
Israel Richardson	Apl. 23, 1904	"	do
Joseph Bloomfield	Dec. 20, 1899	"	Col. H. M. Adams
William Alexander	Jul. 15, 1899	"	do
Battery Halleck	Jan. 6, 1900	Contract	Col. G. L. Gillespie
Battery Peck	Nov. 10, 1903	Not	Lt. Col. W. L. Marshall
Battery Engle	July 2, 1898	"	Col. W. Ludlow
John Gunnison	Dec. 5, 1905	"	Lt. Col. W. L. Marshall

POWER PLANTS

	DATE OF CONSTRUCTION OF BUILDING	INSTALLATION OF EQUIPMENT	DATE OF TRANSFER
Main Power House	Aug. 1901 to Nov. 1903		Nov. 24, 1903
80 Kw. Gen. Set		(Oct. 1901 to)	
37-1/2 Kw. Gen. Set		(Nov. 1903.)	
80 Kw. Gen. Set		1904-5	
Small Power House	1904-5		Aug. 29, 1905
25 Kw. Gen. Set		1904-5	

The old cable tanks (4) were transferred to the Artillery May 16, 1901.

The old Mining Casemate (now abandoned) was transferred to the artillery on May 16, 1901.

APPENDIX C

Dimensions of Magazines
Sandy Hook Coastal Defenses
September 1918

Battery	No. of Magazines	Length	Width	Height
12"-Richardson	2	27	10	9
	2	29	7	9
	2	26	20	9
12" Bloomfield	2	25	11	9
	2	26	20	9
	1	16	15	9
12" Alexander	2	26	11	9
	2	27	20	9
	1	19	14	9
	1	37	12	9
10" Halleck	3	13	10	9
	3	20	13	9
	3	30	6	9
10" Granger	2	20	13	9
	1	13	10	9
	1	14	10	9
	2	30	6	9
8" Arrowsmith	3	16	12	9
	3	18	9	9
6" Gunnison	1	34	14	7½
	1	34	11	7½
6" Peck	2	15	6	7½
	1	30	11	7½
5" Engle	1	21	13	7½
	1	12	8	7½
3" Morris	4	22	12	7½
3" Urmston	2	22	12	7½
	4	15	9	6½
12" Reynolds	1	57	10	9
	1	110	15	9

Battery	No. of Magazines	Length	Width	Height
12" McCook	1	57	10	9
	1	60	15	9
12" Navesink	1	34	19	7
Gun Lift	8	25	15	7

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"Plan Showing Drainage and Electric Systems Emplacements 3 and 4 of Battery Halleck."

"Plan Showing Drainage and Electric Wiring Emplacements 1 and 2 of Battery Halleck."

Rapid-Fire Batteries

"Emplacement for One 5-inch Rapid Fire Gun, Model 1896, on Balanced Pillar Mounting at Fort Hancock, Sandy Hook, N. J., 1897."

"Emplacements for two 15-pdr. Rapid-Fire Guns on Balanced Pillar Mounts, drawn under the direction of Major Adams, Corps of Engineers, U.S.A., January 1899."

"Fort Hancock, Sandy Hook, N. J., Proposed Emplacements for two 15 pdr. Rapid Fire Guns drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., June 1900."

"Drainage Plan 15-pdr. R. F. Gun Battery No. 1, Fort Hancock, N. J., January 1903."

"Drainage Plan 15-pdr. R. F. Gun Battery No. 2, Fort Hancock, N. J."

"Fort Hancock, New Jersey, Plan and Sections of Emplacements for Two 3-inch R. F. Guns on Pedestal Mounts, drawn under direction of Maj. W. L. Marshall, Corps of Engineers, U.S.A., May 1903."

"Fort Hancock, New Jersey, Plans and Sections of Emplacements for Four 3-inch R. F. Guns on Pedestal Mounts, drawn under direction of Major W. L. Marshall, Corps of Engneers, U.S.A., May 1903."

"Fort Hancock, New Jersey, Plan of Emplacements for Two Six-inch Rapid-Fire Guns, on Pedestal Mounts, Model 1900. Drawn under Direction of Major W. L. Marshall, Corps of Engineers, U.S.A., June 1901."

"Fort Hancock, New Jersey, Plan and Sections Showing Modification of Battery for Two 6-inch R. F. Guns on Pedestal Mounts, Model 1900. Drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., February 1903."

"Fort Hancock, New Jersey, Plan and Sections of Emplacements for Two 6-inch R. F. Guns on Disappearing Carraiges, Model 1903, Drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., August 1903."

"Harbor Defense of New York, Battery Gunnison, Alterations & Additions." Fort Hancock, New Jersey, February 16, 1943. 8 sheets. Sandy Hook Unit, Gateway National Recreation Area.

Batteries Kingman and Mills

Plans, "Fort Hancock, N. J., Batteries A and B for Two 12 inch Guns on Barbette Carriages, Model 1917." U.S. Engineer Office, 2d District, New York City, February 3, 1917.

Dynamite Gun Battery

"Map of a Portion of Sandy Hook, N. J., Showing Condition of beach in vicinity of Dynamite Gun Emplacements, 1894."

"Sketch of Pneumatic Dynamite Gun Battery for Two 15-inch and one 8-inch Guns with Powerhouse."

"Fort Hancock, Sandy Hook, N. J., Plans and Sections of Pneumatic Dynamite Gun Battery, drawn under direction of Major W. L. Marshall, Corps of Engineers, U.S.A., March 1901."

Fire Control Stations and Power Station

"Coal Bin at Power House, Fort Hancock, N. J., Sketch showing proposed location and arrangement.

"Fort Hancock, N. J., Plans and Sections of Primary Stations for Battery Reynolds Located on the Platform of Battery Potter."

"Fort Hancock, n.d., Plans for Primary Fire Control Stations, drawn under direction of Lieut. Col. W. L. Marshall, Corps of Engineers, U.S.A., November 1906."

"General Plan of Electric Lighting and Power Plant."

Engineer Wharf

"Proposed Extension of Wharf at Sandy Hook, New Jersey, Engineer Offices, U.S.A., New York, N. Y., Sept. 19, 1890."

"Map of Sandy Hook, N. J. . . . to accompany annual report, U.S. Engineer Office, New York, N. Y., June 30, 1892."

"Sketch of Piles to be Driven to Strengthen Wharf at Sandy Hook Proving Ground, Jan. 6, 1893."

"February, 1903, Sandy Hook, N. J., Present Dock, Showing Proposed Extension."

"Cross-Section of New Dock Being Built at Sandy Hook, N. J., to show progress upon damaged section before it was injured, January 22, 1904."

Engineer Buildings

"Fort Hancock, N. J., Engineer Department, Locomotive Store & Repair House."

"Proposed Shell Storehouse for Fort Hancock." Drawn by J. H. Pearson, Civil Engineer, April 19, 1918.

"Storehouse, U.S. Engineers Department, Fort Hancock, N. J."

Jetties, Bulkheads, Seawalls, etc.

"Fort at Sandy Hook, N. J., Shore Changes of Sandy Hook, during the month of September 1867."

"Sketch of Shore Line of the North Eastern Part of Sandy Hook, N. J., showing line of bulkhead as built under the direction of Genl. H. W. Benham, U.S. Engrs., March to June 1878."

"Chart of Sandy Hook, New Jersey, showing condition of the Shore Improvements, June 30th 1884, executed under the direction of Maj. G. L. Gillespie, Corps of Engineers."

