Ocracoke Light Station

Cape Hatteras National Seashore

Historic Structures Report



December 2015

for

Cultural Resources, Partnerships, and Science Division

Southeast Region, National Park Service

by

JOSEPH K. OPPERMANN – ARCHITECT, P.A.

539 N. Trade Street Winston-Salem, NC 27101

www.jkoa.net 336/721-1711

Ocracoke Light Station

Cape Hatteras National Seashore

Historic Structures Report

December 2015

for

Cultural Resources, Partnerships, and Science Division

Southeast Region, National Park Service

by

JOSEPH K. OPPERMANN – ARCHITECT, P.A.

539 N. Trade Street Winston-Salem, NC 27101

www.jkoa.net 336/721-1711

Cultural Resources, Partnerships, and Science Division
Southeast Region
National Park Service
100 Alabama St. SW
Atlanta, GA 30303
(404) 507-5847

2015
Historic Structures Report
Ocracoke Light Station
Cape Hatteras National Seashore
Ocracoke, NC

Lighthouse: LCS 000016
Keepers' Quarters: LCS 007237
Store House/Pump House: LCS 091907 ("Shed")
Carpenter's Shop: LCS 091908 ("Tool House")
Oil House: LCS 091909
Privy: LCS 091910
Cisterns: LCS 091911

Cover image: CAHA Coll., June 2015

The historic structures report presented here exists in two formats. A traditional, printed version is available for study at the park, at the Southeast Regional Office of the NPS (SERO), and at a variety of other repositories. For more widespread access, the historic structure report also exists in a web-based format through ParkNet, the website of the National Park Service. Please visit www.nps.gov for more information.

Ocracoke Light Station
Cape Hatteras National Seashore
Ocracoke, NC
Historic Structures Report
2015

Approved by: _____ 3/23/16
Superintendent, Cape Hatteras National Seashore Date

Recommended by: Acting _____ 4/26/16
Chief, Cultural Resources, Partnerships, and Science Division, Southeast Regional Office Date

Recommended by: _____ 4/28/16
Deputy Regional Director, Southeast Regional Office Date

Approved by: _____ 4/28/16
Regional Director, Southeast Regional Office Date

Foreword

We are pleased to make available this Historic Structures Report, part of our ongoing effort to provide comprehensive documentation for the historic structures and cultural landscapes of National Park Service units in the Southeast Region. A number of individuals contributed to the successful completion of this work, but we would particularly like to thank the Project Team who authored the report.

The authors would like to thank the staff at Cape Hatteras National Seashore who assisted with the project, especially Jami Lanier, cultural resource manager, for her generous assistance in the Park's archives and for her editorial review. Dr. Ali Miri, historical architect with the National Park Service's Southeast Regional Office, provided helpful comments as part of his technical review and project oversight. We hope that this study will prove valuable to park management in ongoing efforts to preserve the buildings of the light station and to everyone in understanding and interpreting these unique resources.

Dan Scheidt, Chief
Cultural Resources, Partnerships, and Science Division
Southeast Regional Office
2015

Table of Contents

Project Team iii

Management Summary 1

Administrative Data 9

Part I - Developmental History

A. Historical Background and Context 13

B. Chronology of Development and Use 35

Timeline 83

C. Physical Description 91

General Description 91

The Lighthouse 94
The Architecture 94
Construction Characteristics 95
Structural Systems 95
Utility Systems 100
Exterior Features 102
Interior Features 107

The Keepers' Quarters 110
Original Keeper's Quarters 110
The Architecture 110
Construction Characteristics 110
Structural Systems 110
Utility Systems 112
Exterior Features 113
Interior Features 116
Description by Room 116
1929 Addition — Assistant Keeper's Quarters 128
General Description 128
Construction Characteristics 128
Structural Systems 128
Utility Systems 130
Exterior Features 130
Interior Features 133
Description by Room 134

The Outbuildings & Other Ancillary Structures 145
Carpenter's Shop 145
Cisterns 146

Generator House 146
Oil House 147
Privy 148
Pump House/Store House 148

Character Defining Features 150
Summary of Physical Conditions 151

Part II - Treatment & Use

A. Ultimate Treatment & Use 157

B. Requirements for Treatment 159

C. Alternatives for Treatment 163

D. Recommendations 165

Bibliography 171

Appendices

A. Documentation Drawings:

Lighthouse
Entry Level Floor Plan ..... Sheet 1
Section at 3rd Window ..... Sheet 2
Section at 4th Window ..... Sheet 3
Section at 5th Window ..... Sheet 4
Section at 6th Window ..... Sheet 5
Lantern Room Floor Plan ..... Sheet 6
Keepers' Quarters
First Floor Plan ..... Sheet 7
Second Floor Plan ..... Sheet 8
Details ..... Sheet 9
Outbuildings & Other Ancillary Structures
Oil House, Generator House, & Carpenter's Shop ..... Sheet 10
Privy & Store House/Pump House ..... Sheet 11

B. Historic Drawings

C. 1989 Field Report and Mortar Analysis

Project Team

National Park Service – Southeast Regional Office

Laurie Chestnut, Contracting Officer
Dr. Ali Miri, Historical Architect and Contracting Officer's Technical Representative

National Park Service – Cape Hatteras National Seashore

David Hallac, Superintendent
Jami Lanier, Cultural Resource Manager

Joseph K. Oppermann–Architect, P.A. (JKOA)

Joseph K. Oppermann, FAIA, Historical Architect
Langdon E. Oppermann, Architectural Historian
Laura A.W. Phillips, Architectural Historian
Rebecca L. McCormick, AIA
Christopher M. Woollard, Associate AIA

Management Summary

The purpose of this report is to document the development, use, and current condition of the Ocracoke Island Lighthouse, Keepers' Quarters, Outbuildings and Cisterns that comprise Ocracoke Light Station at Cape Hatteras National Seashore. The National Park Service will use this report to inform and guide their stewardship of this historic property.

The scope of work prescribed by NPS for this HSR specifies "limited" historical research as defined by Director's Order #28: Cultural Resources Management Guidelines. Most primary and secondary research was conducted in the Cape Hatteras National Seashore archives in Manteo, NC. Additional secondary research was conducted in the collections of various regional libraries. Oral histories were conducted with local historians and others. Building archaeology was a critical component of identifying the scope and time frame of various changes.

The report is divided into two major segments, *Part I: Developmental History* and P*art II: Treatment & Use*. Part I is organized into three sections that address in sequence the historical background and context of the Ocracoke Island Light Station, a chronology of development and use of the Lighthouse and Keepers' Quarters specifically, a physical description of the exterior and interior on a room-by-room basis of both the Lighthouse and the Keepers' Quarters, as well as an assessment of condition and a listing of character-defining features and a general description and condition assessment of each outbuilding and the two cisterns follows.

Part II presents the recommended "ultimate treatments and uses" for specific buildings and examines an alternative for treatment of the Lighthouse as well as requirements that circumscribe the buildings' treatments and uses.

A bibliography precedes the appendices, which contain scaled documentation drawings of the current floor plans of the Lighthouse, the Keepers Quarters, and the outbuildings. Scaled documentation drawings of selected examples of architectural trim of the Keepers' Quarters are included.

Historical Overview

During the latter part of the eighteenth century and the first half of the nineteenth century, Ocracoke Inlet served as the primary point of entry for seafaring vessels bound for the ports in the northern sounds of North Carolina.

To guide mariners, the first lighthouse was commissioned by the North Carolina General Assembly in 1789. However, lighthouses became the responsibility of the Federal Government and the first lighthouse at Ocracoke Inlet, the Shell Castle Lighthouse, was lighted in 1803. The lighthouse became largely ineffective as the channel shifted. A light vessel was placed at the inlet as a replacement but proved ineffective. Ocracoke Island was then selected for the construction of a new lighthouse. In 1822 Jacob Gaskill sold two acres on the island for $50.00 for the new light station.

The Ocracoke Light Station was constructed in 1823 by Noah Porter of Massachusetts. The station consisted of the conical tower and a small brick one-and-a-half story Keeper's Quarters with gable roof. Outbuildings to support the operation were included in Porter's contract. The cost of construction was $11,359.35.

The Ocracoke Lighthouse is the oldest functioning lighthouse in North Carolina and second oldest still in service in the United States. It is also one of the shortest in the state, with the focal point of its lens just 73 feet above grade and 79 feet above sea level. The tower is constructed of brick. The tower shell wall is over five feet thick at its base and tapers to the metal lantern. A wooden staircase originally circled the interior. The entrance is at grade on the west face of the building. Six double sash windows circle the



Figure 1. Aerial image of Ocracoke Light Station, viewed from southwest. (CAHA Coll., June 2015)

façade tracing the path of the original staircase. Over the years, a number of improvements were made. Among the more significant were the installation in 1854 of the superior fourth-order Fresnel lens from L. Soulter & Cie of Paris, France, accompanied by the installation of a new cast iron lantern designed for the lens. A newer model fourth-order lens of French manufacture was installed in 1899. The Lighthouse converted to electrical power in 1938.

Changes to the lodging for the lightkeeper followed the evolution in lighting. The original Keeper's Quarter was initially a five-room, one-and-a-half story brick house with wood shingle gable roof. In the late nineteenth century, the upper level was made a full story and a rear addition was constructed. As duties for the keeper increased, most light stations added an assistant keeper. And in 1929, lodging for an assistant keeper at Ocracoke was added, attached to the original Keeper's Quarters. References to the pre-1929 building use the singular Keeper's Quarters where post-1929 references to the duplex use the plural Keepers' Quarters. References to the individual residences of the post-1929 duplex also use the singular Keeper's, as in Assistant Keeper's Quarters.

In 1939, the U.S. Coast Guard took over management of the nation's lighthouses. In the 1950s, the Coast Guard granted permission to NPS to first occupy the Keepers' Quarters, and then the outbuildings, in return for keeping the buildings in good repair. In 2000 the Coast Guard transferred the Ocracoke Light Station to the National Park Service. The Coast Guard continues to maintain the light itself.

Statement of Significance

The Ocracoke Island Lighthouse is the oldest functioning lighthouse in North Carolina. Though its original purpose of warning sailing ships of the dangerous offshore shoals has long passed, the Ocracoke Island Lighthouse continues to serve as a navigational aid, primarily to local craft and recreational boats. Today, the lighthouse is typically unoccupied, the need for twice-daily visits by keepers having ended long ago. Public access to the interior is generally limited according to the season. Nevertheless, the light station is one of the favorite tourist destinations of the Outer Banks.

More importantly, the white-painted shotcrete-coated brick building with black lantern is iconic. The lighthouse retains much of its original character. It is, sentimentally and historically, the most important building on the island. It did not function alone, but had a complement of buildings on the station's grounds.

The original, one-and-one-half story brick Keeper's Quarters was expanded over time, first with a larger second story, with later additions to the rear, and eventually with a new two-story quarters built to one side for the Assistant Keeper. The combined sections of the building, known together as the Keepers' Quarters, is significant both architecturally and historically. Both sections now house NPS staff and their families.

Between the lighthouse at the north end of the fenced light station and the Keepers' Quarters well to the south, are several outbuildings and two cisterns. All provide testimony to the evolution of the light station.

The General Management Plan (GMP) prepared for the Cape Hatteras National Seashore in 1984 states that the management strategy for lighthouse and keepers' quarters is to "preserve and maintain." Without distinguishing between the two buildings, it acknowledges the uses as "residence/interpretation" and prescribes that the exteriors be "preserved" and the interiors be treated for "adaptive use."

Methodology

The objectives of this Historic Structure Report (HSR), which complies with the guidelines of NPS-28, are to research and prepare a comprehensive and scholarly assessment of the building's history and fabric and its existing physical conditions, and to recommend treatment for preservation.

The findings and recommendations made in this report rely on the combined research of primary and secondary sources, early photographs, oral histories, and the physical investigation of extant building fabric.

The NPS Scope of Work for this HSR places the level of background research for this report as "limited investigation," as defined in NPS-28. However, because of the scarcity of written documentation, additional research was necessary for an adequate understanding of the context and history of the site.

Physical investigation of the buildings to determine their evolutionary histories was a large component of the work. That investigation involved a close look at features in the buildings and at details such as framing materials and methods; the relationship of finish treatments; and the variety of siding, ghost marks, and nail types. Research efforts, both documentary and physical building fabric, were designed to create a dual, coordinated approach to determining how the building was used and adapted over the progression of the Light Station's history.

The firm of Joseph K. Oppermann – Architect, P.A. (JKOA), prepared this HSR. The team for this property included Joseph K. Oppermann, FAIA, historical architect and principal-in-charge; Rebecca L. McCormick, AIA, and Christopher M. Woollard, Associate AIA, assisting architects; and Langdon E. Oppermann and Laura A. W. Phillips, architectural historians. The team researched, investigated and documented these buildings and authored this HSR. This interdisciplinary approach improves understanding of history and conditions, which aids the development of appropriate treatment recommendations.

An initial multi-day visit to the site and the archives was made in April, 2013 with additional follow-up visits in May, 2013. Measurements were compiled using manual measuring tape, carpenter ruler, digital camera, and digital recorder, a Leica Disto laser distance meter. Overall photography was completed for both exterior and interiors. Detailed field drawings were made. Upon return to the office, these field drawings were used to create digitized AutoCAD drawings of floor plans and a sampling of architectural trim. The digitized floor plan became the base document on which final recordations and assessed conditions were made during the subsequent return trips.

During these subsequent trips, a standard assessment methodology was used for the condition survey of each exterior feature and each interior room, itemizing features and elements. Detail photography was conducted. Visual observation of surface conditions supplemented with a 20-power magnification loupe and Protimeter BLD 2000 moisture meter were the method and instruments of assessing the physical condition of building materials. In accordance with the NPS scope of work, no building system components were tested, and no invasive methods of investigation were employed. Tape measure and digital cameras were used to record the size, design and location of components and conditions.

Findings

The initial construction of the Lighthouse and the original Keeper's Quarter are well documented though with some deviation from the original contract. Major phases of changes to both are as well. Fewer documents are associated with the ancillary structures. The records, in a variety of forms including construction documents, are filed in the archives of the Cape Hatteras National Seashore in Manteo, North Carolina.

Lighthouse

This is the most significant building of the site and, indeed, the island. While it retains much of its historic character, some of the repairs from and since the middle decades of the twentieth century have unintentionally harmed rather than enhanced this important building. The unfortunate changes bear monitoring, evaluation for eventual correction, and possibly a measure of intervention during the interim.

A major change to the interior was the removal of the early wood staircase in the early 1950s and installation of the modern metal staircase now in place. Though the new stair does not appear to be causing further damage to the building, its installation is a significant change to the prominent interior feature. Passage along the new route of travel, which is now clockwise instead of the original counterclockwise, fails to align with the windows as the original staircase did. This creates a significantly different experience than climbing the original stairs.

Chief among the harmful changes is the application of the shotcrete (a pneumatically applied mixture of cement or mortar also known by the trade name Gunite) to the exterior wall surfaces and the sandblasting of the interior wall surfaces. Coupled together, these changes have seriously affected the shell wall of the lighthouse.

The capacity of the original construction system to perform as intended has been compromised by the rigidly impervious shotcrete coating. The original parge coat, like the mortar beds of the masonry, was intended to be sacrificial. The hand-applied coating was removable, repairable, and most importantly, allowed for movement and differential settlement of the building. As cracking occurred, it could have easily been repaired. The pneumatic adhesion of the shotcrete makes repairs difficult to impossible without full reapplication of the exterior coating. The rigidity of the surface worsens cracking from settlement. The severity of the damage can be expected to increase with time.

The shotcrete coating is a Portland cement-based mortar mixture, much harder than the lime-based mortar of the brick wall it coats. The shotcrete created a non-breathable, watertight surface on the brick, effective in keeping water out, but problematic in that it traps moisture inside the permeable masonry. Seasonal freeze-thaw cycles cause heaving and spalling of the masonry, accelerating the deterioration of the brick.

The shotcrete also changed the aesthetic character of the design of a brick tower and stone base. The 1892 construction drawing of the Lighthouse indicates that the original cut-stone foundation was just visible above grade, meaning the juncture between the top of the stone foundation and the bottom of the brick shell wall was visible. The shotcrete as applied coats the tower all the way to grade, covering the once visible stone foundation.

The structural integrity of brick units that comprise the interior surfaces of the walls have been damaged by the sandblasting. The original whitewashing on the interior surface of the brick shell wall would have served to protect the brick from seasonal changes of humidity within the tower. The sandblasting not only damaged the protective harder surface of the brick, but left the soft interiors exposed.

Another unfortunate repair, though far less serious, is the replacement of the early wood windows. The new windows, while approximating the historic configuration, are constructed of far less durable material and are not detailed for longevity. The windows, while not causing harm, cannot be expected to provide weather-tight enclosures for very long.

Though popular, visitation to the interior is infrequent due to the continuing shortage of volunteers guides. Unfortunately, access is further hindered for all but the more able bodied by a pronounced change in grade at the entrance doorway.

Keepers' Quarters

The other large building of the complex, the Keeper's Quarters, is architecturally and historically significant. The preserved exterior contributes to the public understanding of the historic evolution of the site. The two private quarters provide valuable living space for National Park Service staff. The building is generally well cared for.

The recently installed roof is an unfortunate modification. The modern design of tall tightly-spaced seams and bright red factory-applied finish are jarring and incongruous with the historic character of the place. When it is time for replacement, a more historically accurate design with a historically-appropriate color is recommended.

The hanging gutter system has been problematic in recent years, filling with leaves and pulling loose from the wood trim. The maintenance of a protective exterior paint layer on exterior wood and ferrous metal elements is difficult but critical in the harsh marine climate. Termites have been a recurring problem.

Outbuildings & Cisterns

The outbuildings and cisterns are testimony to the operation of the lighthouse and the evolution of the historic site. The buildings also provide valuable enclosed space for a variety of uses.

The most serious deterioration of building elements is found at the cast iron door and vents of the Oil House. All four vents are cracked and rusted. The protective paint finish on the cast-iron door is failing and the metal is beginning to corrode.

As at the Keepers' Quarters, maintenance of exterior wood elements of the outbuildings is a continuous challenge.

Recommended Treatments and Uses

Recommendations for the treatments and uses of the buildings at the Light Station echo the treatment and use strategy of the 1984 CAHA General Management Plan,

- ***The Recommended Ultimate Treatment for the exteriors of the Lighthouse and the Keepers' Quarters, as well as the outbuildings and cisterns, is Preservation.***
- ***The Recommended Ultimate Treatment for the interior of the Lighthouse is also Preservation.***
- ***The Recommended Ultimate Treatment for the Keepers' Quarters and outbuildings is Rehabilitation.***

- ***The Recommended Ultimate Use for the Lighthouse is interpretation for its historic role on the Outer Banks and the community of Ocracoke.***
- ***The Recommended Ultimate Use for the Keepers' Quarters is housing for NPS staff while its preserved exterior contributes to the interpretation of the historic light station.***
- ***For the outbuildings and structures, the Ultimate Uses are ancillary functions in support of the operation and maintenance of the site, while their preserved exteriors contribute to the interpretation of the historic light station.***

This management strategy continues the effective plan for use currently in place. It also recognizes the importance of historical interpretation as the focus of both the exterior and interior of the lighthouse, and of the exteriors of the other structures of the station. In addition, these treatments are the most cost effective.

Recommended specific actions to support these treatments and uses include the following:

Light Station - General

Barrier islands, such as Ocracoke, will be especially vulnerable to the effects of climate change and sea-level rise, which may negatively affect cultural resources on these islands.

Recommendations:

- Consult with Janet Cakir PhD, NPS SER Climate Change, Socioeconomics, and Adaptation Coordinator to guide management policies.
- Use results from the climate change study "Identify Cultural Resources Sites Affected by Sea-Level Rise at Cape Hatteras National Seashore" to guide management policies.
- Prepare or update Topographic Survey for the site.
- Prepare a Log of Flood Occurrences. Record at a minimum the dates of occurrences and approximate extent and severity (e.g. depth at specific locations). Correlate recordings with Topographic Survey. Maintain data so that they can be correlated with conditions such as tide, moon phase, etc.



Figure 2. Misalignment of ramp with threshold of lighthouse entrance door is a barrier for accessibility. Pillowing around masonry openings is a result of shotcrete coating. (2012)

- Evaluate site for flood avoidance potential including the introduction of dams and/or swales to divert or direct flooding waters.
- Evaluate each building, structure, and significant site feature for flood avoidance potential and/or enhancement potential for better withstanding the projected threatening events.
- Identify critical services (fresh water supply, waste disposal, energy sources, etc.), evaluate options, and develop a contingency plan for each.
- Strive to maintain for all buildings a sound structural system and a weather-tight exterior envelope, especially the roof.
- Use maintenance activities as opportunities to enhance the resistive capacities of the buildings and structures whenever feasible.

Site

Recommendations for the Site:

- As an immediate but temporary measure to promote access into the Lighthouse by handicapped persons, provide a small movable ramp that can be kept nearby (perhaps in the lighthouse) and installed when needed.
- Plan now for a more suitable and permanent design solution for access.
- Secure clearance from an archaeologist before commencing work that might require ground disturbance.

Lighthouse

Recommendations for the Masonry Walls:

- Make annual visual inspections to monitor the walls for new signs of distress.
- Make a base record drawing set and plot the hairline cracks that are visible on both the exterior and the interior faces, primarily along the north and south portions, and periodically spot check. Install crack monitors at the most egregious crack locations.
- Locate and archive the samples of original lime-based fulcrum mortars, the 1850s natural cement lantern mortars, the exterior parging and the 1950s shotcrete which were gathered by Blain Cliver in 1989 for the 1990 Historic Structure Report. If samples cannot be located, take new samples and archive.
- Take coring samples of the fulcrum in select locations to identify the nature and condition of the interior wythes. Ensure samples are archived.
- Consider compiling a series of thermographic images to document moisture patterns in the masonry walls. Repeat periodically. Correlate with core samples.
- Test, with strict control parameters, potential methods for removing the shotcrete.
- Sample and test the composition of the remnants of applied finish on the interior wall surfaces. Evaluate potential value of reapplication as a protective shelter coat against seasonal freeze-thaw cycles.

Recommendations for Wood Windows:

- Make annual visual inspections to monitor for signs of damage and deterioration.
- Plot the areas of damages on a set of elevation drawings and periodically spot check.
- Maintain a protective paint finish on both the exterior and interior surfaces.

Recommendations for Lantern:

- Make annual visual inspections to monitor signs of damage and deterioration, with special attention to features at exterior locations.
- Plot areas of damages on elevation and plan drawings and periodically spot check.
- Maintain a protective paint finish on all ferrous metal features.

Keepers' Quarters

Recommendations for the Keepers' Quarters:

- Make regularly scheduled inspections, at least on an annual basis, to monitor for signs of damage, deterioration, and wear, both inside and out.
- Plot the areas of concern on a set of plan drawings; periodically spot check and update notations.
- Locate, sample, and test the composition of original/early bedding and pointing mortars to inform repairs of masonry features.
- Locate, sample, and record the serialization of the original/early paint and other historic finishes, both exterior and interior.
- Periodically inspect brick perimeter walls and porch piers for condition and stability. Make in-kind repairs as needed using pre-established mortar mixes. The proper mortar avoids future damage to the brick. Maintain termite shields at porch posts.
- Periodically inspect the building envelope (siding, doors, windows, trim, porches and roofs) for deterioration and potential for water intrusion. Promptly make in-kind repairs or when an element, such as the modern roofing, is out of character, replace with a more appropriate design.
- Maintain a protective paint finish on all exterior finished wood and ferrous metal elements.
- When adapting the interior for modern uses, strive to maintain the major components of the early floor plans.
- While accommodating changes in lifestyle, strive to retain early interior features and the character defining qualities.
- Strive to locate modern utilities where the installation, operation, and process of repairs cause the least damage to significant historic features.

Outbuildings & Cisterns

Recommendations for Outbuildings and Cisterns:

- Repair the four cast-iron vents of the oil house.
- Make regularly scheduled inspections, at least on an annual basis, to monitor for signs of damage and deterioration.

- Plot the areas of damages on a set of elevation and plan drawings; periodically spot check and update notations.
- Throughout the year keep plant material from the base of all buildings and structures.
- Periodically inspect foundation posts and piers for condition and stability. Make in-kind repairs as needed.
- Maintain termite shields in good condition.
- Periodically inspect the building envelope (siding, doors, windows, trim, and roof) for deterioration and potential for water intrusion. Promptly make in-kind repairs where compromised.
- Maintain a protective paint finish on all ferrous metal features and all exterior finished wood elements.

An alternate treatment of restoring both the interior and exterior of the Lighthouse to an early appearance was also considered. While this treatment addresses two modern modifications that threaten the long-term survival of the lighthouse, the incompatible shotcrete and poor quality replacement windows, a full restoration also replacing the modern staircase is cost prohibitive.

Administrative Data

Locational Data

Property Name:	Ocracoke Light Station
Location:	Cape Hatteras National Seashore
County:	Hyde County
State:	North Carolina

Real Property Information

Acquisition Date:	*2000*

Numbering Information

LCS ID:	Lighthouse: LCS 000016 Keepers' Quarters: LCS 007237 Store House/Pump House: LCS 091907 ("Shed") Carpenter's Shop: LCS 091908 ("Tool House") Oil House: LCS 091909 Privy: LCS 091910 Cisterns: LCS 091911

Size Information

Primary Structures:

Lighthouse

Total Floor Area:	235 square feet ±
Roof Area:	50 square feet ±
Number of Stories:	2
Number of Rooms:	2
Number of Bathrooms:	0

Keepers' Quarters

Total Floor Area:	2720 square feet ±
Roof Area:	1975 square feet ±
Number of Stories:	2
Number of Rooms:	20
Number of Bathrooms:	2

Secondary Structures:

Carpenter's Shop
Total Floor Area: 290 square feet ±
Number of Stories: 1

Generator House
Total Floor Area: 110 square feet ±
Number of Stories: 1

Oil House
Total Floor Area: 80 square feet ±
Number of Stories: 1

Privy
Total Floor Area: 15 square feet ±
Number of Stories: 1

Pump House/Store House
Total Floor Area: 230 square feet ±
Number of Stories: 1

Cultural Resource Data

National Register Status: Name: Ocracoke Light Station;
Contributing structures
November 25, 1977: Listed

Proposed Treatment

Preservation of interior and exterior of the Lighthouse, and the exteriors of the Keepers' Quarters and all outbuildings and ancillary structures. Rehabilitation of the interiors of the Keeper's Quarters and all outbuildings and ancillary structures.

Related NPS Studies

Completion Reports

Ocracoke Lighthouse, Phase I and II, Lighthouse Grant Project, July 1990.

Ocracoke Lighthouse, Phase III Project, 1991.

Ocracoke Lighthouse, Window and Door Replacement Project, 1990.

Ocracoke Light Station Keeper's [*sic*] Quarters, Preservation Project Phase I, National Park Service, 1987.

Ocracoke Light Station Keeper's [*sic*] Quarters, Preservation Project Phase II. Ocracoke, NC: Cape Hatteras National Seashore, 1988.

Impact Assessment, Inc. *Ethnohistorical Description of the Eight Villages adjoining Cape Hatteras National Seashore and Interpretive Themes of History and Heritage*. Final Technical Report, Vol. 2. Atlanta: National Park Service Southeast Regional Office, 2005.

Ocracoke Lighthouse, Cape Hatteras National Seashore, North Carolina, Historic Structure Report. National Park Service, 1990.

Oppermann, Joseph K. *Cape Hatteras National Seashore, Bodie Island Light Station Double Keepers' Quarters Historic Structure Report*. Atlanta: National Park Service Cultural Resources Division, Southeast Region, 2009.

_____. *Cape Lookout Lighthouse, Cape Lookout National Seashore, North Carolina, Historic Structure Report*. Atlanta: National Park Service Cultural Resources Division, Southeast Region, December 2008.

Warfield, Ronald G. National Register nomination for Ocracoke Light Station. National Park Service: 1977.

Wiss, Janney, Elstner Associates, Inc. and John Milner Associates, *Portsmouth Village, Cultural Landscape Report, Cape Lookout National Seashore*. Atlanta: National Park Service Southeast Regional Office, 2007.

I.A Historical Background and Context

The Outer Banks

The coastline of North Carolina extends for 301 miles – more than a quarter of the total coastline of the thirteen English colonies in America. Yet, with all this, North Carolina historically had few deepwater ports.[1] Instead, slender barrier islands, known as the Outer Banks, front the Atlantic Ocean and shelter the mainland.

The formation of the Outer Banks began fifteen thousand years ago when the ocean level was 300 feet lower than today and North Carolina's coast extended fifty to seventy-five miles east of its present location. Winds from the west piled up sediment to create a large dune at the easternmost edge of the continental landmass. Then, as glaciers melted and the sea level rose, the dunes became barrier islands paralleling the coastline.[2]

With some islands thirty miles from the mainland, the Outer Banks are particularly vulnerable to hurricanes and storms that continually resculpt the fragile landscape. Consequently, historical records beginning in 1585 document more than twenty-four inlets cutting through the Outer Banks at various times. Geographic formations indicate that almost half of the Outer Banks has been breached by inlets at one time or another. Today there are six inlets between Morehead City and the Virginia state line.[3]

Several inlets spaced along the Outer Banks at different times allowed seagoing traffic to reach mainland ports.[4] In the early eighteenth century,



Figure 3. Engraving of Blackbeard, hair woven with flaming fuses, ca. 1715. (Hulton Archive, Getty Images)

these inlets also helped pirates find temporary safe haven around the islands. Piracy, in fact, became another danger that mariners confronted along the North Carolina coast. Most notorious was Edward Teach, popularly known as "Blackbeard" (*Fig. 3*). With a fleet of four vessels and a crew of well over 100 pirates, he was responsible for the capture of twenty-five ships between 1716 and 1718. Teach remained a menace and eluded capture until Robert Maynard's crew on a British warship engaged the pirates in battle at Ocracoke Inlet on November 22, 1718, killing Teach. The death of Blackbeard brought an end to the golden age of piracy along the North Carolina coast.[5]

1. David Stick, *North Carolina's Lighthouses* (Raleigh: Division of Archives and History, North Carolina Department of Cultural Resources, 1980), pp. 5, 7.
2. Orrin H. Pilkey et al., *The North Carolina Shore and Its Barrier Islands, Restless Ribbons of Sand* (Durham: Duke University Press, 1998), pp. 41- 45; Karen Bachman, "Shipping and Settlement into the 1770s," in *The Insiders' Guide to North Carolina's Other Banks, 26th edition*, http://www.insiders.com/outerbanks/main-history.htm#tod.
3. Bachman, *Insiders' Guide,* www.insiders.com/outerbanks/main-history.htm#tod.
4. Wiss, Janney, Elstner, Associates, Inc. and John Milner Associates, *Portsmouth Village: Cultural Landscape Report, Cape Lookout National Seashore* (National Park Service Southeast Regional Office, 2007), p. 17.
5. Impact Assessment, Inc., *Ethnohistorical Description of the Eight Villages adjoining Cape Hatteras National Seashore and Interpretive Themes of History and Heritage* (National Park Service Southeast Regional Office, 2005), p. 11.



Figure 4. Detail from Henry Mouzon's "An Accurate Map of North Carolina and South Carolina, 1775," showing Ocracoke Island and Inlet. (North Carolina Collection, Wilson Library, UNC-Chapel Hill)

Ocracoke Island Settlement

Located between today's Hatteras and Portsmouth Islands, Ocracoke is a sixteen-mile-long island ranging from one-half to two miles wide. Like the other islands of the Outer Banks, early Ocracoke was largely inaccessible and conditions were difficult. It was exposed to violent storms over a topography of shifting sands and stunted vegetation. Settlement was generally small and scattered. However, Ocracoke Inlet was of such importance to colonial commerce that in 1715 North Carolina's colonial assembly passed an act for "settling and maintaining pilots" at Ocracoke Inlet. The pilots, who guided ships across Pamlico Sound, settled Ocracoke Village, originally known as Pilot Town, at the south end of the island near the inlet.[6]

By the 1730s, most of the inlets along the Outer Banks were unusable as storms closed or shoaled them. Ocracoke Inlet, however, at the south end of Ocracoke Island, remained navigable and for many years served as the principal ocean passage along the North Carolina coast. During the Revolutionary War, supplies for Washington's army were guided through the inlet (*Fig. 4*).

Between the late eighteenth and early nineteenth centuries, Ocracoke developed from a remote outpost of pilots into a small maritime village that had not only houses, but a small number of businesses, one or two churches, and one or two schools.[7] The lighthouse at Ocracoke was built in 1823. Its importance during the first two decades of operation was tied to Ocracoke Inlet as the only navigable inlet in that section of the Outer Banks from 1828 to 1846. In 1842 the U.S. House Committee on Commerce stated, "Ocracoke Inlet is the outlet for all commerce of the state of North Carolina, from the ports of Newbern [*sic*], Washington, Plymouth, Edenton, and Elizabeth City…more than two thirds of the exports of

6. *The State Records of North Carolina: Laws, 1715-1776,* North Carolina Trustees of the Public Libraries (AMS Press, 1904).

7. M. Ruth Little et. al., National Register nomination for Ocracoke Historic District (North Carolina Department of Cultural Resources, 1990), pp. 7:1, 8:7.

the State of North Carolina pass out to sea at this point."[8] During those decades, approximately 1,400 loaded vessels annually passed through the inlet, guided by the Ocracoke Lighthouse. Naturally, the village of Ocracoke prospered during this period, and by 1850 it had a population of 536 people.[9]

However, in 1846, a heavy storm cut a new inlet to the north, splitting Ocracoke Island to create a separate island named Hatteras. The new Hatteras Inlet gradually siphoned shipping away from Ocracoke Inlet and became the major inlet by the 1860s.[10]

Ocracoke became primarily a fishing village, with life-saving stations also providing employment, and by the twentieth century became popular for its hunting and fishing lodges and as a summer retreat. Tourism increased when regular ferry service began in 1959.[11]

The Graveyard of the Atlantic

When the Spanish settled in the New World, they soon learned that their ships could often save weeks of travel time by sailing north with the Gulf Stream along the Atlantic coast to the Outer Banks and then turning northeast for the rest of their journey back to Europe. The Gulf Stream provided a trade route not only for ships bound for Europe but also for vessels sailing up and down the East Coast.[12] However, the same currents that increased the speed of sailing ships also brought them perilously close to the shifting sand bars of the Outer Banks. Once grounded, ships were soon torn apart by the turbulent waters, their crews without assistance. Historian David Stick vividly describes the sea conditions: "the northbound Gulf Stream and the cold currents coming down from the Arctic run head-on into each other, tossing their spumy spray a hundred feet or better into the air and dropping sand and shells and sea life at the point of impact."[13]

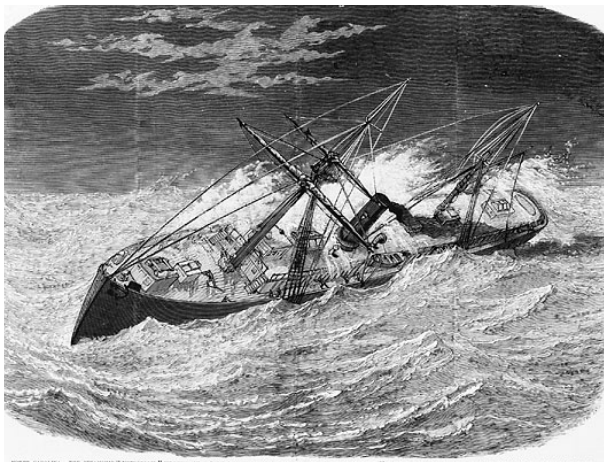


Figure 5. "The steamship *Metropolis,* wrecked in a gale off Currituck Beach, on the night of January 31st [1878], with the loss of one hundred [people], on their way to Brazil," *Frank Leslie's illustrated newspaper*, Feb. 16,1878, p. 413. (Library of Congress Cat. 93502864)



Figure 6. Shipwreck recently exposed on Outer Banks beach. (NPS)

The first recorded shipwreck was of Sir Richard Grenville's flagship *Tyger* at Ocracoke Inlet in 1585. Since then, hundreds of ships have wrecked along North Carolina's treacherous coastline, earning it the moniker, attributed to Secretary of the Treasury Alexander Hamilton, of "Graveyard of the Atlantic." Today few ships wreck, but storms still uncover the ruins of old shipwrecks along the beaches of the Outer Banks (*Figs. 5-6*).[14]

America's Lighthouse Program

Support for maritime shipping along the Atlantic coast was recognized early on as an important concern at both colonial and national levels. The first lighthouses in America were sited

8. David Stick, *The Outer Banks of North Carolina*, 1584-1958 (Chapel Hill: The University of North Carolina Press, 1958), p. 40; Wiss, Janney, Elstner, *Cultural Landscape Report*, p. 25, cites Stick, *The Outer Banks*, pp. 87-88.
9. Currituck Inlet closed in 1828. *Ocracoke Lighthouse HSR, 1990.*
10. Little, National Register nomination, p. 8: 2.
11. Ibid., p. 7: 9.
12. Candace Clifford, National Register nomination for Bodie Island Light Station (North Carolina Department of Cultural Resources, 2003), p. 19.
13. David Stick, *Graveyard of the Atlantic: Shipwrecks of the North Carolina Coast* (Chapel Hill: The University of North Carolina Press, 1989), p. 1.
14. Molly Perkins Harrison, *It Happened on the Outer Banks* (Guilford, CT: The Globe Pequot Press, 2005), pp. 10-15; "Under Sea Graveyard along the Outer Banks Holds the USS Monitor," 19 July 2005, www.kittyhawkfreepress.com/atlanticgraveyard.html.

where coastal populations were concentrated and local businesses were growing. During the colonial period, the individual colonies assumed responsibility for the construction and maintenance of lighthouses on their shores. These towers generally were paid for by the merchants and businessmen at each location and supported by a duty on ships entering the harbor. During this time, however, no standards addressed the priority, placement, construction or operation of lighthouses.[15]

With the adoption of the United States Constitution in 1787, the newly created Federal government was empowered to address navigational safety as a national concern. Aids to navigation were of such high priority that one of the first official acts of Congress was the passage of the Lighthouse Act of 1789, placing responsibility under Secretary of the Treasury Alexander Hamilton. In short order, most locally-owned lighthouses were transferred to the U.S. Treasury.[16]

15. Joseph K. Oppermann, *Cape Lookout Lighthouse Historic Structure Report* (National Park Service Southeast Regional Office, 2008), p. I.A.2.
16. "An Evolving Coast Guard," in *Doctrine for the U.S. Coast Guard* (Coast Guard Publication 1, U. S. Coast Guard, February 2014), p. 28.



Figure 7. Pitcher showing Shell Castle Island Lighthouse and surrounding development. (North Carolina Museum of History)

In North Carolina by the end of the eighteenth century, maritime traffic along the barrier islands had increased to more than a dozen ships a day; however, they were navigating with little organized assistance.[17] Given the number of shipwrecks along the Outer Banks, the urgency for measures that would aid navigation prompted the North Carolina General Assembly in 1789 to pass an act to erect a lighthouse on Ocracoke Island. The following year, William Howard, Jr. and brothers William, John, and Joseph Williams deeded an acre of land on Ocracoke Island for the construction of a lighthouse. However, this site was never used.[18]

Shell Castle Island Lighthouse

The concerns of local pilots and merchants, as well as those of the owners and captains of vessels that used Ocracoke Inlet, prompted construction of the lighthouse to be redirected to nearby Shell Castle Island, just inside Ocracoke Inlet. On November 29, 1797, entrepreneurs John Blount and John Wallace sold a quarter-acre lot to the federal government for a lighthouse and keeper's dwelling. They developed the twenty-five acre, oyster-shell covered island with docks, warehouses, a grist mill, at least one small store, a windmill, and several dwellings (*Figs. 7-8*). Bids for construction of the lighthouse and keeper's dwelling were taken, and multi-talented Henry Dearborn of Boston was awarded the contract.[19]

17. 25th Cong., 2nd Sess, House Doc No. 41 (Serial #322), p. 60; 25th Cong., 2nd Sess, House Ex. Doc No. 24 (Serial #345), p. 113.
18. Phillip Howard, "Ocracoke Lighthouse," *Ocracoke Newsletter* (August 1, 2004), http://www.villagecraftsmen.com/news080104.htm; *Ocracoke Lighthouse, Cape Hatteras National Seashore, North Carolina, Historic Structures Report (HSR)* (National Park Service, 1990), p. 9.
19. Dennis L. Noble, *Lighthouses & Keepers: The U.S. Lighthouse Service and its Legacy* (Naval Institute Press, 2014), n.p.