"Sandy Hook, New Jersey, from a survey made under direction of Maj. G. L. Gillespie, Corps of Engrs., April 1885."

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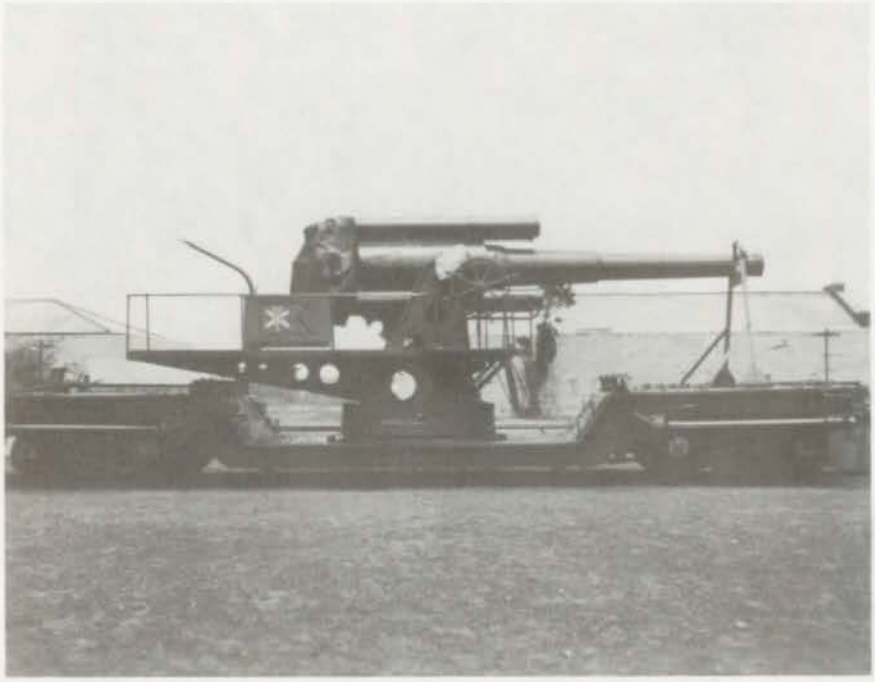
PHOTOGRAPHS

All photographs are located in the Sandy Hook Museum photographic archive collection.

Photograph No. 1. (NA 77-F-45-89-1). Test firing south gun lift, Lift Gun Battery No. 1 at Sandy Hook 1894.

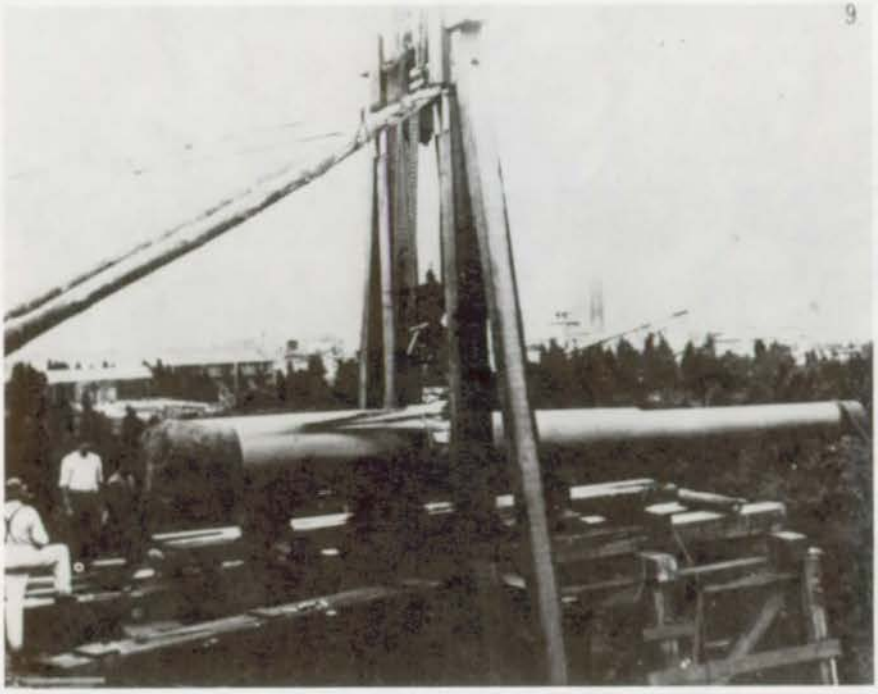
Photograph No. 2. Casemated gun emplacement of Battery Kingman, September 1945. Taken by Staff Sgt. William K. Tuting, Battery F, 245th CA.

Photograph No. 3. 8-inch rifle mounted on a Model 1918 railway flat car belonging to Battery E, 52nd Coast Artillery, ca. 1937-40.

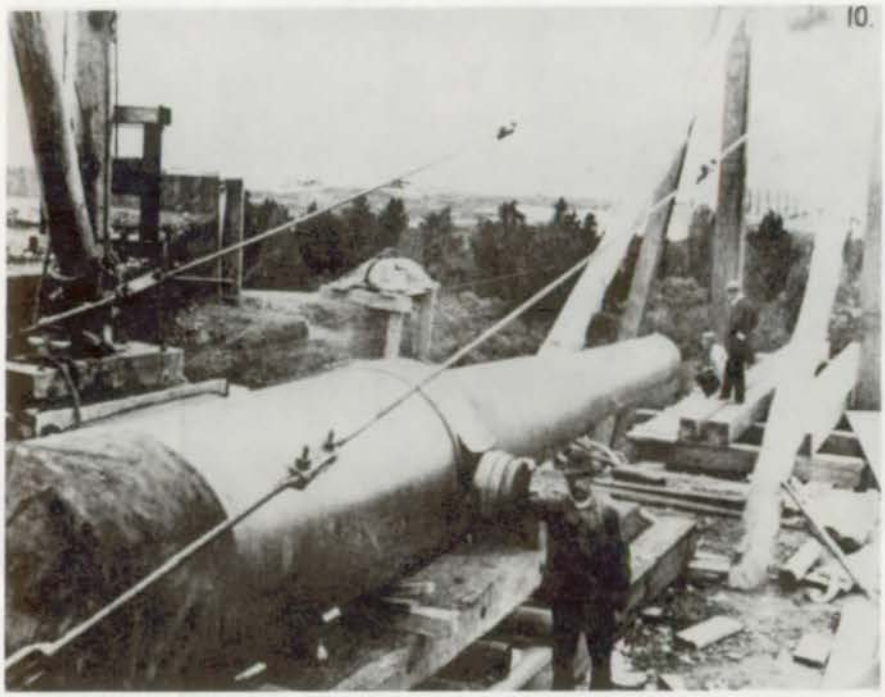


Photograph No. 4. (NA 77-F-45-90-5). Barbette carriage during assembly on north elevator platform atop Lift Gun Battery No. 1, ca. August 1892.

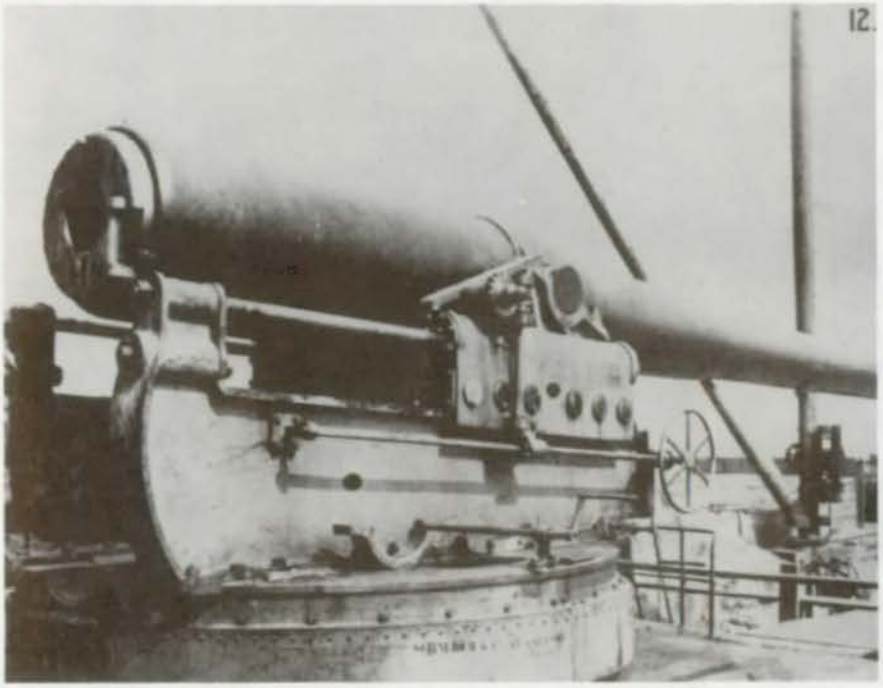
Photograph No. 5. (NA 77-F-45-90-7-9). Hoisting 52-ton, 12-inch breech-loading rifle atop Lift Gun Battery No. 1 for emplacement on elevator mounted barbette carriage, ca. August 1892.



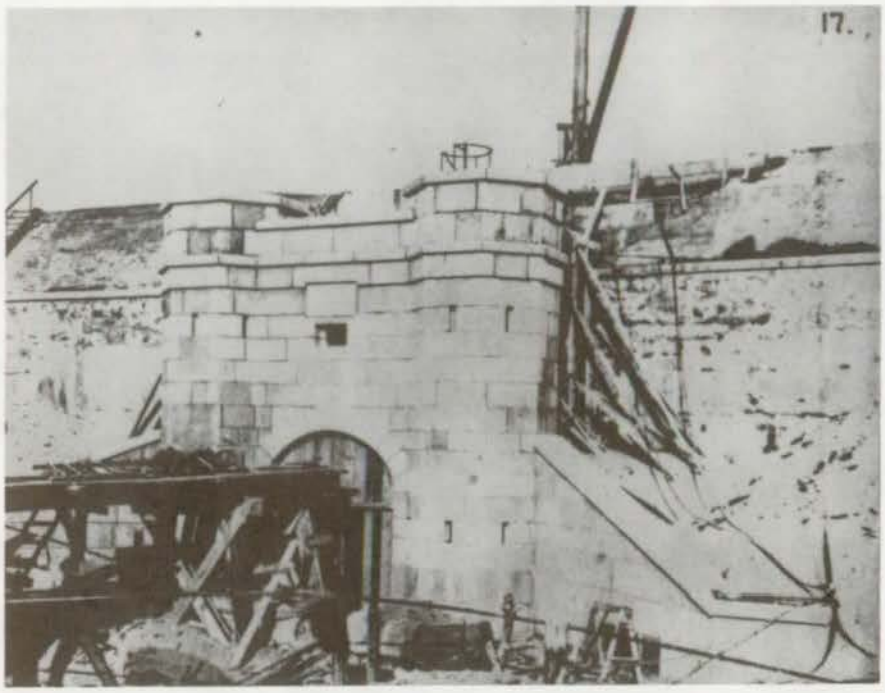
Photograph No. 6. (NA 77-F-45-90-10). View of 12-inch rifle being moved off the hoisting frame on rollers on to its elevator platform mounted barbette carriage atop Lift Gun Battery No. 1, ca. 1892.



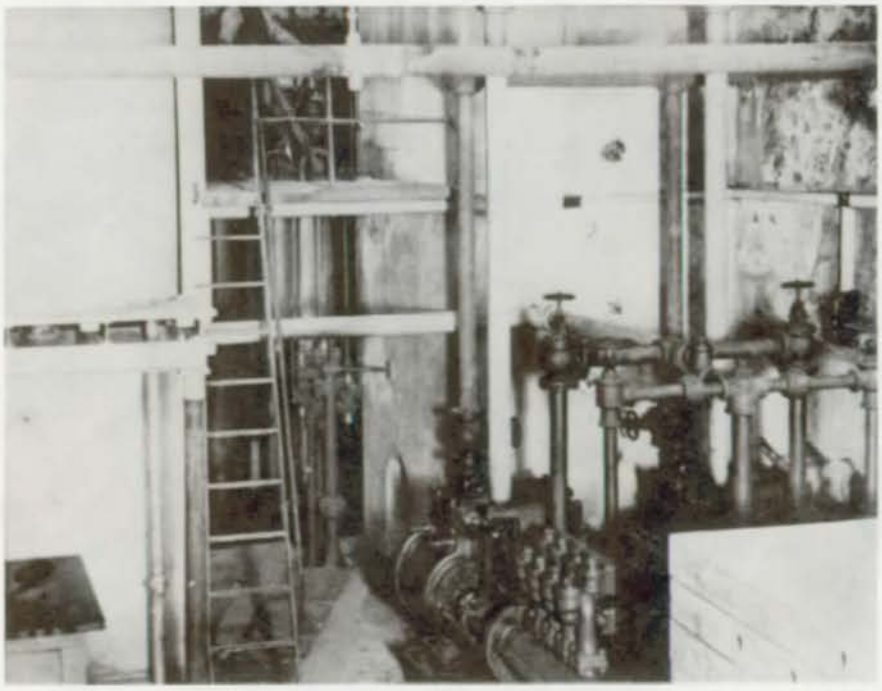
Photograph No. 7. (NA 77-F-45-90-12). 12-inch rifle emplaced upon its carriage and raised to firing position on the hydraulic lift elevator, August 29, 1892.



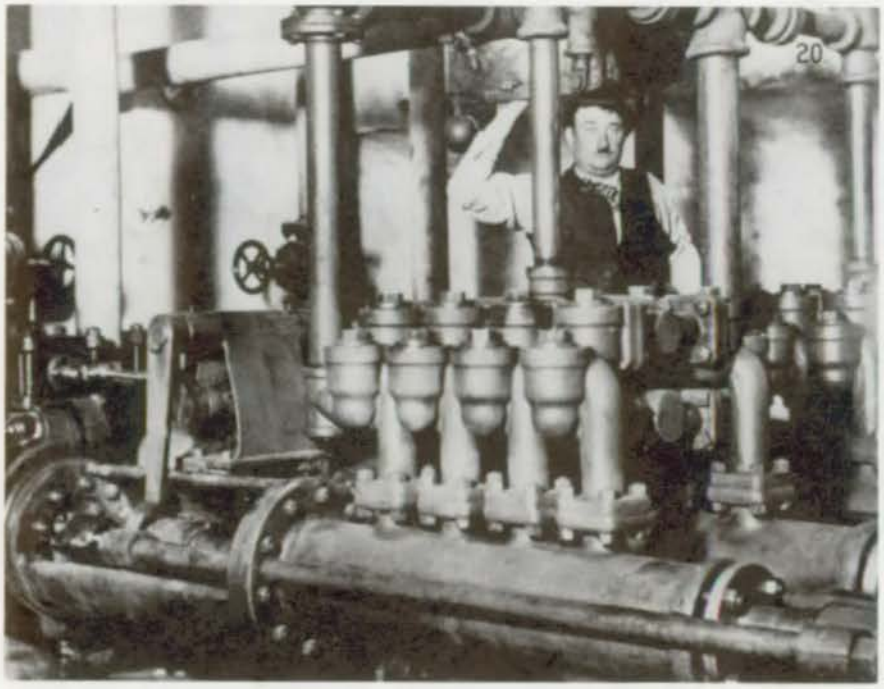
Photograph No. 8. (NA 77-45-90-17). Main entrance structure under construction, ca. 1892.