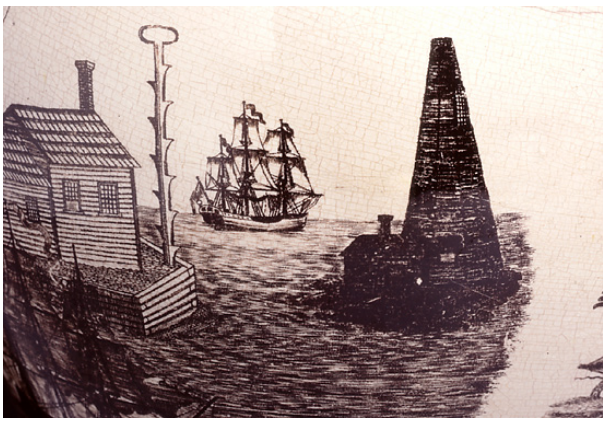


Figure 8. Detail of pitcher, showing close-up of lighthouse. (North Carolina Museum of History)

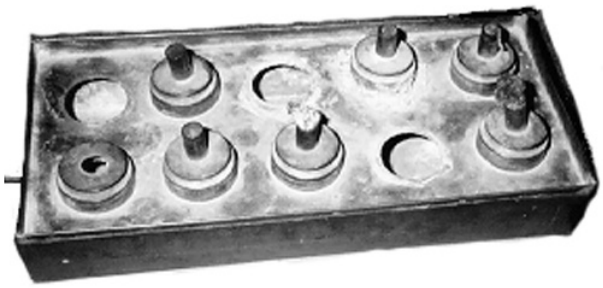


Figure 9. Typical Pan Lamp, also called spider lamps, this one with ten "blazes" (ca.1760). Pan lamps varied from two wicks to twenty-four, with eight to ten more common. (Maine Lighthouse Museum)

At the same time, Dearborn was awarded the contract for building the Cape Hatteras Lighthouse. The lighthouse built on Shell Castle Island rested on a substantial stone foundation and was a fifty-five-foot, pyramidal-shaped wood structure covered with cedar shingles. A six-foot enclosure at the top of the tower with a crowning dome contained the lantern. The lighthouse and associated dwelling were completed in 1798.[20]

The lighthouse on Shell Castle Island was short-lived. By 1814, storms had caused the channel to shift significantly and shoal up to the extent that the lighthouse was no longer effective. Then, in 1818, lightning destroyed both the wooden lighthouse and the keeper's dwelling. Instead of rebuilding, in 1820 Congress appropriated money to station a lightship, or floating lighthouse, in Ocracoke Inlet to direct ships through the channel. However, the lightship proved unsatisfactory.[21]

Sending Out a Light

Lighthouses are simply towers that support a beacon produced by combining a lamp and fuel. Early lighthouses relied on multiple candles and simple oil lamps; hence the quantity of light was measured in candlepower. As maritime commerce increased, so did the quality of lights. By the late eighteenth century, American lighthouses were using spider lamps, also called pan lamps, with numerous wicks; these, however, consumed a high quantity of oil and produced heavy smoke and fumes (*Fig. 9*).[22]



Figure 10. Francois-Pierre Ami Argand (1750-1803), Swiss-born physicist living in France who invented the hollow wick capillary lamp, known as the Argand lamp. (http://uslhs.org/history/builders-inventors)

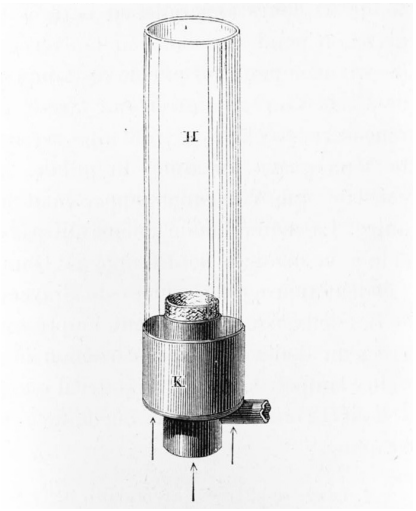


Figure 11. Argand Lamp with circular wick and glass chimney. (Illustration from Les Merveilles de la Science [1867–1869] by Louis Fiquier. LOC # 9951972)

Light production improved in 1781 with the design of Swiss physicist and chemist Francois-Pierre Ami Argand; his was a single-wick lamp with air flow design that emitted as much light as seven candles (*Figs. 10-11*).[23] The Argand Lamp became the common light in public buildings and private homes.[24]

Britain was also making advances in lighthouse technology. By the early nineteenth century, its chief supplier of lamps was optics expert

20. Howard, "Ocracoke Lighthouse; in *Ocracoke Lighthouse HSR*, 1990, p. 9.
21. *Ocracoke Lighthouse HSR*, 1990, p. 9.
22. Francis Ross Holland, Jr. *America's Lighthouses: an Illustrated History* (New York: Dover Press, 1988), pp. 21-23.
23. Lighthouses of the Western Great Lakes," http://www.terrypepper.com/lights/closeups/illumination/argand/lewis-lamp.htm.
24. http://www.terrypepper.com/lights/closeups/illumination/argand/lewis-lamp.htm

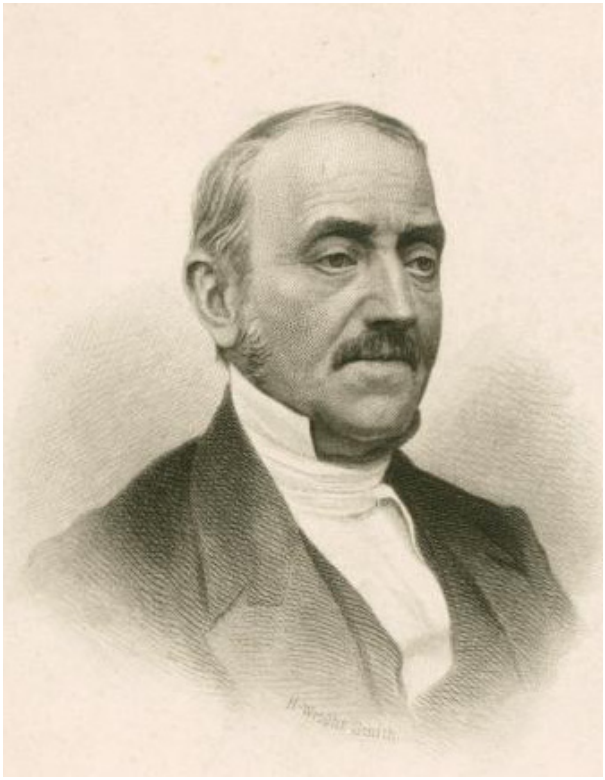


Figure 12. Winslow Lewis (1770-1850). (New York Public Library Digital Gallery, ID# 1559607)

George Robinson. In 1809 his parabolic reflectors were installed in the lighthouse at South Stack in Wales.[25] Scotland's Robert Stevenson also improved parabolic lamps; his lamp was installed in Scotland's Bell Rock Lighthouse in 1811.[26]

The incorporation of parabolic reflectors with the lamps was developed perhaps by Argand himself, by Robinson, or even by Stevenson, but its American use is attributed to unemployed sea captain Winslow Lewis, a self-styled inventor who eagerly accepted the credit (*Fig. 12*).[27] Lewis, who confessed that he knew nothing of lighthouse optics, presented his "reflecting and magnifying lantern" in the United States in 1810 soon after seeing Robinson's lenses at South Stack (*Fig. 13*).[28] The Lewis lamp, as it was called, was similar to Robinson's, but with a flawed design—in shape (more spherical than parabolic), in inferior

25. United States Lighthouse Society, http://uslhs.org/lens-use-prior-fresnel.
26. http://uslhs.org/lighthouse-lamps-through-time.
27. S.G. Drake, *The New England Historical & Genealogical Register and Antiquarian Journal*, Vol. 17 (Albany: J. Munsell, 1863), p. 8. Ray Jones, *The Lighthouse Encyclopedia: The Definitive Reference* (Guilford, CT: The Globe Pequot Press, 2004*), p. 25.*
28. http://uslhs.org/history/reflectors.

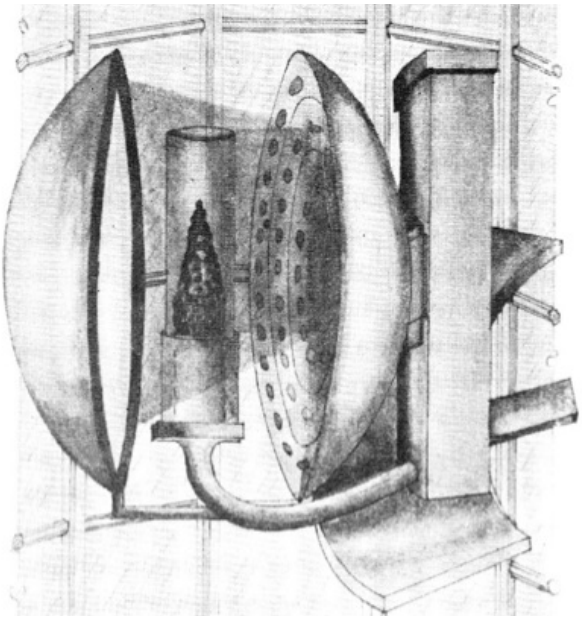


Figure 13. Nineteenth century drawing of Winslow Lewis's patented lighthouse lamp, which stole heavily from Argand's design and others' incorporation of parabolic reflectors. (U. S. Coast Guard Historian's Office)

materials, in assembly, and finally in function. It produced a weak light, required frequent cleaning, and was easily damaged.[29] The lamp nevertheless became the standard in United States lighthouses.

Winslow Lewis (1770-1850) was born in Cape Cod, the son of a sea captain of the same name.[30] A sea captain himself, he was out of work during the 1807 embargo that prohibited exports from the United States, and remained unemployed when it was lifted. It was then that he turned to lighthouse lamps. After a successful test in the United States in 1810, Lewis was granted a patent for his lamp design (*Fig. 14*). In 1812, Congress authorized a $60,000 contract with Lewis; the Secretary of the Treasury then purchased the patent rights from Lewis and contracted with him to install lights in all of the nation's forty-nine lighthouses.[31]

When all were equipped, Lewis pursued more lighting work. A crafty businessman, he skirted the normal bidding process and in 1816 secured

29. http://uslhs.org/lens-use-prior-fresnel. Lighthouses of the Western Great Lakes," http://www.terrypepper.com/lights/closeups/illumination/argand/lewis-lamp.htm.
30. Drake, *Antiquarian Journal*, Vol. 1, p. 8.
31. United States Bureau of Light-Houses, *Compilation of public documents and extracts from reports and papers relating to light-houses, light-vessels, and illuminating apparatus and to beacons, buoys and fog signals. 1789-1871*, p. 323.

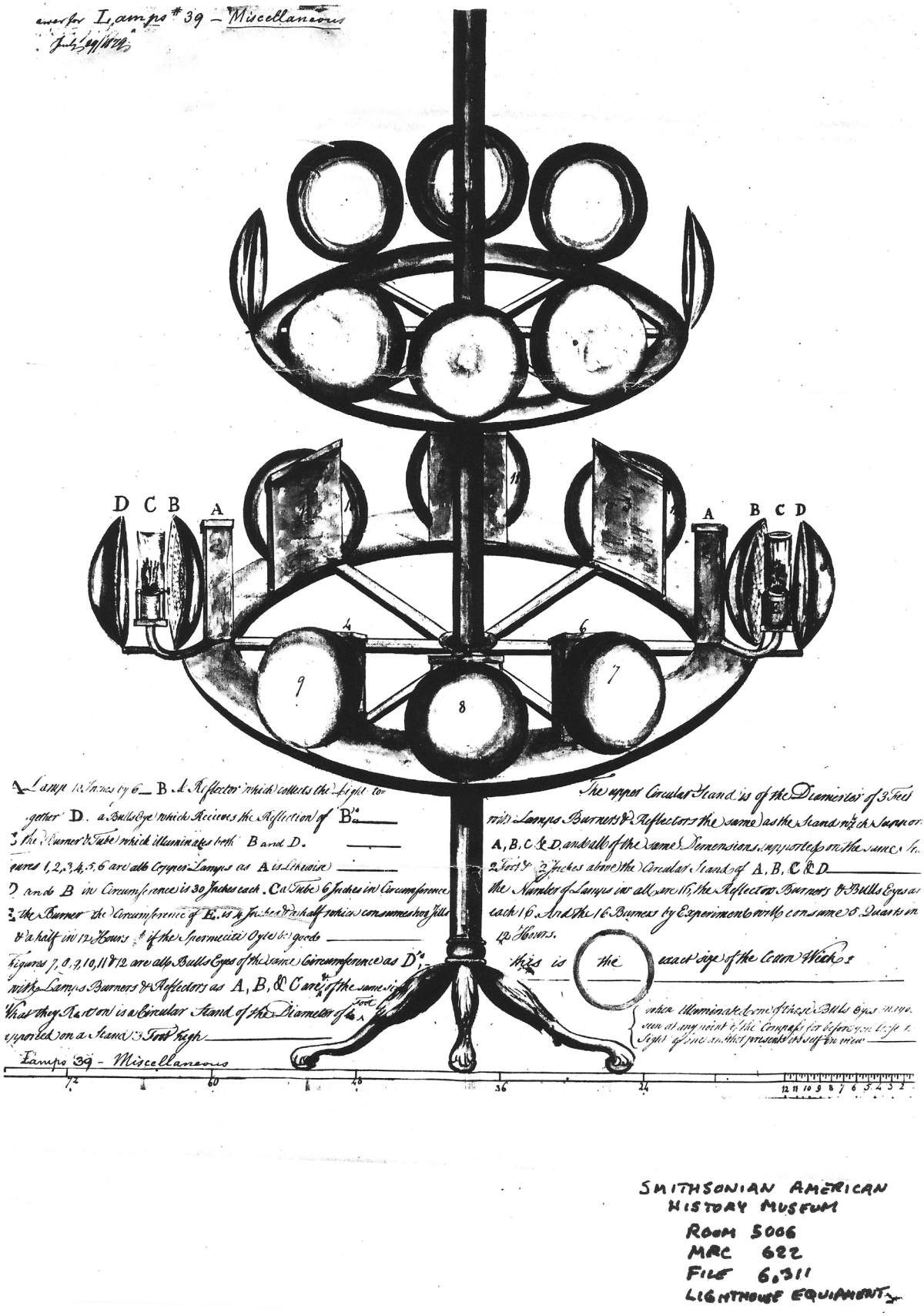


Figure 14. U.S. Patent Office, specification drawing for Letters Patent No. 1305-X, dated June 8, 1810, for Winslow Lewis of Boston, Massachusetts, Magnifying and Reflecting Lantern. (National Museum of American History)

a lucrative contract to supply the oil for all east coast light stations and to visit and report on each once a year.[32] These responsibilities effectively made Lewis the unofficial superintendent of lighthouses.[33]

Lewis expanded his involvement even further. In 1818, he criticized the design of a Louisiana lighthouse, but then offered to construct the base. Ensconced as he was in the nation's lighthouse programs, he managed to first declare a design to be flawed, then build the same design with a contract stipulating no penalty for failure. And the foundation did indeed fail, apparently due to Lewis's failure to follow the design. In a scenario to be repeated many times, Lewis was not penalized. On the contrary, he was awarded a new contract to build a replacement lighthouse of his own design.[34] Like his lamp system, Lewis's lighthouse design would become the standard.

32. Ibid.
33. Noble, *Lighthouses & Keepers*, n.p.
34. David L. Cipra, *Lighthouses, Lightships, and the Gulf of Mexico* (Alexandria, Virginia: Cypress Communications, 1997), pp. 135-37. Noble, *Lighthouses and Keepers,* n.p.

During Lewis's tenure, one of the great improvements in lighthouse technology was developed by the Swiss physicist Augustin Fresnel (pronounced fruh-nel), who lived in France. Through his studies of optics and light waves, Fresnel invented in 1822 a complex lens that concentrated light into a powerful, long-distance beam (*Figs. 15-16*).[35] A significant change from the Argand and Lewis systems, and far superior, it consisted of hand-polished prisms which took on the appearance of a large beehive. Some were fixed, but others could revolve and flash, allowing a unique pattern for each lighthouse to help navigators identify their locations.[36]

An advantage for lighthouse keepers was the reduced amount of fuel required to produce a stro1823nger light, which meant fewer trips up the steps. The lens quickly revolutionized lighthouses in Europe, while the United States continued its use of the Lewis parabolic system.

35. The distance a Fresnel light can be seen is a function of the height of the tower and the earth's curvature, the curvature being the limiting factor.
36. Jones, *Encyclopedia*, p. 14.



Figure 15. Augustin Fresnel (1788-1827). (Smithsonian Image Gallery SIL14-R005-10a)



Figure 16. Fourth-Order Fresnel lens, ca. 1857. Curtis Island Lighthouse, Camden, Maine. (www.lighthousefriends.com/curtisisland_lens.jpg)

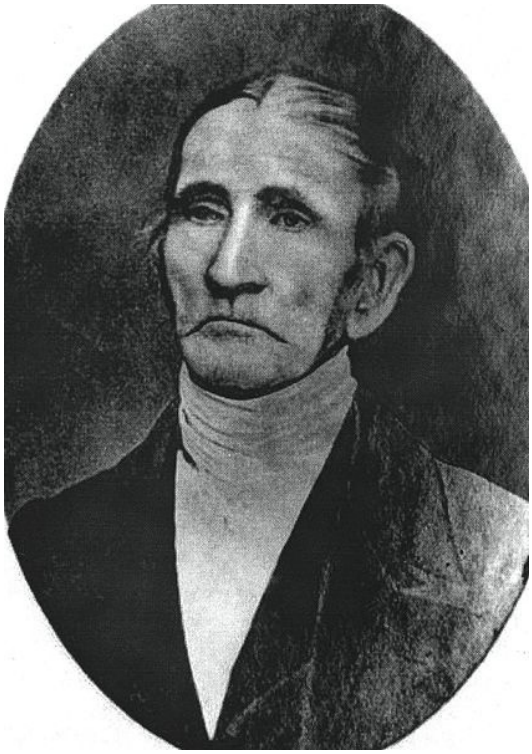


Figure 17. Stephen J. Pleasonton (1777-1855). (Library of Congress Photographs & Prints Division, item 2002722957)

The Pleasonton Era

Congress in 1787 had given the Treasury Department oversight of lighthouses. In 1813, however, the fast-growing lighthouse program was delegated to the Treasury's Commissioner of Revenue. Lewis at that time was installing his lenses.

When, in 1820, the lighthouse program shifted again and was placed under the Fifth Auditor of the Treasury, Stephen J. Pleasonton, the vitality of the program changed. Pleasonton, a bureaucrat, had no direct knowledge of the sea, of construction, or of lighthouse operation, and for the next 32 years ran a harmfully frugal lighthouse program in which he was more interested in saving money than in producing high-quality lighthouses (*Fig. 17*).

Pleasonton relied heavily on Lewis and the two formed an alliance of sorts in all matters of the lighthouse program, well beyond lamps and oil, and of questionable integrity. Pleasonton allowed Lewis to review bids for construction of new lighthouses, and accepted his negative assessments. Lewis subsequently was awarded contracts to build most of the nation's lighthouses Unfortunately, due to Lewis's ignorance of engineering, his lighthouses generally were poorly built, and were fitted with his out-of-date reflector lamps.