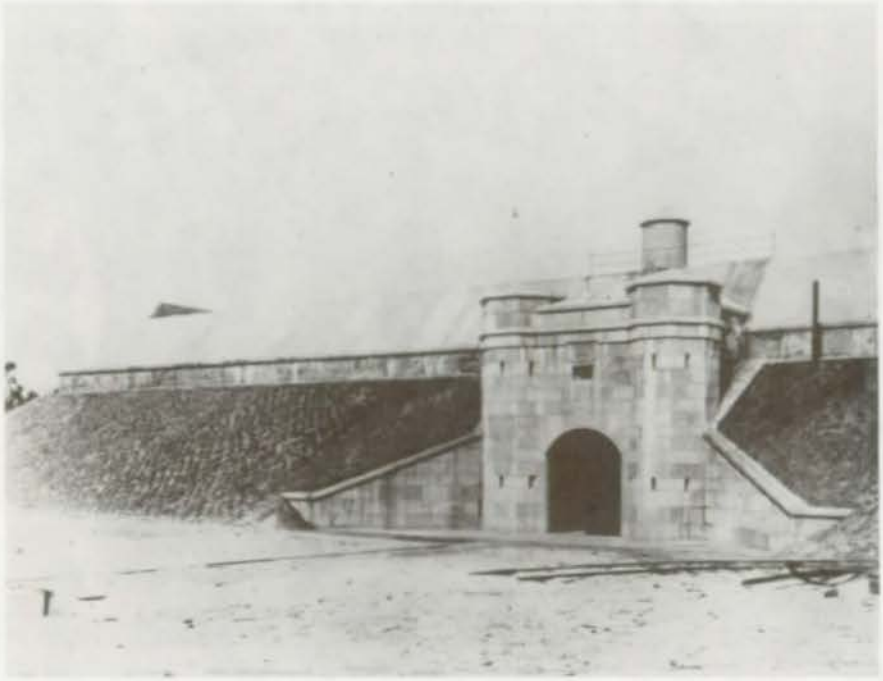
Photograph No. 9. (NA 77-F-45-90-19). Interior view of the hydraulic machinery that operated the lift mechanism of Lift Gun Battery No. 1, ca. 1893-94.



Photograph No. 10. (NA 77-F-45-90-20). Close up view of hydraulic machinery that operated the lift mechanism of Lift Gun Battery No. 1, ca. 1893-94.



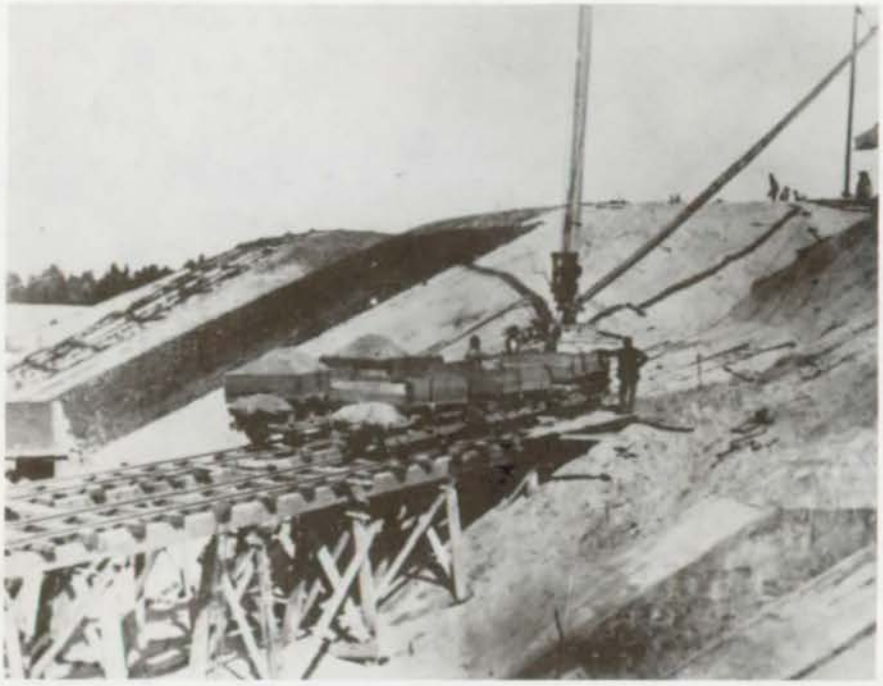
Photograph No. 11. (NA 77-F-45-115-5). Main entrance (west side) view of newly-completed Lift Gun Battery No. 1 (later named Battery Potter), America's first and only steam powered disappearing gun battery, March 1894.



Photograph No. 12. (NA 77-F-45-SH-144-5). General view of newly-completed fire control stations atop Battery Potter along with telephone operator buildings (lower right of photograph), ca. 1907-08.

Photograph No. 13. (NA 77-F-45-1073). Construction of concrete "Ten-inch Battery No. 2" (later named Battery Halleck) over the old Civil War Era "Fort at Sandy Hook," ca. June-July 1897.

Photograph No. 14. (NA 77-F-45-115-3). A ca. 1893 view of workmen using inclined rail system and rotary dump cars to dump sand on the Sandy Hook Mortar Battery.



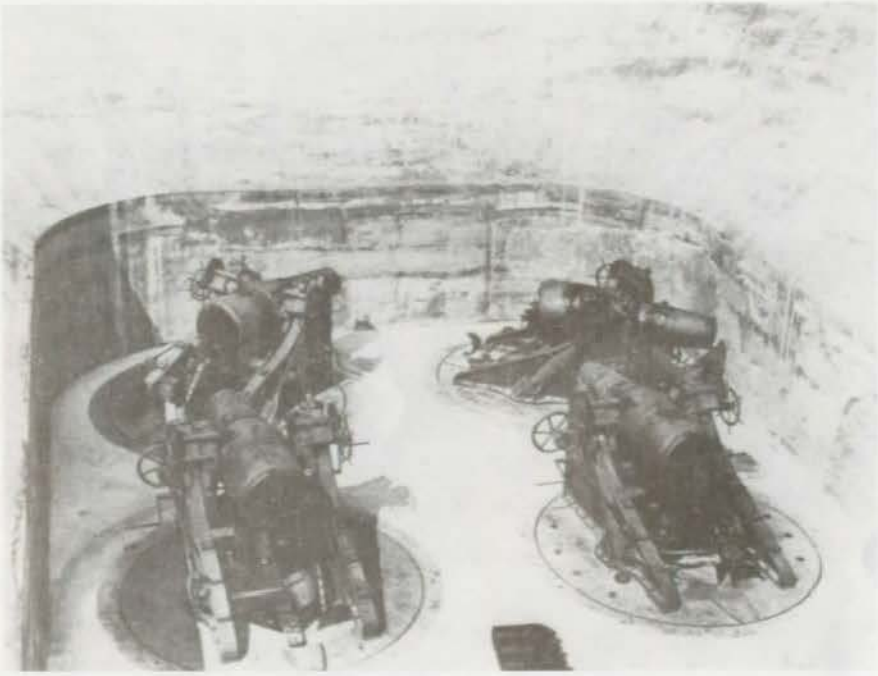
Photograph No. 15. (NA 77-F-45-90-32). View of Mortar Battery tunnel structure being covered with sand, ca. 1893.