Lewis had plans drawn up for conical masonry lighthouses in five heights, 25, 30, 40, 50, and 65 feet. The contract specifications for most were almost identical, the variations generally addressing materials according to region. His designs were used for lighthouses and keepers' houses up and down the east coast and on the Great Lakes, including the light station at Ocracoke. Dozens were built, most towers of brick, others of stone. One of many examples is Lake Erie's 1822-1823 Marblehead Lighthouse. The text of the contract is almost identical to that of the 1823 Ocracoke Lighthouse and Keeper's Quarters, the differences reflecting regional construction materials: Marblehead's stone tower to Ocracoke's stone or brick, Marblehead's "good pine" to Ocracoke's Georgia pine (*Fig. 18*).[37]

Lewis's lighthouses were often poorly built or inadequate. His 1825 Thomas Point Light in Annapolis proved "nearly useless," yet he was contracted to build another thirteen years later. That light too proved inadequate.[38] And at Long Beach Island he built a tower in 1835 that was found poor in workmanship and with inadequate light.[39]

37. This contract was used for the 1825 Fairport Lighthouse in Ohio, the 25-foot 1819 Bird Island Lighthouse in Massachusetts, and many others. James Proffitt, *Marblehead Lighthouse on Lake Erie: Ohio's Historic Beacon* (Arcadia Publishing, 2015), pp. 35-37.
38. Ray Jones, Bruce Roberts, Cheryl Shelton-Roberts, *American Lighthouses: A Comprehensive Guide to Exploring our National Coastal Treasures* (Guilford, CT: Globe Pequot Press, 2012), p. 130.
39. Jones and Roberts, *American Lighthouses*, p. 114.



Figure 18. Marblehead Lighthouse, Ohio. Constructed in 1822-23 under contract virtually identical to Noah Porter's Ocracoke contract. Photographed October, 1897, after mid-century alterations. (U. S. Coast Guard Historian's Office)

Yet, and important to Ocracoke, it was not Lewis's design that caused problems, but the actual construction. Lighthouses built to his design by builders other than Lewis were successes and served for decades, some, like Ocracoke, for over a century. Ocracoke's was one of the early lighthouses designed by Lewis. Fortunately, he did not win the construction contract. Instead, it was awarded to Noah Porter of Massachusetts, and the buildings he erected in 1823 were sound.[40]

Lewis's lighthouses of course were equipped with his lamps, though the Fresnel lenses were known by mariners to be superior. And though Lewis's was not the only firm with the molds for the parabolic reflector, it was he who consistently obtained contracts from Pleasonton to supply the reflector apparatus.[41] Lewis also held a monopoly on selling oil to the government. It was certainly in his interest to delay the introduction of the Fresnel lens.

Increasing protests came to Congress about the inadequacy of the Lewis lamps and of the lighthouse program, yet Pleasonton clung to the reflector system, shunning the Fresnel lens. Insurance companies complained about unnecessary loss of life and property. By 1838 persistent concerns led to a trial of the Fresnel lens. Even after successful tests, Pleasonton did not adopt the lens, citing its expense.[42] As a result, in 1847 Congress transferred responsibility for construction of six new lighthouses from Pleasonton to the Corps of Engineers.[43]

The U.S. Light-House Board (1852-1910)

Pleasonton's controversial administration was brought to an end in part by public outcry after a shipwreck in 1849 and the subsequent collapse of a lighthouse in 1851. His refusal to consider more modern advances in lighthouse technology, including the Fresnel lighting system, and his desire to spend as little money as possible had proved his undoing. In 1851 a commission was appointed to investigate all aspects of America's lighthouse program. Membership of the commission, which was called the Light-House Board, is an indication of the importance of the lighthouse program at that time, and of the severity of its failure. Among the members were prominent military officers, including Chief Engineer of the U.S. Army Joseph G. Totten, the superintendent of the U.S. Coast Survey, and officers of the U.S. Topographical Engineers, as well as other engineers with experience in lighthouse construction and renovations (*Fig. 19*). [44]

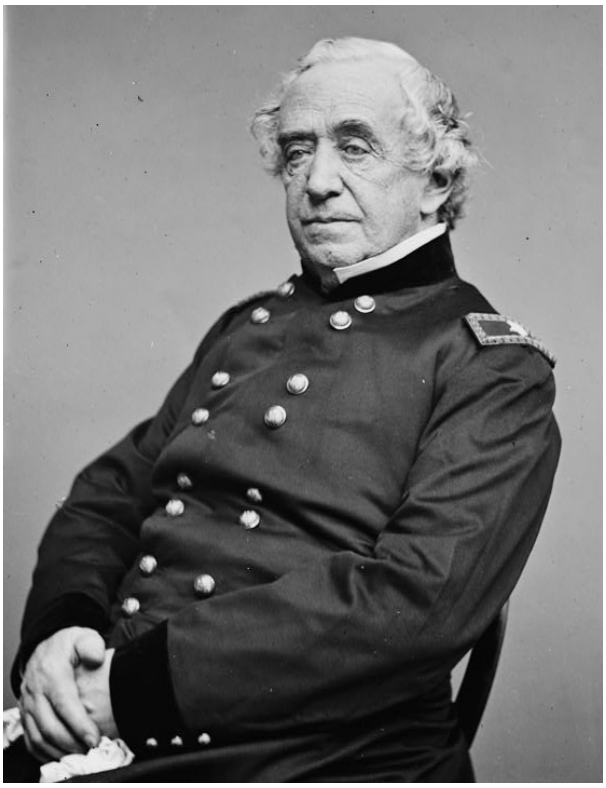


Figure 19. Joseph G. Totten, Chief Engineer of U.S. Army who served on the commission to investigate the U.S. lighthouse program after decades under Pleasonton's management. (Library of Congress, cwpb 05190)

The commission undertook an extensive investigation and published its report in 1852, titled "Report of the Officers Constituting the Light-House Board…to Inquire into the Conditions of the Light-House Establishment of the United States, Under the Act of March 3, 1851" (Senate Ex. Doc. No. 28, 1852) (*Fig. 20*). The 760-page

40. Contract for Ocracoke Light House, June 20, 1823.
41. The other was Henry N. Hooper & Company of Boston, a noted bell foundry and maker of lighting devices. Winterthur Museum Collections. Holland, *Illustrated History*, p. 16.
42. http://uslhs.org/fresnel-lens-makers. Lighthouses of the Western Great Lakes," http://www.terrypepper.com/lights/closeups/illumination/argand/lewis-lamp.htm.
43. William J. Heynen, Elizabeth K. Lockwood, and Margo Szabunia, *Lighthouse Plans in the National Archives; A Special List of Lighthouse-Related Drawings in Record Group* 26 (NARA, Special List 57, Revised 1999), p. 1; http://www.archives.gov/publications/lists/special-list-57.pdf.
44. "History of the Administration of the Lighthouses in America," http://uslhs.org/history-administration-lighthouses-america.



Figure 20. Bound report of the commission "…to Inquire into the Conditions of the Light-House Establishment of the United States, published 1852. (Courtesy of Lighthouse Antiques)

report found nothing right. Lighthouses were too short, "roughly and badly made," poorly spaced, inadequately lighted, the lamps improperly ventilated, the reflectors defective, and he oil below standard. Beyond that, keepers received inadequate training to tend the lights. The board reported that "the illuminating apparatus in the United States is of a description now nearly obsolete throughout all maritime countries."[45]

The report went beyond assessment to provide information on up-to-date illuminating apparatus and fuels, research and experiments in progress, personnel practices, and information on foreign apparatus for comparison. It was in book form, hard-bound with 44 large fold-out plates including lamps and burners, lens apparatus, lanterns, light vessels, and more.

Not surprisingly, the report was so critical of Pleasonton's management that Congress wasted no time in relieving him of his duties. Winslow Lewis had died the year before.

The commission recommended a complete overhaul of the system to be overseen not by a single administrator, but by a nine-member Light-House Board, and they urged the adoption of the Fresnel lens for U.S. lighthouses. Congress followed the recommendations. The new Light-House Board exercised complete authority over the lighthouse system and all of America's navigational aids. It created twelve lighthouse districts, each assigned an officer as lighthouse inspector and later an engineer, and ensured more rigorous management of light stations.[46] A new era in American lighthouse construction began.

The study commission had found the Fresnel lens "greatly superior" to other lenses, and "in point of economy is nearly four times as advantageous as the best system of reflectors and Argand lamps."[47] The Board embraced the new technology immediately. Many of Winslow Lewis's substandard towers were demolished and dozens of new towers were built during the early years of the Light-House Board, each with a Fresnel lens. The board also took steps to replace all reflector systems with Fresnel lenses, and by 1861 nearly all existing lighthouses had been upgraded with a Fresnel lens. A fourth-order Fresnel lens was installed at Ocracoke in 1854, its light visible from a little over fourteen miles.[48]

The American Light-House Board bought its Fresnel lenses from France, splitting its purchases roughly fifty-fifty between the two Paris firms of Henry-Lepaute and Louis Sautter. The Navesink test lenses had come from Henry-Lepaute in 1839, and from 1853 through 1860 the Board purchased 336 Fresnel lenses from that factory. Sautter's first lens sent to America was the third-order lens made for Alcatraz Island, California in 1853. Both companies made improvements to the fabrication and quality of the lenses and associated devices. Sautter, for instance, developed an improved rotation clockwork regulator and became a major supplier of lighthouse equipment by 1861 (*Figs. 21-22*).[49]

45. Holland, *Illustrated History*, pp. 21, 33-34.

46. Oppermann, *Cape Lookout Lighthouse HSR*, p. I.A.4; Jones, *Encyclopedia*, p. 108. The Board, whose official name and stationery hyphenated the word to Light-House, was under the Treasury although it had little influence.
47. *Senate Documents*, Volume 171 (U.S. Government Printing Office, 1862), p. 8.
48. Michigan Lighthouse Conservancy, "Lighthouses: A Brief Administrative History." http://www.michiganlights.com/fresnel.htm; Cheryl Shelton-Roberts and Bruce Roberts, *North Carolina Lighthouses: Stories of History and Hope* (Globe Pequot, 2011), p. 57; NPS guides' notebook.
49. http://uslhs.org/fresnel-lens-makers.

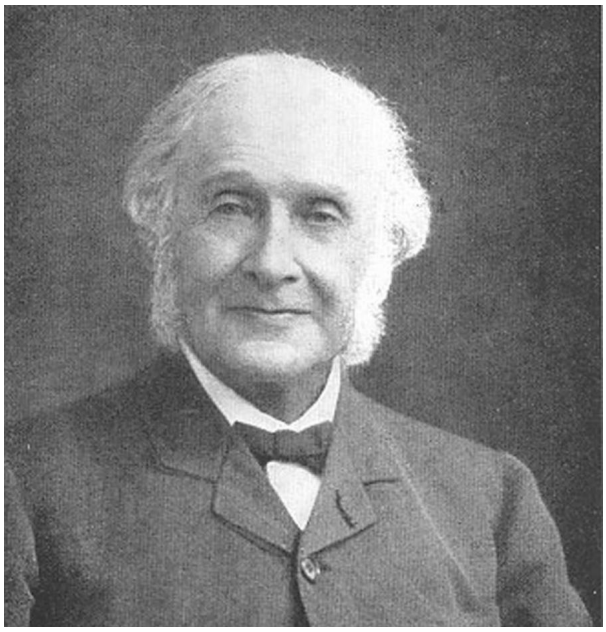


Figure 21. Louis Sautter (1825-1912). (http://uslhs.org/fresnel-lens-makers)

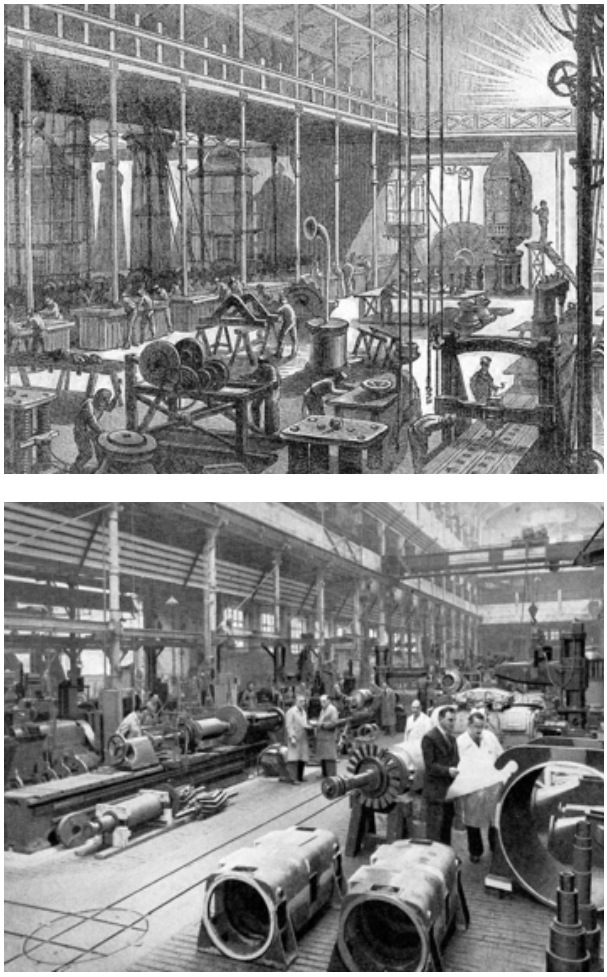


Figure 22. Top: Interior of the Sautter, Lemonnier & Cie. Factory in 1872 when building Fresnel lenses. Bottom: Same factory in 1952 when building turbine generators. (http://uslhs.org/fresnel-lens-makers)

Lanterns

The switch to Fresnel lenses changed not only the light, but the look of American lighthouses. Towers are topped by "lanterns," the glass-enclosed rooms that hold his lamp system. Winslow Lewis's lighthouse contracts included specifications describing his lantern design, which was built on most lighthouses during his decades with Pleasonton:

> On the top of the tower to be an iron lantern of an octagon form, the posts to be two inches square.... The height and diameter of the lantern to be sufficient to admit an iron sash in each octagon, to contain twenty one lights of fourteen by twelve glass..., and glazed with double glass from the Boston Manufactory.

Ocracoke was among the dozens of lighthouses built with these "birdcage" lanterns designed for the Lewis reflector lamps. Today they are rare, but several were photographed in the nineteenth and twentieth centuries (*Fig. 23*).

The majority of Lewis's birdcage lanterns were replaced by a lantern of new design when Fresnel lenses replaced the old reflector lamps. The lanterns were of cast iron, transported in sections to the site, where they were assembled on the top of the finished tower. Modifications to the deck, railings, and even the tower were not uncommon, and positioning of the new lantern had to correspond to the features of the existing lighthouse (*Fig. 24*).[50]

One of several manufacturers was the Baltimore stove works (foundry) of Hayward, Bartlett and Company, "the largest manufacturer of architectural iron detail (stoves, porches, fences, cornices, etc.)," and maker of the first "pre-fabricated" structures. Their materials were shipped all over the country, and numerous mid-nineteenth century lanterns are documented to be their work.[51] Elements typical of mid-nineteenth-century lanterns are larger, single-pane glazing starting about mid-height of the lantern room, with the lower portion often of metal panels or masonry. Ocracoke was one of many lighthouses to receive a new lantern in the 1850s.

50. Detailed lantern plans are available at the National Archives, often the plan for a specific lighthouse. "History of the Lighthouse Service and Lighthouse Construction Types, in *Historic Lighthouse Preservation Handbook, p. II-9.*
51. Among the company's several names were Hayward, Bartlett and Company (1848-1866) and the reversed Bartlett, Hayward Company (1909-1936). "Bartlett-Hayward Industrial Complex (HABS No. MD-42), Historic American Engineering Record (1981), pp. 6-7. Maryland Historical Society, "BCLM Works on Paper," http://www.mdhs.org/findingaid/bclm-works-paper-legal-boxes-16-18.

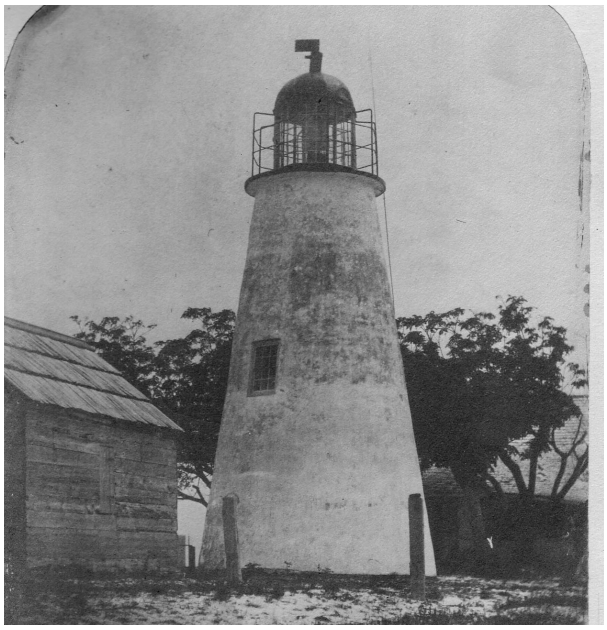


Figure 23. Birdcage lantern and railing of Winslow Lewis's design, seen here on 1831 Cat Island lighthouse, Mississippi. (n.d., U.S. Coast Guard, http://www.uscg.mil/history/weblighthouses/lhms.asp)

The Civil War

By 1859 on the eve of the Civil War, the modernization of the lighthouse system was almost complete as Fresnel lenses replaced the Lewis reflectors.[52] With the onset of war in April 1861, the new Confederate States quickly established a Lighthouse Bureau to take control of lighthouses.

On May 20, 1861, North Carolina seceded from the Union. Although the people of the Outer Banks were primarily neutral, the inlets were vital shipping channels for supplies as well as strategic points of entry for Union forces. The Confederates built several forts "to guard the inlets and thus protect the sounds from Yankee incursions," including a fort at Ocracoke Inlet.[53]

52. David Cipra, "The Confederate States Lighthouse Bureau,"http://uslhs.org/confederate-states-lighthouse-bureau-david-cipra.
53. Holland, *Illustrated History*, p. 34.



Figure 24. Lighthouses at Cape Romain, South Carolina reflect two periods in the U.S. lighthouse program. At left is the 1827 Lewis-designed tower with his "birdcage" lantern. To the right stands the 1858 tower with lantern designed to accommodate a Fresnel lens. Newly designed lanterns were installed on most existing and new towers by the Light-House Board. 1893 photograph. (http://www.lighthousefriends.com/CapeRomain2_1893_na.jpg)

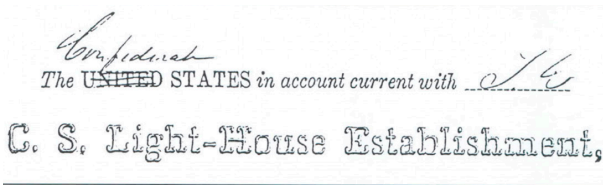


Figure 25. Edited emblem of the Confederate States Light-House Establishment, generally known as Confederate Lighthouse Board. (David Cipra, "The Confederate States Lighthouse Bureau," http://uslhs.org)

The lighthouses served dual and conflicting roles, lighting the coast for both sides. To hamper Northern blockaders, in June 1861 the Confederate States Lighthouse Bureau ordered the removal of lighting apparatus from coastal lighthouses, hoping to present a darkened, and therefore dangerous, coastline to Union ships heading to Southern harbors. Lamps and lenses were removed from several towers to prevent Union troops from capturing and operating the light stations.[54]

After the Union capture of New Orleans in April 1862, the Confederate Lighthouse Board quickly ordered lighthouses to "remove the property belonging to the Lighthouse establishment under their charge to such points as in their judgment may be secure from the approach of the enemy."[55] Ocracoke's lens was one of the first in North Carolina to be removed, just as coastal counties came under Union control.[56]

The Outer Banks remained under Federal occupation for the duration of the war. Federal troops replaced many of the lenses, and the U.S. Lighthouse Board reported that by June 30, 1863, the lighthouses at Cape Lookout and Ocracoke had been "refitted and the lights re-exhibited."[57] Yet the Ocracoke light apparently was not permanently lighted; almost a year later, in a letter of May 31, 1864, the commanding Union general requested of the Commission for the Establishment of Light-Houses "that the light at Ocracoke should at once be established."[58]

54. Fred M. Mallison, *The Civil War on the Outer Banks: A History of the Late Rebellion Along the Coast of North Carolina from Carteret to Currituck, with Comments on Prewar Conditions and an Account of Postwar Recovery* (Jefferson, NC: McFarland and Company, 1998).
55. Cipra, "Confederate States Lighthouse Bureau."
56. Bodie Island lighthouse and the Roanoke Marshes screwpile light were first. Daniel E. Dempster and Elinor De Wire, *Lighthouses of the South* (Voyageur Press, 2004), p. 67.
57. United States. Department of the Treasury *Annual Report of the Secretary of the Treasury on the State of the Finances* (1863), p. 156.
58. U.S. Government Printing Office, *Congressional Serial Set* (1892), pp. 424-25.
59. Cipra, "Confederate States Lighthouse Bureau."
60. Samuel Willard Crompton and Michael J. Rhein, *The Ultimate Book of Lighthouses* (San Diego: Thunder Bay Press, 2003), p. 26, found in Oppermann, *Cape Lookout Lighthouse HSR*, p. I.A.4; www.uscg.mil/history.