Photograph No. 16. (NA 77-F-45-90-25). A ca. 1892 view showing workmen using a derrick crane to dump concrete on the roof of the west magazine of the Mortar Battery.

Photograph No. 17. (NA 77-F-45-92-2). Excavation for the foundations of the mortar carriage platforms, July 1893.

Photograph No. 18. (NA 77-F-45-115-2). Workmen in a Sandy Hook mortar pit, cutting holes in a granite block for mounting bolts for bases mounting mortar platforms, ca. 1893.

Photograph No. 19. (NA 77-F-4591). Sandy Hook Mortar Battery firing pit containing four 12-inch mortars, northwest pit, ca. 1894-95.

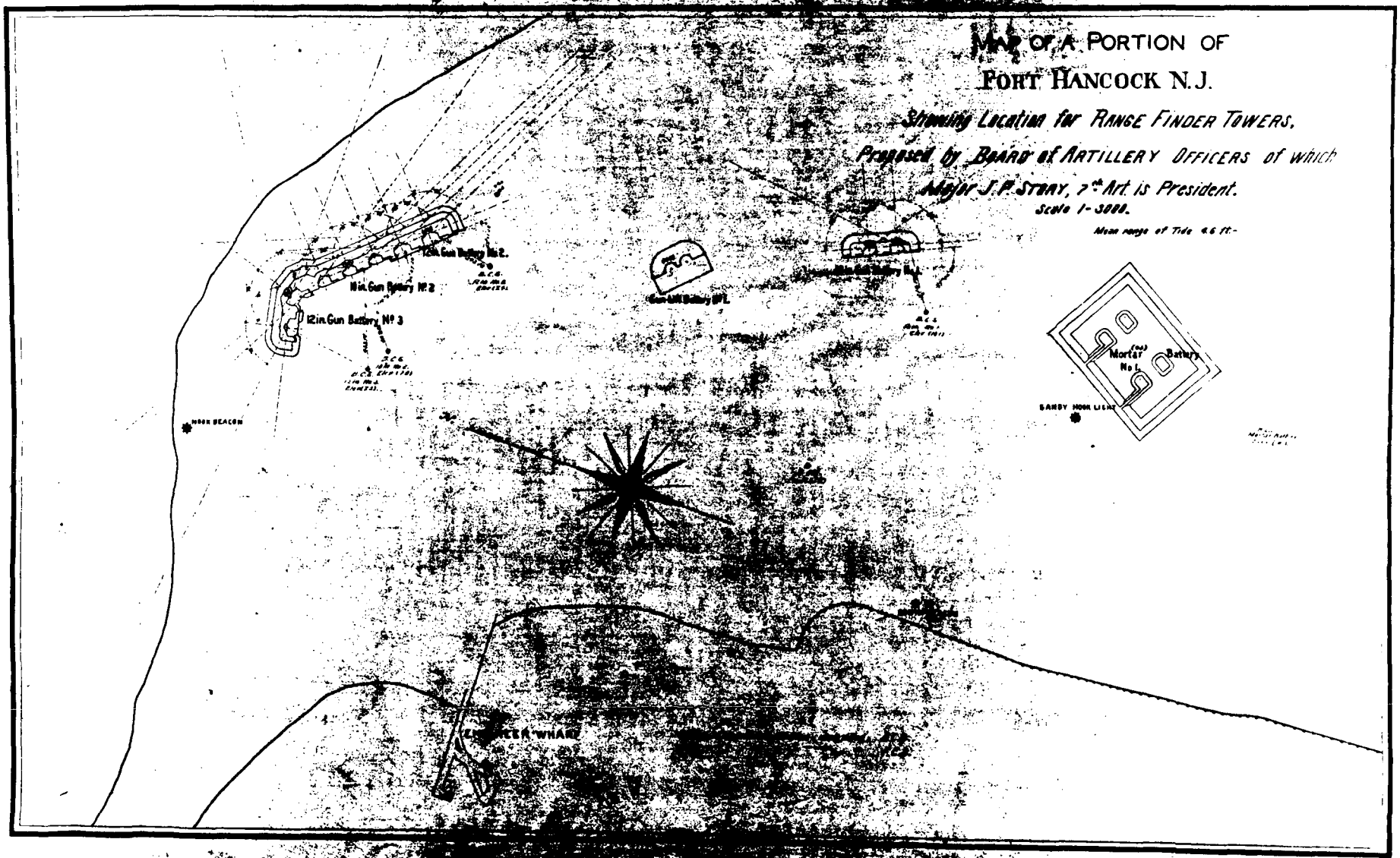


Photograph No. 20. (SC-118996). Machine gun crew working .50 caliber Browning water-cooled machine gun in gas masks. 245th Coast Artillery, Battery B, ca. 1941-42.

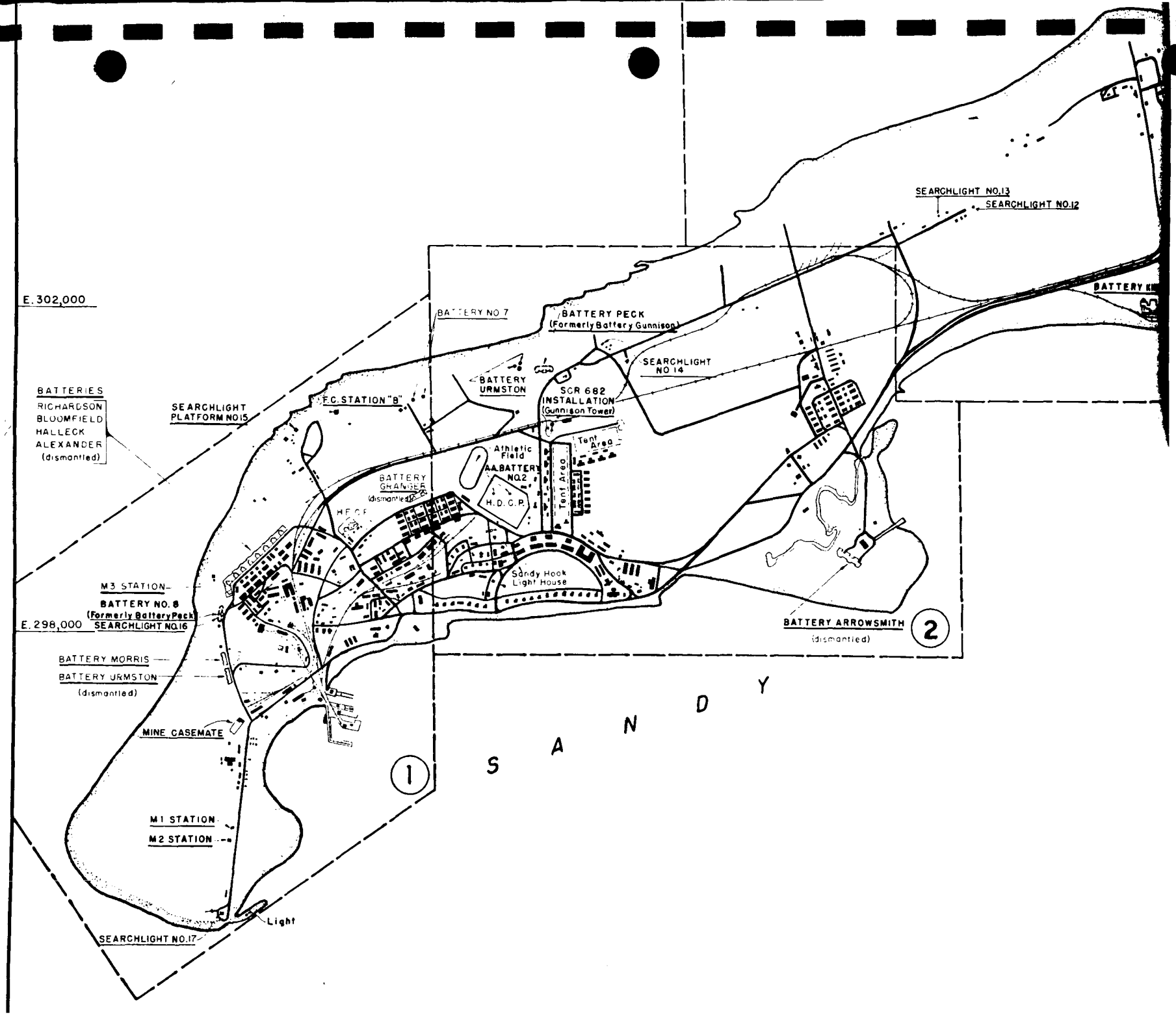
Photograph No. 21. (SC-118992). Lt. Brian P. Emerson, 245th Coast Artillery, instructing newly-inducted selectees on the working of a 3-inch antiaircraft gun, ca. 1942.

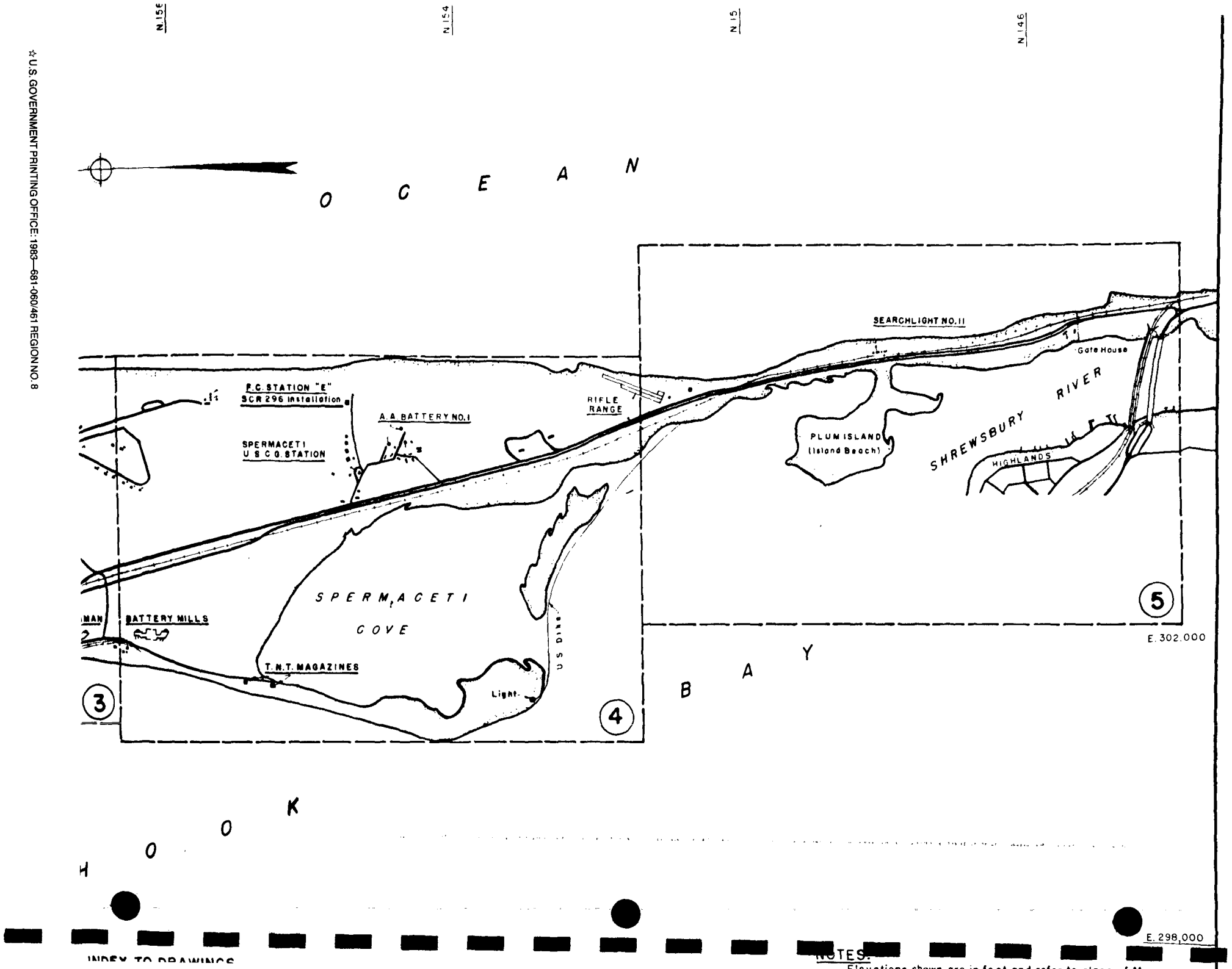
Photograph No. 22. Battery Urmston, No. 1 (right) and No. 2 (left) 3-inch pedestal-mounted rapid fire guns being loaded during target practice, ca. 1900-08.

Photograph No. 23. Dismantling operation of Battery Potter's 12-inch guns, elevator mechanisms, and machinery, ca. summer 1906.


MAP OF A PORTION OF
FORT HANCOCK N.J.
Showing Location for RANGE FINDER TOWERS.
Proposed by BOARD of ARTILLERY OFFICERS of which
Major J.P. STORY, 7th Art. is President.
Scale 1-3000.
Mean range of Tide 4.6 ft.
12in. Gun Battery No 2
10in. Gun Battery No 2
12in. Gun Battery No 3
Mortar (Sea) Battery No 1
SANDY HOOK LIGHT
HOOK BEACON

Map of Sandy Hook Defenses, July 29, 1944, Parts I and II.