The Confederate States Lighthouse Board submitted its annual report to the Confederate Treasury in January 1864, apparently expecting the war to end in its favor. The report explains that "Instructions were given to the various Superintendents of Lights to cause the illuminating apparatus and other fixtures to be carefully removed, boxed, and conveyed to different points of the interior, removed from the depredations of the enemy. I am happy to report that with two or three exceptions the efforts made in this regard were entirely successful, so that when any order may be issued by you for the resumption of the active operations of the Lighthouse Establishment (which time I trust is not far distant) no great difficulties will arise in replacing the machinery and carrying out the designs for which the Bureau were created."[59]

The U.S. Lighthouse Service (1910-1939)

In 1910, Congress dissolved the Light-House Board and created in its place the civilian U.S. Bureau of Lighthouses under the Department of Commerce. The legislation referred to the bureau as the Lighthouse Service, its more commonly known name. George R. Putnam was appointed the first "Commissioner of Lighthouses" and modernized the Service, bringing technical improvements to navigational aids and pioneering the use of radio navigation. At its height, the Lighthouse Service operated around 1,200 lighthouses in America and 54 lightships with a total of 11,713 navigational aids.[60]

Many improvements were made under the administration of the Lighthouse Service. From the late 1910s through the early 1930s, advances in electronics led to the automation of lighthouses, a transformation that reduced the number of on-site personnel needed to operate the lighthouse stations. In 1916, a device for automatically replacing burned-out electric lamps in lighthouses was introduced. The next year an updated bell alarm was developed to warn keepers of fluctuations in oil-vapor lamps. In the same year, an experimental radio beacon was installed in a



Figure 26. Lighthouse Service seal on the 1932 Department of Commerce building, Washington, DC. Date on seal reflects passage of the Lighthouse Act of 1789 when a national lighthouse program was first established. (USCG)



Figure 27. Frederick P. Dillon, Superintendent of Lighthouses, photographed May 1938 after an 18-month trip visiting all lighthouses in the United States and its possessions. (Courtesy of Lighthouse Antiques)

lighthouse. An automatic time clock for operating electric range lights came into use in 1926, and by 1933, a photo electric-controlled alarm device had been developed to check the operation of the unwatched electric light.

Lightships and buoys were similarly improved. These technological improvements brought the United States from sixth in shipping safety worldwide in 1920 to second in 1935, with only the Netherlands holding a better safety record.[61]

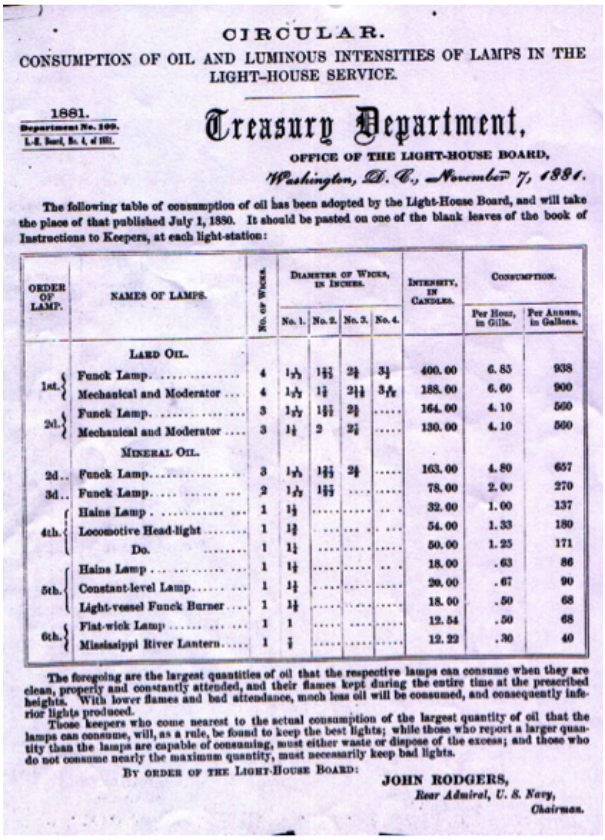
A Keeper's Life

The 1915 definition of a lighthouse by the U.S. Bureau of Lighthouses was "a light station where a resident keeper(s) is employed."[62] The lighthouse formed the heart of the daily life of the keeper, who had to work in all weather conditions, especially during hurricanes and gales when ships were in the greatest danger. The success of the station was fully dependent on the consistent and dependable tending of the light.

During the first half of the nineteenth century, politics, tempered by some consideration for skill, dominated the selection of lighthouse keepers. During the second half of the century, a career service began to develop as keepers were transferred and promoted from one assignment to another. Toward the end of the century, however, politics once again came into play until the position of lighthouse keeper was brought under the Civil Service in 1896. In fact, a keeper had to be a master of many skills, although his pay was low. By the 1840s, it ranged between $400 and $600 a year, and assistant keepers received half that amount. In the 1850s, Congress set the pay for East Coast keepers at $600, and this amount remained unchanged for more than half a century. In 1923, an act was passed that based the keeper's salary on the classification of the light station to which he was assigned. The few benefits included a fuel allowance and, after 1916, free treatment by the Public Health Service. However, until 1918, there was no provision for pensions or retirement pay.[63]

Prior to 1852, when the operation of lighthouses was taken over by the Light-House Board, keepers received no real training or operating instructions regarding their responsibilities. What information they had was acquired on a random basis from various sources. In 1852, however, the Light-House Board took action to establish uniformity and accountability. The position of District Lighthouse Inspector was created, and the board put into place a system of stringent regulations and inspections,

61. Maritime Digital Archive, United States Lighthouse Service, www.ibiblio.org/maritime/photolibrary/index.php?cat=1554.
62. Jones, *Encyclopedia*, p. 105.
63. *Ocracoke Lighthouse HSR*, 1990, pp. 23, 25.



CIRCULAR.

CONSUMPTION OF OIL AND LUMINOUS INTENSITIES OF LAMPS IN THE LIGHT-HOUSE SERVICE.

1881.

Treasury Department,

OFFICE OF THE LIGHT-HOUSE BOARD,

Washington, D. C., November 7, 1881.

The following table of consumption of oil has been adopted by the Light-House Board, and will take the place of that published July 1, 1880. It should be pasted on one of the blank leaves of the book of Instructions to Keepers, at each light-station:

ORDER OF LAMP.	NAMES OF LAMPS.	No. of Wicks.	Diameter of Wicks, in Inches. No. 1.	No. 2.	No. 3.	No. 4.	Intensity, in Candles.	Consumption. Per Hour, in Gills.	Per Annum, in Gallons.
	LARD OIL.								
1st.	Funck Lamp.	4	1 7/8	1 13/16	2 1/8	3 1/4	400.00	6.85	938
1st.	Mechanical and Moderator	4	1 7/8	1 1/2	2 1/16	3 1/8	188.00	6.60	900
2d.	Funck Lamp.	3	1 7/8	1 13/16	2 1/8	.....	164.00	4.10	560
2d.	Mechanical and Moderator	3	1 1/8	2	2 1/8	.....	130.00	4.10	560
	MINERAL OIL.								
2d.	Funck Lamp.	3	1 7/8	1 13/16	2 1/8	.....	163.00	4.80	657
3d.	Funck Lamp.	2	1 7/8	1 13/16	.....	.....	78.00	2.00	270
4th.	Hains Lamp.	1	1 1/8	.....	.....	.....	32.00	1.00	137
4th.	Locomotive Head-light	1	1 1/8	.....	.....	.....	54.00	1.33	180
4th.	Do.	1	1 1/8	.....	.....	.....	50.00	1.25	171
5th.	Hains Lamp	1	1 1/8	.....	.....	.....	18.00	.63	86
5th.	Constant-level Lamp	1	1 1/8	.....	.....	.....	20.00	.67	90
5th.	Light-vessel Funck Burner	1	1 1/8	.....	.....	.....	18.00	.50	68
6th.	Flat-wick Lamp	1	1	.....	.....	.....	12.54	.50	68
6th.	Mississippi River Lantern	1	7/8	.....	.....	.....	12.22	.30	40

The foregoing are the largest quantities of oil that the respective lamps can consume when they are clean, properly and constantly attended, and their flames kept during the entire time at the prescribed heights. With lower flames and bad attendance, much less oil will be consumed, and consequently inferior lights produced.

Those keepers who come nearest to the actual consumption of the largest quantity of oil that the lamps can consume, will, as a rule, be found to keep the best lights; while those who report a larger quantity than the lamps are capable of consuming, must either waste or dispose of the excess; and those who do not consume nearly the maximum quantity, must necessarily keep bad lights.

By order of the Light-House Board:

JOHN RODGERS,
Rear Admiral, U. S. Navy,
Chairman.

Figure 28. Light-House Board circular regarding oil consumption, 1881.

reporting, "Inspectors and light-keepers should be provided with printed instructions, in the form of manuals of instruction to guide them in the policing of the establishments." According to the 1852 Report of the Light-House Board,

> Frequent visitation and minute examinations by competent inspectors would insure vigilance, economy, and order on the part of the keepers. The inspectors should be men thoroughly acquainted with all details of light-house management and superintendency, with the manner of adjusting the lamps and reflectors, and for keeping them in order.[64]

Each keeper and all assistants received a copy of the codified regulations, printed in a manual entitled "Instructions to Light-Keepers," and were evaluated by their careful adherence to procedure. First issued in 1852, the manual was revised and amended on a regular basis, especially as technology changed the operation of lighthouses, and by 1914 it formed a volume of around 180 pages. The regulations extended beyond the how to do and specified exactly when an activity was to be done, leaving little to the imagination or discretion of the keeper. They prescribed a strict daily regime of maintaining the light, cleaning, and record keeping. For each station, the board determined the number of keepers necessary and the duties of each.[65]

An 1881 circular issued by the Board prescribed the quantity of oil needed for the different lamps in use at that time (*Fig. 28*). The board instructed that the table "should be posted on one of the blank leaves of the book of Instructions to Keepers, at each light-station."[66] The table was accompanied by the admonition,

> The foregoing are the largest quantities of oil that the respective lamps can consume when they are clean, properly and constantly attended, and their flames kept during the entire time at the prescribed heights. With lower flames and bad attendance, much less oil will be consumed, and consequently inferior lights produced.
>
> Those keepers who come nearest to the actual consumption of the largest quantity of oil that the lamps can consume, will, as a rule, be found to keep the best lights; while those who report a larger quantity than the lamps are capable of consuming, must either waste or dispose of the excess; and those who do not consume nearly the maximum quantity, must necessarily keep bad lights.

Fuels

The keeper's job was ruled by fuel, and fuels for lighthouses were changing as well as the technology. In the 1850s, colza oil from rapeseed replaced expensive whale oil. In the late 1850s, Joseph Henry of the Light-House Board discovered lard to be an excellent fuel if heated to a high temperature. Lard was plentiful and outperformed earlier fuels, and by 1867 it fueled the larger lighthouses while smaller lighthouses continued to use colza oil.[67] The fuel at Ocracoke changed from whale oil to lard oil in 1867.[68]

By 1878 kerosene, popularly known at the time as

64. Inspector Correspondence (1903-1912) (National Archives, Washington, DC).

65. Oppermann, *Cape Lookout Lighthouse HSR*, p. I.A.10; *Ocracoke Lighthouse HSR*, 1990, pp. 23-24.
66. Circular: Consumption of Oil and Luminous Intensities of Lamps in the Light-house Service," November 7, 1881.
67. Henry was chairman of the board's committee on experiments; he helped introduce numerous improvements in illumination and signaling and encouraged research in optics and thermodynamics. Holland, *Illustrated History*, p. 23; Smithsonian Institution Archives, Joseph Henry Papers, www.siarchives.si.edu/history/jhp.
68. NPS guides' notebook.

mineral oil, began to be used for fuel. Selling for a fraction of the cost of lard, it initially was popular for smaller lamps but eventually was used in lamps of all sizes. The Ocracoke Lighthouse switched from lard oil to kerosene in 1878.

Oil consumption was considerable. In 1902, the oil required for a large, first-order Fresnel light was calculated to be 2,283 gallons per year, all of which had to be carried by the keeper, typically in five-gallon cans, from the oil house up the winding stairs to the lantern.[69]

The last technical upgrade before the installation of electricity was the invention of the Incandescent Oil Vapor (I.O.V.) light, first used in France in 1898 and America in 1904. Similar to a modern Coleman lantern, the device vaporized kerosene against a hot wall, forcing it through small holes to a mantle where it burned in a fireball. An improved I.O.V. lamp was developed in 1911. The I.O.V. increased the burn temperature and light intensity, at the same time reducing the effort needed by the keeper to keep the lens clean.[70]

In 1886, the Light-House Board tested a new technology in the illumination of the Statue of Liberty—electricity. The lighting of the statue heralded the beginning of modern lighthouse illumination. In 1900, the Board began converting lighthouses to electric service; however, the scarcity of nearby power lines hampered a widespread conversion. To solve this, generators were introduced where power lines were not available, and in the 1920s and 1930s the Lighthouse Bureau converted most lighthouses to electricity.[71] Ocracoke converted to electricity in 1929.[72]

The change to electricity drastically reduced the manpower needed to operate a lighthouse but, more significantly, it opened the door to new methods of communication that would, in time, eliminate the need for keepers altogether. In 1898, the Navesink Lighthouse in New Jersey was the first in America to have an electric arc lamp installed and supported by its own generating plant. Navesink had been the location of the first Fresnel lens used in America and was also the place from which, in 1901, the first wireless message was transmitted between a lighthouse and lightship.[73]

Ever Cleaning

For the early lighthouse keepers, cleaning the lens and lantern house was a constant and critical chore. Fuels changed and many kinds of burners and wicks were used, but all produced soot or smoke. Cleaning was a daily task and, throughout, keepers were required to keep their uniforms clean. The lens glass was extremely delicate and required cleaning in just the right manner to avoid harm to the lens in the process.[74]

The Lighthouse Service provided both soft linen cloths for lens cleaning and cleaning coats or aprons to protect both the keepers' uniforms and the lens. The coats were of tight-weave linen, long enough to protect against a buckle or button underneath. The circular logo of the Lighthouse Service was stamped on the coats and the linen cloths as well as on all objects supplied by the Service.[75]

69. U. S. Light-House Board, *Instructions to Light-Keepers* (Washington: U. S. Government Printing Office, 1902), p. 14; NPS guides' notebook.
70. *Annual Report of the Commissioner of Lighthouses to the Secretary of Commerce and Labor for the Fiscal Year Ended June 1911* (Washington: U. S. Government Printing Office, 1911), p. 15; George Rockwell Putnam, *Lighthouses and Lightships of the United States* (Houghton Mifflin, 1917), p. 187.
71. Michigan Lighthouse Conservancy, "Lighthouses."
72. NPS guides' notebook.
73. Truman R. Strobridge, "Chronology of Aids to Navigation and the United States Lighthouse Service 1716-1939," http://www.uscg.mil/history/articles/h_USLHSchron.asp.
74. *Lighthouse Digest*, April 2006. www.lighthousedepot.com/lite_digest.asp?action=get_article&sk=02440&bhcd2=1248574720.
75. Ibid.



Figure 29. Official Seal of United States Lighthouse Service. (US Coast Guard flag index; http://www.uscg.mil/history/FlagIndex.asp)

More than a Lighthouse

The duties of the lighthouse keeper were many and went beyond the lighthouse itself to include the entire station. It was the keeper's responsibility to keep the whole of the light station in order, and days were spent doing the work necessary to keep the complex operating. The keeper had to clean, paint, and repair all buildings on the station; clean the chimneys of the keeper's dwelling; keep the privy clean and apply lime; stack wood properly in the woodshed; maintain all mechanical equipment; maintain a log book and record all daily light station activities; take weather readings every day; weed the walkways and maintain the light station grounds; keep inventories of all equipment and fuel; provide visitors with tours of the station; and plant and tend a personal garden as needed. Each aspect of a keeper's responsibilities was addressed by the Lighthouse Service.[76]

There were other duties, as well, that the keeper was expected to perform. He watched for and reported on all shipwrecks in his vicinity and if he could lend any assistance, he was instructed to do so. By 1902, the keepers were also acting as conservation wardens charged with preventing trees from being cut on Federal lands and assuring compliance with state game laws. For example,

> It is most desirable that not only the game animals of the country but that song birds and birds of all kinds should be protected and encouraged to occupy their abodes in their natural habitats and the Light-House Board directs that all persons in the service not only exercise this spirit of protection but encourage others to do likewise.[77]

Supplies

Many reports and letters between keepers and the district offices deal with supplies and equipment. The Light-House Board provided all supplies for the light, the station, and the keepers, especially where lighthouses were located in isolated areas with limited access to food. Provisions were delivered by lighthouse tenders, ships that served a vital role by "tending" to the needs of others. The crews on the tenders brought fuel, food, news, mail, supplies and maintenance crews to help with major repair work. Specifically designed to support lighthouses and light vessels, the tenders had shallow drafts suitable for coastal waters.[78]



Figure 30. USLHS tool box. (Michigan Lighthouse Conservancy)



Figure 31.USLHS portable library, closed box (top), open box (bottom). (Michigan Lighthouse Conservancy)

76. "A Lighthouse Keeper's Duty," http://ponceinlet.org/images/content/keepers_duties.pdf.
77. .*Instruction to Light-Keepers*, 1902 edition, pp. 8, 12.
78. Lighthouse Service Commissioner George R. Putnam in his *Lighthouses and Lightships of the United States*



Figure 32. USLHS pitcher. (CAHA Museum Coll.)



Figure 33. USLHS CLOCK. (CAHA Museum Coll.)

In a letter dated May 24, 1909, a 14-page list of supplies was sent to fifth district light stations. An undated letter entitled "Schedule of Deliveries of Fuel from Washington Depot, NC" instructed that coal, hard wood, and pine wood be sent to Ocracoke, as well as Bodie Island, Cape Hatteras, Hatteras Inlet, and other stations in the District.[79]

The Lighthouse Service provided myriad other supplies, such as furniture for a simple residence, a tool chest, a medicine chest, blankets, china, a clock and a barometer.[80] In 1876 the Service began to provide portable libraries with a selection of reading materials to light vessels and isolated light stations. These were distributed with other supplies

(Cambridge, MA, 1933, 2nd. ed.).
79. Inspector Correspondence (1903-1912).
80. John Gaskill (son of last Principal Keeper of Bodie Island Light Station), Personal interview, July 15, 2009; *Gaskill Remembers*, p. 38.

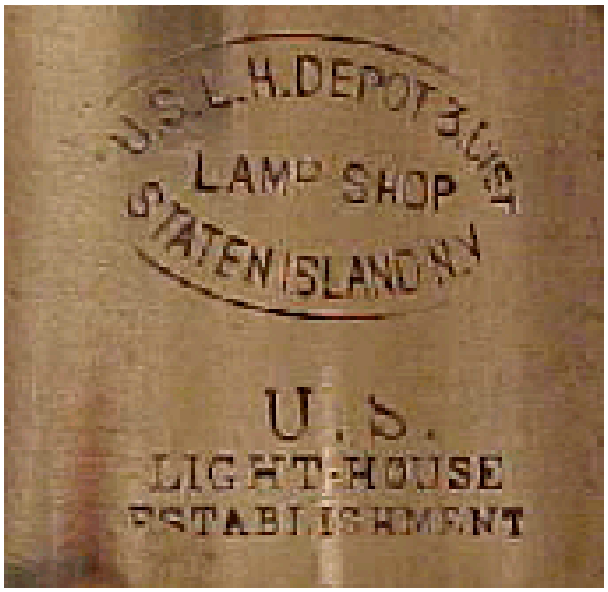


Figure 34. USLS brassware was stamped or had official plates affixed. This one was fabricated at the USLH lamp shop on Staten island. (Michigan Lighthouse Conservancy)

by the tender ships. Early "traveling libraries" were contained in a portable wooden case, each with a printed listing of the contents posted inside the door. Later the libraries were rolling bookcases to be placed against the wall of the keeper's residence. These libraries were exchanged at six-month intervals, sent to another lighthouse and replaced by a different set of books. A typical library consisted of about fifty books, largely fiction with a mix of history, poetry, scientific works, and always a Bible. Each was marked in the front with the official "Light-House Establishment" bookplate.[81]

Hardship and Mobility

Whether it was the isolation, the demands of the job, the rigor of the inspections, or the salary, keepers and especially assistant keepers transferred to and from light stations frequently. Keepers at isolated stations often sought better positions for themselves or assignments closer to their families. They generally started their careers as 2nd or 3rd Assistant Keepers and were gradually promoted as Principal Keepers at the less attractive stations, then moved up the ranks to the more desirable stations. Onshore stations near towns were generally considered more desirable and were awarded to keepers with seniority.

In addition to requesting transfers, keepers also made many requests for leaves of absence to visit

81. Gaskill interview; clarke.cmich.edu/lighthouses/lhkeep1.htm; http://www.michiganlights.com/lhlibrary.htm; *Ocracoke Lighthouse HSR*, 1990, p. 25.

their families who lived onshore or to tend to personal business. To help relieve the hardships of isolation and monotony, keepers were occasionally given leave to visit or be assigned to popular national expositions. These expositions often included lighthouse exhibits.[82]

Life at Ocracoke

Life at the Ocracoke Light Station was not as harsh as at many locations because it was in a village. The keeper and his family were able to enjoy a social life with villagers and thus did not have to suffer the loneliness and monotony experienced at many other locations on the Outer Banks. They could shop in the village, there was at least one church they could attend, and their children had access to local schools. Like many of their neighbors, the family had a garden. The keeper could fish and hunt for waterfowl. Most of Ocracoke's population kept chickens and often a cow and perhaps a few pigs, and it is reasonable to assume that the keeper's family did as well.[83]

During hurricanes, Ocracoke Light Station sometimes served as a refuge for local residents

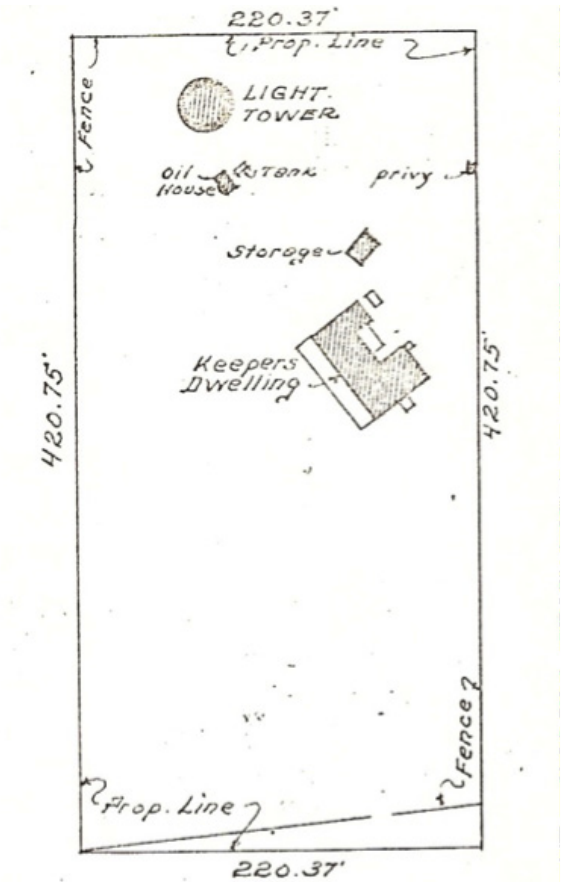


Figure 35. Detail, Ocracoke Light Station Plot Plan, 1944, showing the realm of the keeper's responsibility. (US Coast Guard)

82. Inspector Correspondence (1903-1912).
83. *Ocracoke Lighthouse HSR*, 1990, p. 24; "Ocracoke Light Station," NPS website.



Figure 36. Ocracoke Light Station, 1893. (H. H. Bamber, photographer, CAHA Coll.)



Figure 37. Capt. Leon Wesley Austin (1864-1941) and his wife Isabelle Barnett Austin (1870-1934). The Austins lived in the keeper's quarters from 1912 to 1929. (www.findagrave.com)

because it was situated on higher ground and often remained above flood waters. At times of high flooding, especially the Great Hurricane of 1944, villagers arrived by boat over the flooded terrain to wait out the storm in the keeper's house or the lighthouse.[84]

Ocracoke had a total of eleven keepers. Their time of service varied significantly, from J. William Gillikin's eight months in 1897 to Enoch Ellis Howard's record thirty-five years from 1862 to 1897. The first known keeper was Anson Harker, who served from 1824 to 1846 – the years during which Ocracoke Inlet was the only navigable passage in that section of the Outer Banks, serving ports from New Bern to Elizabeth City.[85]

Wesley Austin's (1864-1941) time with the Lighthouse Service was representative of the career trajectory experienced by many keepers. He entered the service by working on the tenders that provided supplies to the light stations. In 1885, he was hired as Third Assistant Keeper at Cape Hatteras Lighthouse, and by 1892, had worked his way up to First Assistant Keeper. The following year, he was transferred to the Currituck Beach Light Station, where he served as First Assistant Keeper. He remained there until 1912, when he was transferred to the Ocracoke Light Station as Keeper. He and his wife, Belle, brought their eight children to the Ocracoke Light Station to live, remaining there until 1929 (*Fig. 37*).[86]

Joseph M. Burrus followed Wesley Austin as Keeper of the Ocracoke Light Station (*Fig. 38*). Beginning in 1929, the year the lighthouse was electrified, he remained through the critical years of World War II, when keeping a lookout for German submarines and ships off the coast was added to his list of responsibilities.[87]

The last lightkeeper was Clyde Farrow (1903-1981), who served at the Ocracoke Light Station from 1946 to 1954. As with Wesley Austin, his employment with lighthouses was fairly representative of the mobility experienced by many light tenders. Farrow entered the service in 1924, when he was twenty-one years old, and retired in 1963. His first station was on a lightship, but he

84. "Ocracoke Light Station," NPS website.
85. Lighthouse Friends, "Ocracoke, NC." http://www.lighthousefriends.com/light.asp?ID=355.
86. Liz Austin Carlin, "The Austins of Hatteras Bank, North Carolina: Wesley Leon Austin," http://afaoa.org/db_files/Hatteras_Austins_NC/Individuals/I667.html.
87. Lighthouse Friends, "Ocracoke, NC."



Figure 38. Joseph Merritt Burrus, Keeper from 1929-1946. (Ocracoke Island Journal)

subsequently served at lighthouses in Maryland, Virginia, and other stations in North Carolina in addition to his years at Ocracoke. Typical of the duties of mid-twentieth-century keepers, Farrow made certain the light came on every night, checked the generator when the electricity went out, tended other navigational aids, including beacons and buoys, to make sure they stayed functional, and generally maintained the lighthouse and station as a whole. When Farrow and his family arrived at Ocracoke, they found no paved roads, no doctor, and only two phones on the island, one of which was at the lighthouse. Nevertheless, they loved life there. His next transfer was to the buoy tender station at Washington, North Carolina, where he served until his retirement.[88] Since 1954, the Ocracoke Lighthouse has been fully automated, no longer needing a resident keeper to tend to its daily needs.[89]

From Lighthouse Service to Coast Guard

In 1939, the U.S. Coast Guard was assigned responsibility for America's lighthouses, becoming the operational steward for all lighthouse personnel, equipment, and property. The Coast Guard oversaw the transition of lighthouses from manned to unmanned stations. In more recent years, the Coast Guard has transferred many lighthouses as surplus property, placing them under the management of the National Park Service (NPS), other federal agencies, and appropriate non-profit organizations. Despite the transfer of ownership and responsibility, many lighthouses continue as working navigational aids with the lighting apparatus remaining the property of the Coast Guard.[90] Ocracoke remains operational, the oldest operating lighthouse in North Carolina and the second oldest operating lighthouse in the nation.

88. *Ocracoke Lighthouse HSR*, 1990, p. 24; Pat Garber, "The Last Keeper of the Ocracoke Light," in *The Island Breeze* (Hatteras, NC: June 1999); Nate Littlejohn, "Model Man of Belhaven," Coast Guard Mid Atlantic, May 1, 2015, midatlantic.coastguard.dodlive.mil/2015/05/model-man-of-belhaven.

89. "Ocracoke Light Station," NPS website.

90. Outer Banks Lighthouse Society, www.outerbankslighthousesociety.org.

I.B Chronology of Development and Use

The lighthouse and keepers' quarters face southwest. For the purposes of this report, the front elevations are said to face west.

The quarters is identified as the singular "keeper's" until 1929 when a second residence was added, and it became the plural "keepers' quarters."

Prelude to a Lighthouse

When North Carolina's General Assembly passed the act in 1789 for construction of a lighthouse on Ocracoke Island, it was more than three decades before success could be claimed. It was not, however, for lack of trying. The state bought an acre of land on Ocracoke Island in 1790 for the lighthouse; however, the Federal government assumed oversight of the nation's lighthouses the same year, and the Shell Castle Island Lighthouse was built instead. After the Shell Castle Light was lost and the lightship failed, attention turned again to Ocracoke Island.

A long-lasting solution to the need for an effective navigational aid at Ocracoke began on May 7, 1822, when Congress authorized $20,000 for the construction of a lighthouse and keeper's quarters on the island. On December 5th, the government purchased two acres for that purpose from Jacob Gaskill for $50. Nearly two centuries later, the Ocracoke Lighthouse still beams its light out to sea.

Although they all served as important navigational aids, not all lighthouses had the same purpose. Many warned approaching vessels of the presence of the coastline, while others guided ships into harbor. In a letter dated December 18, 1830 and published in 1832, the Collector's Office, District of Ocracoke, made the specific purpose of the Ocracoke Lighthouse clear: "Its object is not to guide vessels into the harbor as no one can enter at night, but to give warning to mariners when off the Inlet, or to prevent vessels bound in from passing the bar at night."[91]

91. Robert Mills, *The American Pharos, Or Light-house Guide: Founded on Official Reports Received at the Treasury Department; Also, a General View of the Coast, from the St. Lawrence to the Sabine* (Thompson & Homans, 1832), p. 79.



Figure 39. Ocracoke Light Station, 2013. (JKOA)

A Light Station Takes Its Place on Ocracoke Island

The contract for Ocracoke's tower and quarters was Winslow Lewis's standard contract and specifications, with the few regional variations, in this case allowing the lighthouse to be brick or stone. However, to the good fortune of Ocracoke, Lewis was not the contractor. Instead, Noah Porter of Massachusetts was awarded the contract for building the new lighthouse and keeper's quarters, and he succeeded in this endeavor. The two soundly built structures were completed in late 1823 for a cost of $11,359.35. This represented a cost overrun, for the contract called for the work to be completed for the sum of $10,200.[92]

Little is known of Porter, a builder from Massachusetts. Twelve years prior, Porter and a man named Thomas Heath won the contract to build Boon Island Lighthouse in Maine by hugely underbidding their competitors. The contract was completed later that year and included a keeper's dwelling, an oil house, and a cistern.[93] Ten years after his work at Ocracoke, he won the contract to build the Round Island Lighthouse in Mississippi, but apparently voided that contract and instead built the lighthouse and keeper's quarters at Assateague, Virginia.[94] While the Ocracoke Lighthouse was considered a success, the lighthouse at Assateague was seen as less so, for it was inadequate in height and light quality. Porter's work was not criticized; it was Winslow Lewis who determined the height and supplied the light system.

The contract for Ocracoke was signed on June 20, 1823 between "Noah Porter, Contractor" and Henry A. S. Dearborn, collector of customs in Boston who was representing the United States (*Fig. 40*). With that contract was another, a performance bond that obligated Porter and two others to a payment of $20,400, exactly twice the construction contract, if the work was unsatisfactory or late. A similar performance bond accompanied Winslow Lewis's contract to supply



Figure 40. Henry A. S. Dearborn, collector of customs in Boston. (William L. Clements Library, University of Michigan)

Ocracoke's lamps, again at twice the contract amount.[95]

The construction contract was very detailed in its requirements. It set forth:

> The tower to be built of stone or hard brick, the form round. The foundation to be sunk as deep as may be necessary to make the whole fabric secure, to be laid in good lime mortar. The height of the tower to be sixty-five feet from the surface of the ground. The diameter of the base to be twenty five feet, and that of the top twelve feet. The thickness of the walls at the base to be five feet, to be uniformly graduated to two feet at the top. The top to be arched, on which is to be laid a deck of soap stone fourteen and a half feet in diameter, five inches thick, the joints filled in with lead, on one side of which to be a scuttle twenty-four by twenty inches, to enter the lantern; the scuttle door an iron frame covered with copper. The outside wall is to be well painted, and white washed twice over. There are to be six windows in the tower, of twelve lights each, of eight by ten glass, in strong frames, and a door five feet by three feet, made of double inch boards, cross nailed, with substantial hinges, lock and latch, the ground floor to be paved with brick or stone.
>
> A sufficient number of circular stairs to lead from the ground floor to within six feet of the lantern, connected by a centre post, guarded by a good hand railing. The stairs, summers

92. Although $20,000 was appropriated, the amount of funds actually made available is not known. The project included purchase of the land and at least two contracts for construction and for lamps and oil.
93. Bill Caldwell, *Lighthouses of Maine* (Portland, ME: Guy Gannet Publishing Co., 1986).
94. Congressional Edition, Volume 234 (U.S. Government Printing Office, 1832), Doc. No. 108, p. 4. http://www.roundislandlighthouse.org/history.htm.

95. The two other signers of Porter's performance bond were Daniel Baxter, Jr. and Lawson Caryl, both of Boston. Copies of both contracts in CALO archives.

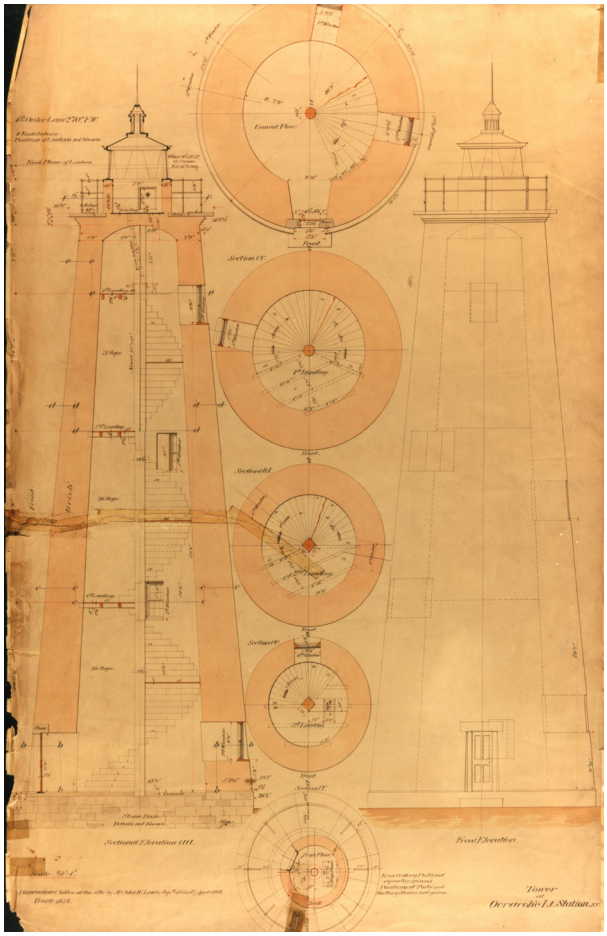


Figure 41. Drawing sheet, Tower at Ocracoke Light Station, 1892. (CAHA Coll.) See larger version in *Appendix B*.

> [girders] and floors of each story to be made of Georgia pine clear of sap; the stairs and floor to be two inch plank (planed). From the top of the stairs to the entrance of the scuttle to be an iron ladder, with steps two and a half inches square. On the top of the tower to be an iron lantern of an octagon form, the posts to be two inches square, to run down five feet into the stone or brick work, and secured with anchors. The height and diameter of the lantern to be sufficient to admit an iron sash in each octagon, to contain twenty one lights of fourteen by twelve glass, the lower tier to be filled with copper; the rabbets of the sashes to be three quarters of an inch deep, and glazed with double glass from the Boston Manufactory. In one of the octagons to be an iron framed door, covered with copper four feet by two in the clear, to shut tight into the rabbets with a strong turned button. The top to be a dome formed by sixteen iron rafters concentrating in an iron hoop five inches wide nine inches diameter, covered with copper thirty two ounces to the square foot, which is to come down and rivet in the piece that forms the top of the sash, which is to be three inches wide. On the dome to be a traversing ventilator, two and a half feet long and fifteen inches diameter, on which is to be secured a vane three feet long and twenty inches wide; the ventilator and vane to be framed with iron, and covered with copper and painted black. Around the lantern to be an iron railing, the posts of which are to be one and three eights of an inch square, the upper one to be four feet from the deck. The lantern and woodwork of the tower to be painted twice over with white lead, except the dome, which is to be black. The lighthouse to be furnished with one complete electrical conductor [lightning rod], three quarters of an inch in diameter, with points.
>
> And the said Noah Porter agrees and engages on his part to furnish all the requisite materials and to perform all the work as aforesaid in a faithful and workman-like manner, to the approbation of the Superintendent of the establishment by the first day of December next, for the consideration of the sum of ten thousand two hundred Dollars.[96]
>
> [*Contract specifications for the dwelling house, outhouse and well are discussed below in the history of the keeper's house and outbuildings.*]

A dispute followed completion of the lighthouse. Initially, the Federal government refused to accept the lighthouse and withheld payments to Noah Porter because of complaints lodged by Lighthouse Supervisor Joshua Tayloe. This was a financially devastating situation for Porter, who had borrowed money for the needed project materials and labor, and without compensation from the government had no way to repay it.[97]

Tayloe had several complaints. The contract stipulated that the tower was to be uniformly graduated from the base to the top, but the finished walls presented an uneven, projecting surface at one place. According to the contract, the deck around the lantern was to be of soapstone five inches thick. As built, the deck used freestone and was only four-and-a-half inches thick.[98] While the contract specified that the walls of the rooms in the keeper's quarters be lathed and plastered, they were, in fact, plastered directly over the brick. In addition, the contract required that all timber be of Georgia pine but, instead, Carolina pine was used.[99]

96. Contract for Ocracock [*sic*] Light House, June 20, 1823, Noah Porter Contractor. Duplicate. CAHA Coll.
97. Correspondence from George S. Bulfinch to Pleasonton, February 4, 1824. From the wording of the letter, it appears that Bulfinch, son of Charles Bulfinch, U. S. Commissioner of Public Building, was serving as Noah Porter's attorney.
98. Freestone refers to an oolitic sedimentary stone favored by masons for its spherical graining in concentric layers that can be worked in any direction with hand tools. In this case it is likely limestone.
99. Correspondence Lewis to Pleasonton, February 9, 1824.