E. 302,000
BATTERIES
RICHARDSON
BLOOMFIELD
HALLECK
ALEXANDER
(dismantled)
SEARCHLIGHT PLATFORM NO.15
F.C. STATION "B"
BATTERY NO. 7
BATTERY PECK
(Formerly Battery Gunnison)
BATTERY URMSTON
SCR 682 INSTALLATION
(Gunnison Tower)
SEARCHLIGHT NO. 14
SEARCHLIGHT NO.13
SEARCHLIGHT NO.12
BATTERY K
Athletic Field
A.A. BATTERY NO.2
H.D.C.P.
Tent Area
Tent Area
BATTERY GRANGER
(dismantled)
H.F.C.F.
Sandy Hook Light House
M3 STATION
BATTERY NO. 8
(Formerly Battery Peck)
E. 298,000
SEARCHLIGHT NO.16
BATTERY MORRIS
BATTERY URMSTON
(dismantled)
MINE CASEMATE
M1 STATION
M2 STATION
Light
SEARCHLIGHT NO.17
BATTERY ARROWSMITH
(dismantled)
1
2
S A N D Y



☆U.S. GOVERNMENT PRINTING OFFICE: 1983—681-060/461 REGION NO. 8

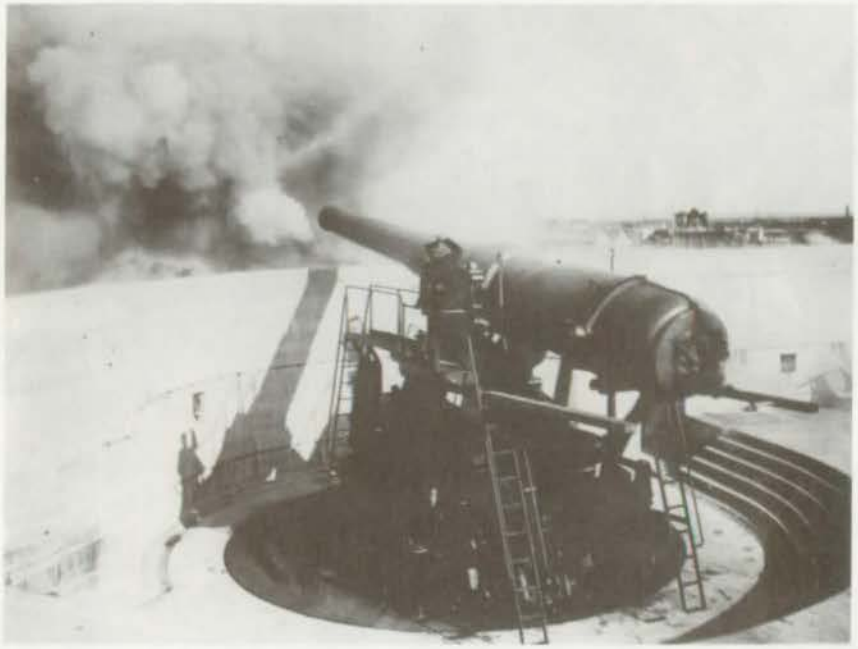
Photograph No. 24. Interior of fire control station atop Battery Potter. Three soldiers are seated around plotting bench, while four others calculate flight of shell, ca. 1905-10.

Photograph No. 25. Gun crew loading a 10-inch projectile into the breech of Gun Emplacement No. 2 disappearing gun mounted at "Ten-Inch Battery No. 1" (later named Battery Granger), ca. 1898-99.

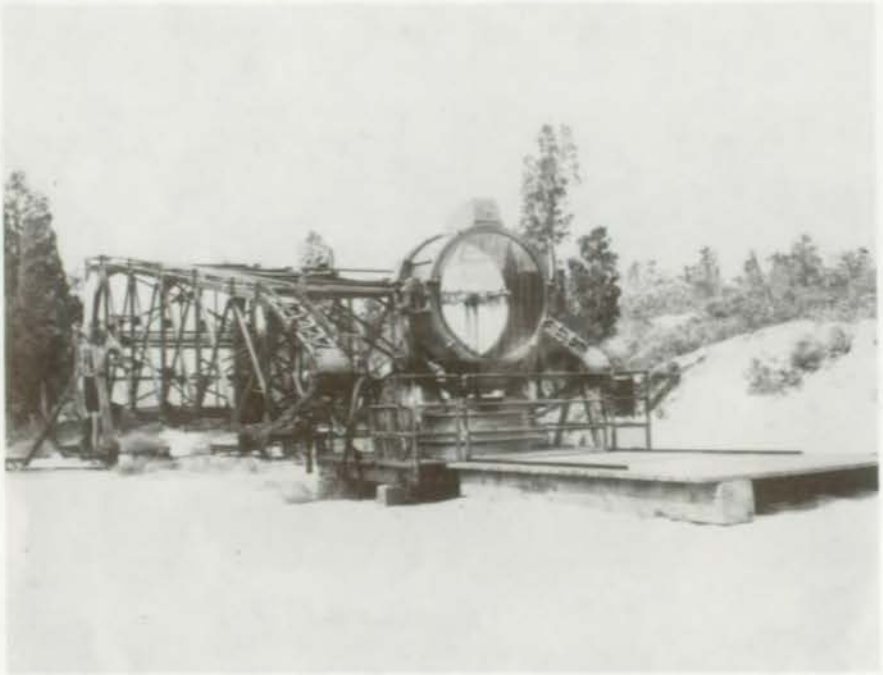
Photograph No. 26. 10-inch disappearing gun in firing position, Gun Emplacement No. 2, at "Ten-Inch Battery No. 1" (later named Battery Granger), ca. 1898-99.

Photograph No. 27. Battery Richardson, Gun Emplacement No. 1, 12-inch rifle mounted on Buffington-Crozier counter weight carriage seen in loading position, ca. 1902-04. Proof battery facilities of the Sandy Hook Proving Ground can be seen in the distance.

Photograph No. 28. Battery Richardson, Gun Emplacement No. 1. Probable test firing of 12-inch rifle, ca. 1902-04. Proof battery facilities of the Sandy Hook Proving Ground are in the background from the center to the right.



Photograph No. 29. Strauss Disappearing Searchlight Tower in lowered position, ca. 1908-12.

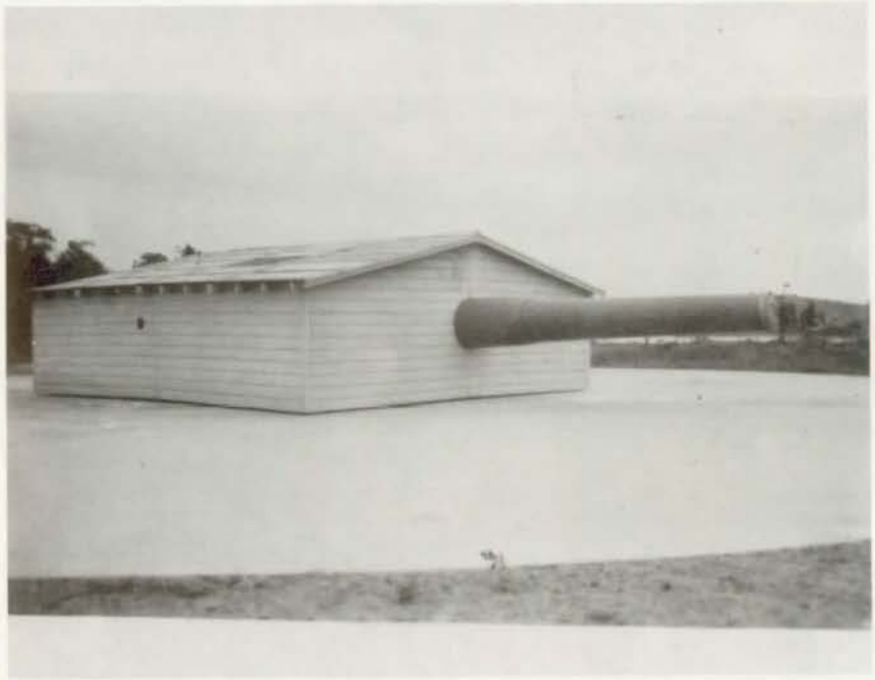


Photograph No. 30. Strauss Disappearing Searchlight Tower in the "up" position ready for use, ca. 1908-12.