Other complaints noted that Porter had dug a hole United States land for the purpose of obtaining sand to make mortar and had not refilled the hole; that the chamber floors in the dwelling were single rather than double-laid; and that the lightning rod was attached by wood rather than iron.[100]

On the other hand, letters to Fifth Auditor Stephen J. Pleasonton in Porter's defense pointed out that Porter was an industrious mechanic who had raised a large amount of money to fund the project until he could be paid by the government; that the lighthouse was constructed of the very best materials and built in the most solid and substantial and workmanlike manner; and that Porter had not only supplied materials in amounts well above what had been called for, but also provided considerably more work than required. Winslow Lewis, who had built numerous lighthouses himself, even went so far as to suggest that the objections against the government accepting the lighthouse arose more from a personal conflict between Tayloe and Porter than from any deficiency of the work.[101]

Among the last correspondence concerning the settlement of the contested contract was the suggestion that $203 be deducted from Porter's pay. However, another letter asserted that not even one cent should be held back.[102] The ultimate resolution regarding Porter's settlement is unknown. Although documentation of the exact date of lighting has not been found, the contract for fitting the lamps was completed by January 14, 1824.[103]

The Lighthouse: A Solid Presence on the Land

The oldest known drawing of the Ocracoke Lighthouse dates from 1892 (*Fig. 41*), and no photographs are known to have been made prior to 1893, so knowledge of its appearance during its first seventy years is based solely on the written record. From the dispute that arose at the end of construction, we know of several ways in which the completed lighthouse differed from the specifications. Considering the close inspection given the lighthouse at its completion, it can be assumed that there were no other major digressions from the specifications. The contract gave the choice of using brick or stone for the tower. Brick was used, and stone formed the base and foundation.

One somewhat confusing aspect of the lighthouse is its height. The contract stated that it should be sixty-five feet from the ground. Since then, various figures have been used, including sixty-nine, seventy, and most often seventy-five feet. The differences apparently come from what is being measured, e.g. the height above ground, the height above sea level, the height from the base of the tower to the focal plane, etc. The replacement of the lens and construction of a new lantern room in 1854 accounts for some or all of the discrepancy.

Unusual news regarding the lighthouse was reported on October 17, 1834. According to the Superintendent of Lights for the District of Ocracoke, the "partial destruction of the Lighthouse at Ocracoke by fire" had occurred.[104] How much destruction and of what kind is not known. No evidence has been uncovered that suggests fire damage, although it may have been obscured by subsequent changes to interior, exterior, and lantern.

As discussed in *Part I.A*, Pleasonton was removed in 1852 as overseer of America's lighthouse program when Congress created the Light-House Board. The board immediately addressed Pleasonton's harmfully frugal management, and made improvements both in management of the program and in the physical condition of the nation's lighthouses and other navigational aids.[105]

An 1852 annual report of the Light-House Board identifies the light at the Ocracoke Lighthouse at that time as ten lamps and twenty one-inch reflectors in a rotating configuration, a change that occurred sometime after the original fifteen sixteen-inch reflectors that apparently were installed in 1823 (*Fig. 42*).[106] In 1854 in a major change, the out-of-date and insufficient reflector lamp system was replaced with a fourth-order Fresnel lens with a fixed white beam (*Fig. 43*). The lens was manufactured by L. Sautter et Cie of Paris, France. Beginning in 1867, lard oil was used as fuel instead of whale oil, later updated to kerosene in 1878.[107]

100. Correspondence [illegible] to Pleasonton, April 1, 1824.
101. Bulfinch to Pleasonton; Lewis to Pleasonton; [illegible] to S. Pleasonton; Statement of William Howard, April 1, 1824.
102. [Illegible] to Pleasonton; William Howard statement.
103. Reported that date by Joshua Tayloe. Shelton-Roberts and Roberts, *North Carolina Lighthouses*, pp. 56-57.
104. Correspondence from Charles W. Morgan to Stephen Pleasonton, October 17, 1834.
105. Dennis L. Noble, *Lighthouses and Keepers: The U. S. Lighthouse Service and Its Legacy* (Annapolis: Naval Institute Press, 1997); USCS, "Historic Light Station Information."
106. Annual Report of the Light-House Board, Thirty-second Congress, First Session, February 5, 1852.
107. Noble, *Lighthouses and Keepers*; USCS, "Historic Light

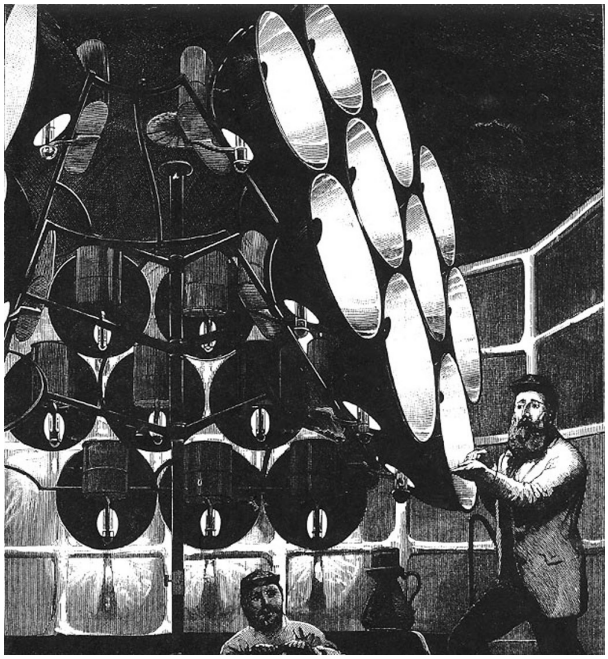


Figure 42. Drawing of a 19th century rotating chandelier frame with parabolic reflectors on three sides. (uslhs.org/reflector-chandeliers)



Figure 43. Fourth-order Fresnel lens, 1850s, manufactured by L. Sautter et Cie, Horton Point Lighthouse, New York. (lighthousefriends.com/horton5.jpg)

During the Civil War, the Confederates, under instructions from the Confederate Lighthouse Board, removed the lens from the Ocracoke lighthouse in 1862, just as coastal counties came under Union control.[108] While Ocracoke was still under Union occupation, he U.S. Lighthouse Board reported that by June 30, 1863, Ocracoke Lighthouse had been "refitted and the lights re-exhibited."[109] Though in place, the light apparently was not permanently lighted until almost a year later in early-to-mid 1864.[110]

In 1868, several years after the Civil War, a report of repairs undertaken at the Ocracoke Lighthouse provides a representative sampling of the work completed periodically on the structure over nearly the next century and a half. A listing of this work was reported as follows:

> Recemented a large portion of the Light House tower and gave it 2 coats of whitewash. Painted Lantern inside and out, and repaired the lantern deck. Repaired the sashes and frames, also the stairway extensively putting in 33 ft. of newel 14 ins. diameter, painted all the woodwork inside and out 2 coats.[111]

Interior whitewashing may have been applied annually, and exterior painting tended to occur every few years. There are so many recorded instances of these activities that, for the most part, they are not noted in this report unless of an unusual nature. Less frequent was the need for recementing, though window frames and sash were often in need of repair, sash were replaced at times, and it seems that other work of one type or another was periodically required. From a review of the years of upkeep on the lighthouse, it is clear that the general coastal environment and numerous storms took their toll on the structure.

In 1882, Ocracoke was described as an old station that needed extensive general repairs. A report on the condition of the lighthouse that year found that a portion of the wooden stair and landing, at the connection to the masonry, had decayed. Window frames and sash needed renewal, the tower door and door frame needed to be replaced, and some cement work was necessary. Some repointing of the brick was also needed. However, a May report from the Office of the Light House Engineer to the Chairman of the Light-House Board claimed that

Station Information"; Ronald G. Warfield, North District Interpreter, National Park Service, Cape Hatteras National Seashore, National Register nomination for Ocracoke Light Station, 1977.

108. Bodie Island lighthouse and the Roanoke Marshes screwpile light were first. Daniel E. Dempster and Elinor De Wire, Lighthouses of the South (Voyageur Press, 2004), p. 67.

109. United States. Department of the Treasury, *Annual Report of the Secretary of the Treasury on the State of the Finances* (1863), p. 156.

110. U.S. Government Printing Office, *Congressional Serial Set* (1892), pp. 424-25.

111. Report to the Office of the Fifth Lighthouse District, Baltimore, October 14, 1868.



Figure 44. Early 19th century "Birdcage" style lantern, Selkirk Lighthouse, Pulaski, New York. (uslhs.org/lantern)



Figure 45. ca. 1854 replacement lantern, Ocracoke Lighthouse. (2013 photograph, JKOA)

funds available for repairs within the Fifth District that fiscal year would not allow for the needed work to be accomplished. The following month, the Engineer's Office declared that no repairs of value had been made at the lighthouse during the previous ten years.[112]

Establishing a Visual Record

In May 1892, plans of the lighthouse—including a front elevation, a section, and floor plans of the tower—were drawn based on dimensions taken on site in April by John W. Lewis, Superintendent of Construction (*Fig. 41*). This is the first known visual documentation of the lighthouse. Although there are errors in the drawings, they illustrate not only how the 1823 specifications translated into the actual building, but also changes that were made between 1823 and 1892. Among other features, the plans show a cut-stone base, brick walls, a counterclockwise wooden spiral stair with three landings, six windows set counterclockwise along the path of the stairs and at the lower level, the entrance door, and the ca. 1854 off-center, glass-enclosed lantern room with its surrounding railed deck. The plans mistakenly give the year the lighthouse was built as 1828 instead of 1823.

112. Correspondence from O. E. Babcock, Light House Engineer, to John Rodgers, Chairman of the Light-House Board, Baltimore, May 4, 1882; Correspondence from Babcock to Robert H. Wyman, Chairman of the Light-House Board, Baltimore, June 13, 1882.

The 1892 drawing shows several changes from what was specified in the original contract. While work records from the period of construction to the date of the drawing are lacking, these deviations likely denote changes made after construction. On the drawing, the door is not shown as the called-for double-thick board door with iron strap hinges, but as a four-panel door. It is likely that the original door and door frame were replaced between 1882 and 1892 with the four-panel door. Curiously, the drawing shows the door jamb and lintel to be made of stone, though this may be an error. The dimensions of the door opening are shown as 2'-4½" wide by 6'-4" tall, whereas the original contract states that the door was to be three feet wide by five feet tall. The wood lintels known to exist above the window and door masonry openings are not shown. The floor plan shows that by 1892, a layer of cement had been poured over the masonry of the ground floor.

Perhaps the most notable difference is the lantern. The 1823 contract specified the lantern in some detail. It was to be an octagon in form, and each section of the octagon was to have an iron sash with twenty-one lights of fourteen-by-twelve glass, the lower tier to be filled with copper. This description, common to Winslow Lewis's lighthouse specifications of the first half of the 1800s, describes what is known as a "birdcage" lantern (*Figs. 44-45*).

The fitting out of the lamps to be installed inside Ocracoke's lantern room was separately contracted. Winslow Lewis, bolstered by Pleasanton's support, held a standing contract to fit out all U.S. lighthouse lanterns with his patented reflector system. The contract for Ocracoke between Winslow Lewis and Henry A. S. Dearborn was signed and dated July 28, 1823, the same day Noah Porter signed his construction contract. Lewis's contract stated:

> That the said Winslow Lewis on his part engages and agrees to fit up and light the Lantern on the Light House to be built at or near Ocracoke, North Carolina, as a revolving light with fifteen Lamps fitted with the oil heaters and fifteen sixteen inch reflectors and furnish two spare lamps, ten double tin oil butts to hold ninety gallons each, ten wooden horses, one lantern canister and iron trivet, one tube box, one wick box, one hand lantern, one torch, one oil feeder, one copper oil measure fitted to answer the purpose of an oil heater, two files, two pair scissors, one pair cutting nippers, and one glazier's diamond—and the said Winslow Lewis agrees and engages to furnish all the requisite materials for fitting the said Light House in the manner before described and to do all the aforesaid work in a faithful and workman-like manner within thirty days after said Light House shall be built, for the consideration of some Thirteen Hundred Dollars.[113]

A decade earlier in 1812, Boston clockmaker Simon Willard developed a clockwork mechanism used to rotate Lewis's reflector chandeliers. According to the description on an early patent, the reflector chandelier was

> "...supported upon two copper tables, which have the machinery for producing their revolutions attached. The lamps are divided into two clusters, and are so arranged upon the tables that each cluster...will display its light for a certain period during each revolution. The motive power of the machinery is a weight of 228 pounds, attached to a rope, which is wound over a horizontal barrel; this barrel is connected with a spindle by means of a wheel and pinion, and upon the spindle the tables are placed: motion is in this manner communicated to the tables, and it is regulated by the revolution of a series of vanes, which are connected with the spindle by means of horizontal wheels and pinions."[114]

Typically the counterweight mentioned in the description was hung on a pulley system running the vertical length of the tower. The weights were installed in one of three configurations, in a wall channel, on a guide cable down the open center



Figure 46. Rotational counterweight on pulley system inside central column, Point Sur Lighthouse, Big Sur, California (lighthousetrek.com/sur.html)

of the tower, or in the central column supporting the stairs (*Fig 46*).[115] The configuration used at Ocracoke was likely of the last type, as the walls are of solid masonry and the stairs spiraled around a center column.

The 1820 Sapelo Island Lighthouse was built and the light for it fitted out by Winslow Lewis. The wording of the 1819 construction contract is identical to that of Ocracoke. Abandoned in 1905 when a newer and taller lighthouse was constructed, the original wood stairs of the first Sapelo Island Lighthouse remained in place until the lighthouse was refurbished in the late 1990s.[116] An undated photograph taken before the 1990s work shows the deteriorated original staircase (*Fig. 47*). The wood treads span from a central wooden column to the brick shell wall, just as they do in the 1892 drawing of the Ocracoke Lighthouse. Splintered in places, it is clear in the Sapelo Island Lighthouse photograph that the central column is hollow. The central wood column likely served as the shaft for the original counterweight in both of these lighthouses.

113. Contract for Ocracocke [*sic*] Light, July 28, 1823, Winslow Lewis Contractor. Duplicate. CAHA Coll.
114. United States Lighthouse Society, http://uslhs.org/clockworks.
115. Ibid.
116. Georgia Department of Natural Resources, State Parks & Historic Sites, http://gastateparks.org/item/5943?mode=p.



Figure 47. Original wood spiral staircase in the Sapelo Island Lighthouse, photographed before its 1998 removal, Sapelo Island, Georgia.



Figure 48. Rectangular masonry opening at center of dome, Ocracoke Lighthouse. (2013 photograph, JKOA)

At Ocracoke Lighthouse, there is a 2'-0" by 6" rectangular opening in the center of the domed brick ceiling of the tower (*Fig. 48*). It is likely that this masonry opening was the anchor point of the original hollow central wood support for the 1823 wood staircase and the opening through which the counterweight for the clockwork rotational system of the original reflector system ran.

Ocracoke's original wood staircase is detailed in the 1892 drawing (*Fig. 41*). The steps ran counterclockwise, beginning just south of the doorway at ground level and connecting three landings, with each window falling along the path of the steps except for the lowest, which lit the entry level. The landings were supported by a joist system of wood beams anchored into the brick shell wall.

From the third landing, an iron ladder provided access to the lantern room. The scuttle hatch in the floor of the lantern room is shown hinged on its south side, the reverse of the present arrangement. The lantern deck is shown as visibly segmented stone, 4½" thick.

The lantern shown in the Ocracoke drawing dates to about 1854, when the fourth-order Fresnel lens was installed (*Figs. 41, 45*). The new lens was more compact than the previous Winslow Lewis-designed chandelier reflector, and also fixed, meaning the clockwork mechanism used to rotate the previous reflector chandelier was no longer required. The replacement lantern was smaller in circumference than the 1823 lantern and round in shape rather than octagonal, with glass set in a framework of iron bars forming alternating truncated triangles. The smaller footprint of the new prefabricated lantern when installed over the existing floor hatch location made necessary the slightly off-center placement of the new lantern on the tower. There is no reason to believe the original lantern was placed off center.[117]

This lantern design is not unique to the Ocracoke Lighthouse. Among several lighthouses with identical lanterns is the New Point Comfort Lighthouse in Port Haywood, Virginia. Constructed in 1805, the Lewis lens and reflector system was replaced with a fourth-order Fresnel lens in 1856. The 1858 records of the fifth lighthouse district engineer indicate that "The old lantern has been replaced by a cast iron one with cast iron deck and brick parapet wall laid in plaster with cement." The account is corroborated by an 1858 fifth district lighthouse inspection report listing the lantern as "circular, 6' diameter, cast iron by Hayward & Bartlet [*sic*] with (interior) iron deck and ventilator, 12 trapezoidal lights 3' tall."[118]

Founded in 1832, Hayward, Bartlett, and Company was a foundry based in Baltimore and specializing in industrial manufacturing and architectural iron work.[119] It is likely they were the supplier for all lanterns of this design.

117. In the 1850s, many existing lighthouses were fitted with Fresnel lenses, which were made in different sizes, or "orders." The scale of the new lanterns matched the lens, so some new lanterns were larger that the originals, others, like Ocracoke's, smaller. Bald Head Island Lighthouse, also in North Carolina, has an offset lantern of 1850s design, likely because of a hatch location similar to that of Ocracoke.
118. Building & Monument Conservation and Sutherland Conservation & Consulting. "New Point Comfort Lighthouse Conservation Plan, Working Draft February 13, 2009," 2009, pp. 12, 15.
119. *Bartlett Hayward presents this Pictorial Review of its Industrial Activities*, 1945, Koppers Company, Inc. Hartlett Hayward Division, Baltimore, Maryland.



Figure 49. Tower at Ocracoke Light Station, May 24, 1893. Keyed to camera station 2 on 1905 light station plat, *Fig. 115*. (Herbert H. Bamber, photographer. CAHA Museum Resource Center (MRC), Rm. 1, Map Case 4, Dwr. R)

Ocracoke's lantern balcony railing was also replaced in 1854 as part of the prefabricated lantern design. The posts are anchored to the stone deck by a horizontal bar with embedded end. There are brackets on the posts for three equally spaced horizontal railings; however, horizontal rails are shown only in the top and middle brackets (*Fig. 41*).

The first known photograph of the tower, taken in 1893 by Herbert H. Bamber, gives much the same appearance as the lighthouse today. The stone foundation can be seen in this photograph, rising to a height of about one and a half feet above grade. By this time the exterior has been pargeted, and the photograph shows areas of spalling of the parge coat near the top of the tower. Also visible is the four-panel wood door shown on the 1892 drawing. Window frames, sash and sills are painted white. This is the first photograph of the 1854 lantern (*Fig. 49*).

Repairs and replacements continued. In 1897, new window frames and sash were installed, as well as a storm door from the lantern room to the balcony.[120] At times, repairing one problem revealed another. In 1904, a new lightning rod was installed, and mortar was added to the outside. During that work, it was noted that the outside wythe of brick and part of the next inner wythe, located about ten rows down from the top of the tower and about half way around from the front, was about to collapse. Little mortar remained and what was there had crumbled and caused the outside wythe to bulge out two to three inches. Furthermore, birds had built a nest there, going through the outside wall to do so. Presumably, the problem with the brickwork was repaired.[121] The following year, Lightkeeper T. F. Smith requested ten panes of plate glass to replace eight cracked and broken ones in the lantern.[122]

A new model fourth-order Fresnel lens was installed in 1899 and is still present today.[123] Unlike the 1854 fixed lens, this new lens was designed for movement to create a recognizable flash

120. Correspondence from E. H. Ruffner, Light House Engineer, to Light-House Board, Baltimore, March 13, 1897.
121. Correspondence from John W. Lewis to John A. Jones, Light House Engineer, Ocracoke, April 10, 1904.
122. Correspondence from T. F. Smith to Comdr. Henry McCrea, Inspector, Baltimore, March 15, 1905.
123. "Historic Transportation Sites in North Carolina," N.C. State Historic Preservation Office, Office of Archives and History, https://sites.google.com/site/trbcommitteeabg50/home/us-state-transportation-history-sites/north-carolina.



Figure 50. Ocracoke Lighthouse, ca. 1900. (CAHA Coll.)