Photograph No. 31. View of "Fort at Sandy Hook," bay side area looking south.

Photograph No. 32. (NA 77-CD-21-M1). Battery Peck, Ft. Hancock, New Jersey, 1921. Battery armament consisted of two Model 1900 6-inch rifles mounted on shielded barbette carriages.

Photograph No. 33. (NA 77-CD-21-M4). Battery Mills, Fort Hancock, New Jersey, 1921. Note the 12-inch gun barrel protruding from "false building" used to camouflage gun from aerial observation.



Photograph No. 34. (NA 77-CD-21-P-18). Battery commander stations for Batteries Kingman (right) and Mills (left), June 24, 1922.

Photograph No. 35. (NA III SC 60719). Breech and breech block (closed position) of Battery Kingman's 12-inch barbette gun, June 24, 1919, at first test firing of Battery Kingman.

Photograph No. 36. (NA III SC 60720). Battery Kingman's 12-inch barbette gun showing breech, breech block (open position), and bore. Taken on June 24, 1919, at first test firing at Battery Kingman.

Photograph No. 37. (NA III SC 60733). Army gun crew loading one of Battery Kingman's 12-inch barbette mounted guns for the first test firing at Battery Kingman, June 24, 1919.

Photograph No. 38. (NA III SC 60734). Firing of Battery Kingman's 12-inch barbette high angle gun.

Photograph No. 39. (NA III SC 84749). Explosion of Army Coast Artillery Corps controlled "submarine mine" in the water. Controlled mines remained inert until exploded electrically from a position ashore through insulated cables.

Photograph No. 40. (NA III SC 97974-6). Civilian Military Training Camp students at Battery Gunnison, Emplacement Gun No. 2, August 11, 1932.

Photograph No. 41. (NA III SC 91557). Coast Artillery 155 mm mobile mounted gun being readied for firing by gun crew. This gun was the most widely used of the mobile artillery pieces adopted for seacoast defense after World War I.

MAPS

The maps are located in the Sandy Hook Museum archives.

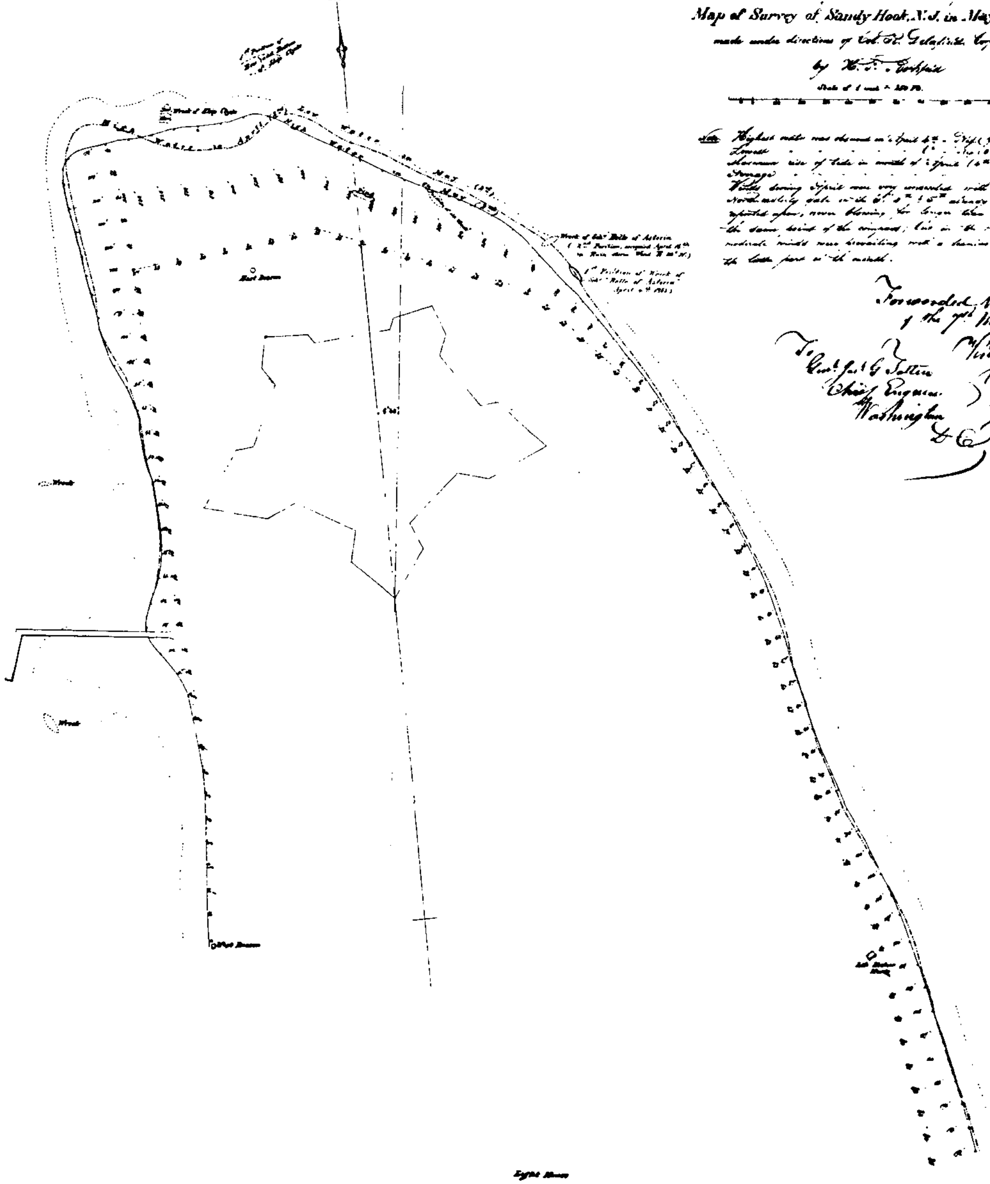
"Fort At Sandy Hook, N. J. Map of Survey of Sandy Hook, N. J. in May 1863. Made under directions of Col. R. Delafield, Corps of Engrs. by H. F. Rothfield."

12

Drawer 44.
Sheet 12.

FORT AT SANDY HOOK, N.J.

Map of Survey of Sandy Hook, N.J. in May 1863.
made under directions of Col. R. Delafield, Corps of Engrs
by H. F. [illegible]
Scale of 1 inch = 100 Ft.



Note. Highest water was observed on April 4th - Diff. (9.65). Time 4. 30 P.
Lowest " " " " " 1st - Diff. 0 " " 9.
Maximum rise of tide in month of April 1st, " 10"
Average " " " " " " 4' 8"
Winds during April were very moderate with the exception of the Northeasterly gale on the 3rd 4th & 5th already mentioned and reported upon, never blowing for longer than 12 hours from the same point of the compass; but on the whole easterly and moderate winds were prevailing with a [illegible] to the south in the latter part of the month.

Forwarded with my letter
of the 7th May 1863 — (D 62.79)

Richd Delafield
US Corps of Engineers

To
Genl. Jos. G. Totten
Chief Engineer
Washington
D.C.

"Map of A Portion of Fort Hancock N. J. Showing Location for Range Finder Towers. Proposed by Board of Artillery Officers of which Major J. P. Story, 7th Art. is President." 1900.

As the nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, parks and recreation areas, and to ensure the wise use of all these resources. The department also has major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration. NPS 2110