Figure 51. Ocracoke Lighthouse, June 24, 1936. (CAHA Coll.)

pattern. The beehive-shaped glass prisms sit on a round brass base with built-in wheels allowing free rotation. This design is known as a chariot system.[124] Though currently retrofitted to be stationary, it is probable that this lens was installed to be rotational. The brass base is stamped with the manufacturer name "Barbier et Cie" and the date 1890. Barbier et Cie of Paris, France produced lenses under that name from 1887 to 1894.[125]

A photograph taken around 1900 shows changes in trim colors since the photograph of 1893. By 1900 the tower window frames, sash, and sill had been painted black. The dome remained black as called for in Porter's 1823 contract (*Fig. 50*).

In the four decades following the 1910 creation of the Lighthouse Service, there were few events of particular note regarding the lighthouse. In 1916, a closet was built and painted in the tower. Records do not mention its location, but presumably it was on the ground level. The next year a telephone was installed in the office. In 1929, the light in the tower was electrified through the use of two Delco generators placed in the concrete oil house near the base of the tower.[126] It is likely that the tower window sash were replaced in 1929 when all the windows of the Original Keeper's Quarters were replaced during construction of the Assistant Keeper's Quarters (*Fig. 57*). A 1990 completion report for a window sash replacement project states that these sash may have been installed as early as the 1890s, given a probable range of 1890s to 1929.[127]

A 1936 photograph shows that by that time the masonry wall at the base of the lantern and the visible edge of the lantern deck had been painted black (*Fig. 51*). The window sash, frames, and sills are again black as seen in the 1900 photograph.

In 1939, the U. S. Coast Guard took over management of America's lighthouses, including Ocracoke.[128] After the Great Atlantic Hurricane of 1944, the Coast Guard removed the wooden staircase from the tower and replaced it with temporary ladders. It is unclear whether this was strictly a result of damage from the storm, or whether long-term deterioration also played a role.[129]

124. United States Lighthouse Society, http://uslhs.org/lens-rotation.
125. Ibid.

126. Wesley Austin, Lightkeeper's Logbook, April 11, 1916 and October 29, 1929; Office of Lighthouse Inspector, Lighthouse Service, Estimate of Cost of Proposed Works at Ocracoke Light Station, May 3, 1929, p. 5.
127. Completion Report, Ocracoke Lighthouse Window and Door Replacement Project, 1990.
128. www.outerbankslighthousesociety.org.
129. Warfield, National Register nomination.



Figure 52. Tower during shotcrete application, ca. 1952. (Mary Ruth Dickson Coll., Ocracoke Preservation Society)



Figure 53. Tower post shotcrete application, December 1952. (CAHA typed photo id sheet)

Mid-Twentieth Century Changes

The early 1950s were busy years at the lighthouse, with several changes, some harmful to the structure. Especially damaging were significant changes made to the masonry, harmful to both the interior and exterior of the tower. The whitewashed interior was sandblasted. This removed the hard-fired protective surface, increasing moisture penetration and intensifying the effects of the freeze-thaw cycle. Perhaps more serious, the exterior of the brick tower and its stone foundation were coated using the shotcrete process, often called gunite, in which Portland cement, water, and sometimes sand are mixed and sprayed onto a surface under pressure and in layers. The application prevents evaporation of moisture from the underlying brick and causes continued damage. In addition, the surface and thickness of the coating changed the appearance of the lighthouse, increasing the depth of door and window recesses and obscuring details.

An undated color photograph, likely taken in 1952 or 1953, shows the tower apparently during application of the shotcrete coating. Large metal scaffolding rises the height of the tower. A full vertical panel has been coated, the shotcrete sprayed in horizontal bands corresponding to the scaffolding levels, each approximately four to five feet in height. The yet-uncoated portions of the

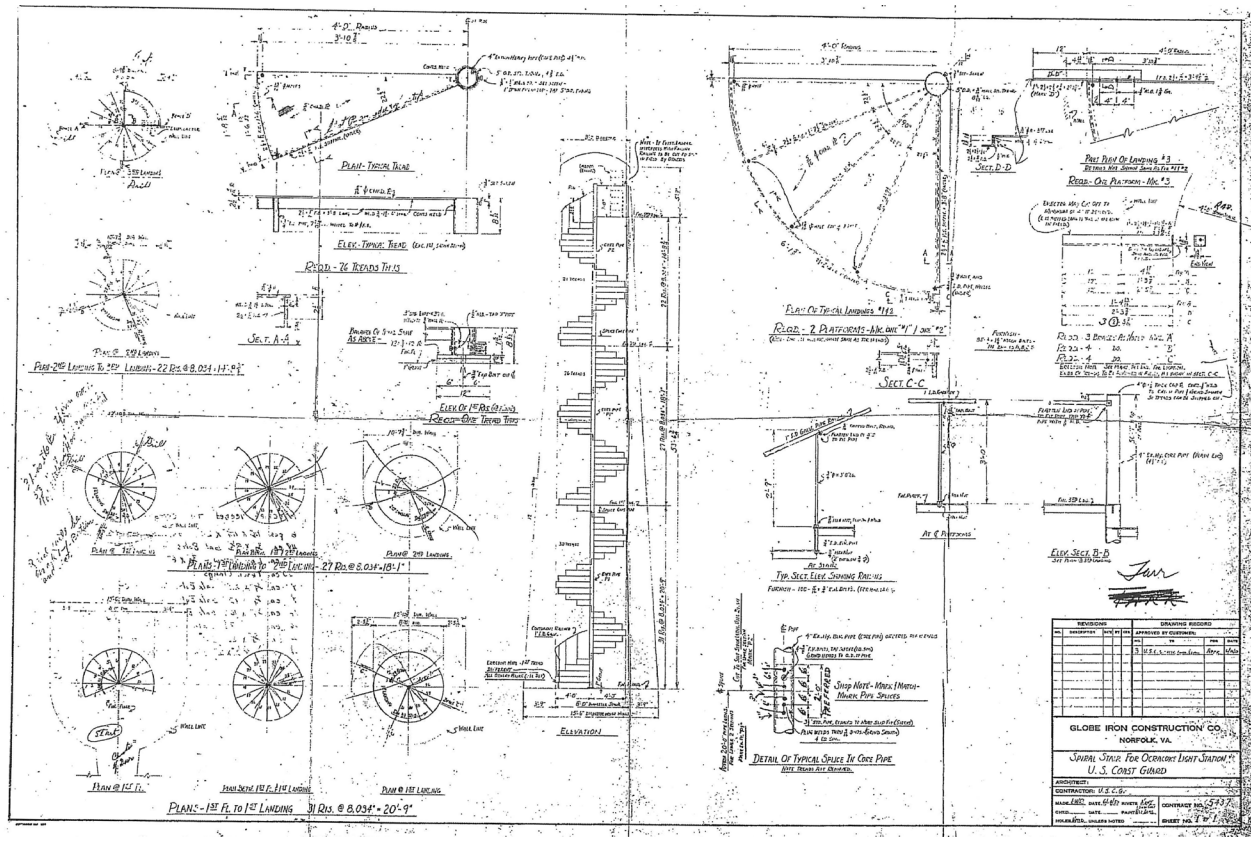


Figure 54. Spiral Stair for Ocracoke Light Station. Shop drawing by Globe Iron Construction Company of Norfolk Virginia, dated June 14, 1953. (CAHA MRC, Rm. 1, Map Case 4, Dwr. R) See larger version in *Appendix B*.

tower appear to be bare brick, meaning that the parge coat was removed before the shotcrete was applied (*Fig. 52*).

A photograph (dated December 1952 but perhaps later) shows the tower after the coating process was complete. The photograph is surprisingly clear; the application bands are evident and the surface texture is visible. The rows of brick corbelling immediately beneath the lantern deck have been coated and lost definition that was visible in earlier photographs. This photograph shows that a third horizontal railing has been added to the lantern balcony. It also shows that the tower window sash, frames, and sills had been repainted white sometime before, a change from the black trim in the ca. 1900 and 1936 photographs. The dome remained black (*Fig. 53*).[130]

Another major change was made in the early 1950s. In 1953, the Coast Guard replaced the temporary ladders with a steel spiral stair. The new staircase was designed by the Globe Iron Construction Company of Norfolk, Virginia. Shop drawings dated June 14, 1953 indicate probable installation later that year (*Fig. 54*). For some reason the orientation of the stairs was changed from the original counterclockwise spiral to a new clockwise rotation; therefore, landings no longer corresponded to the placement of windows meant to light them. During the project, a new steel and concrete floor was installed at the lantern level.

A photograph taken in October 1954 shows that the newly coated tower and the masonry wall at the base of the lantern room had been repainted white, as well as the window components, leaving the dome, the cast-iron lantern and the visible edge of the lantern deck as the only black elements. [131] A photograph taken two years later in July of 1956 shows the same paint scheme and what is unmistakably the shotcrete coating (*Fig. 55*).

130. The bottom railing on the lantern balcony is noted as not present in the 1892 drawings of the lighthouse and does not appear in 1893 photographs. The photographs dated ca. 1900 and 1936 are of low resolution and provide no information.

131. The 1954 photograph is omitted from this report as it is out of focus and overexposed. The 1956 photograph shows the tower having the same appearance.

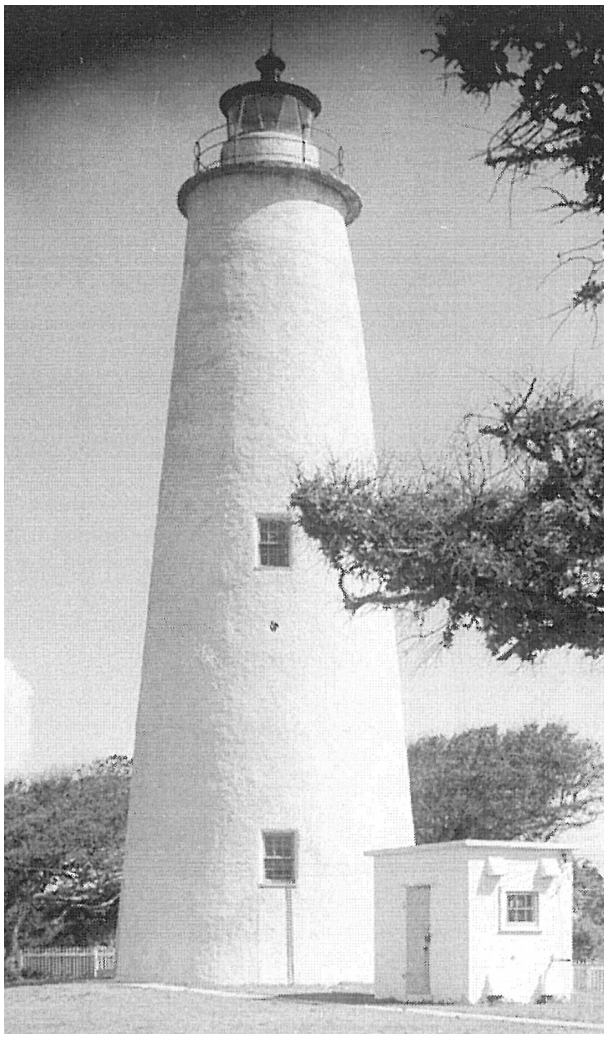


Figure 55. Lighthouse, July 1956. (CAHA typed photo id sheet, negative no. 56-285)

The greatest change to the functioning of the Ocracoke Light Station came in 1954 when the lighthouse was automated. With this change, lightkeepers were no longer needed.[132] As a result, the next year the Coast Guard allowed NPS to use the vacant Keepers' Quarters for park purposes.

Moving Towards Preservation

A photograph taken on Kodak Safety Film 5063, popular in the 1970s-80s, shows that a flush wood or metal door with a large centered lower panel of louvers had replaced the four-panel door design seen in the 1890s drawing and photograph. The body of the door is painted a darker color, with the louvers a light color, likely white or unpainted metal (*Fig. 56*). The reason for the change in doors was likely utilitarian and perhaps in response to moisture damage from the interior sandblasting and exterior coating of the 1950s. Louvers allow for ventilation and temperature regulation of the interior of the tower even when the window sash are closed, especially when the upper hatch is open to create chimney-effect air movement.

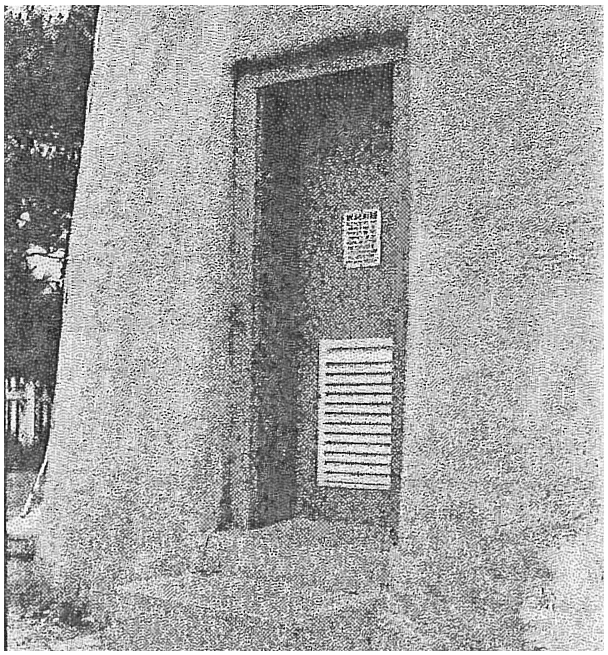


Figure 56. Replacement wood or metal door with louvers at lighthouse entry, 1970s-80s. (CAHA Coll.)

Maintenance of the lighthouse lagged until 1987 when public concern was expressed over its condition. Alton M. Balance, Hyde County Commissioner representing Ocracoke, wrote a letter to Rear Admiral A. D. Breed of the U. S. Coast Guard Fifth District enumerating his concerns. In his view, the lighthouse was in a serious state of disrepair. Balance had inspected the lighthouse and discussed his concerns with the NPS preservation team supervisor for the rehabilitation of the keeper's quarters. His list of the most serious problems included: 1) algae build-up on the interior masonry surfaces, 2) lack of ventilation, 3) window and door deterioration, 4) use of Portland cement to patch interior masonry, 5) a general loss of mortar on the tower's interior, 6) corrosion of the metal in the circular stair, 7) leaks in the balcony, and 8) the use of paint on the exterior, trapping moisture in the masonry walls.[133]

132. Warfield, National Register nomination. Gunite began as a name brand and became the generic term for the process also known as shotcrete. Other trademarked names included Guncrete, Pneucrete, Blastcrete, Blocrete, and Jetcrete. These products vary somewhat in application technology.

133. Correspondence from Balance to Breed, November 1, 1987.

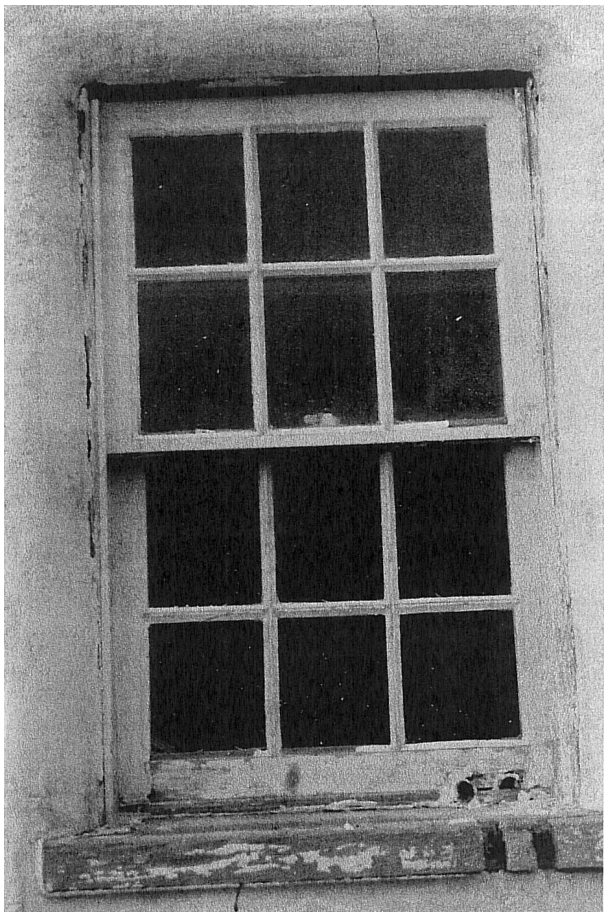


Figure 57. Wood windows, probably installed in 1929, showing physical condition prior to 1987 replacement. (CAHA Acc. 315, Cat. 5429, Box 10, Folder 2)

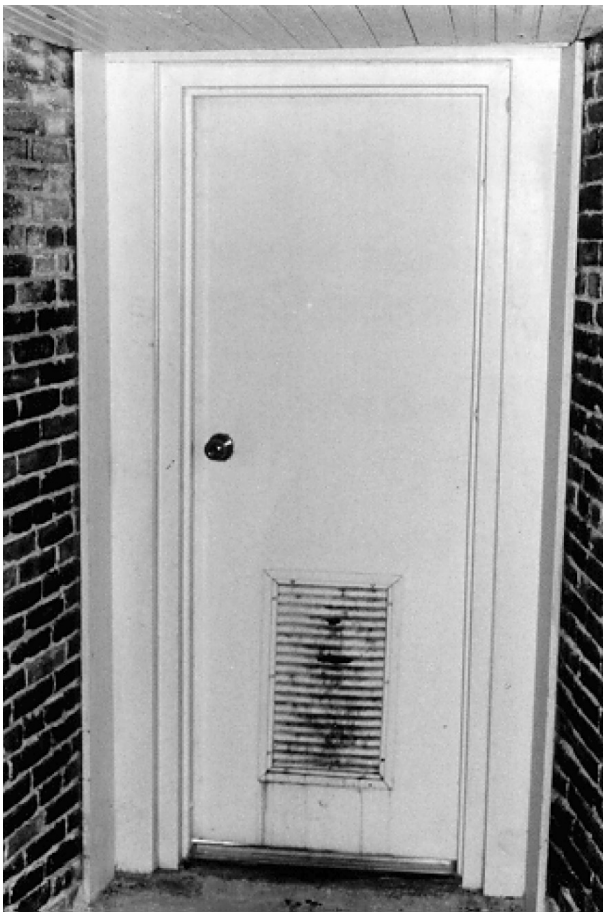


Figure 58. 1987 replacement metal door at lighthouse entry. (Historic Lighthouse Preservation Handbook, NPS, USCG, August 1997, Part IV.F, p. 6)

These conditions are typical of damages from sandblasting and coating; the sandblasting allowed easy penetration of moisture, and the shotcrete coating served to trap moisture in the masonry, forcing it to climb and create higher and higher damage.

The Coast Guard made an inauspicious start. In May of 1987, upon review of the specifications for the window and door replacement project, NPS notified the Coast Guard that its proposed replacement of existing wood windows with vinyl windows was in violation of the Secretary of the Interior's Standards. Also noted was the inappropriate installation of a metal door frame; however, a metal door was deemed acceptable for security purposes.[134]

The next year, the Coast Guard contracted with a private firm to replace the tower windows and entrance door in accord with written agreement with the State Historic Preservation Office. The contract stipulated that the existing windows were to be replaced in kind. Instead, in 1989, the contractor replaced the wood windows with vinyl-clad sash. Horrified local residents rescued eight of the removed wood sash (*Fig. 57*).[135]

The new metal door was similar in design to the door it replaced. It was a flush door, but with a smaller panel of louvers in the lower section. The louvers were narrower in width and smaller in scale than the previous door and provided less ventilation (*Fig. 58*).

The public urged the transfer of responsibility for the buildings to NPS from the Coast Guard (USCG). In April of 1988, NPS and USCG entered into an interagency agreement allowing NPS to apply for grants to fund preservation work on the USCG-owned light station. NPS received

134. Letter from North Carolina Department of Cultural Resources to Marvin H. Barnes, Jr., Environmental Protection Specialist, USCG, May 27, 1987.

135. Completion Report, Ocracoke Lighthouse Window and Door Replacement Project, 1990.

two consecutive grants from the Bicentennial Lighthouse Fund in 1988 and 1989. These grants were used in part to fund a Historic Structures Report and preservation work from late 1988 to September of 1991. The HSR included a condition assessment, documentation of the structure, and development of a scope of work for future preservation work. It was completed in April 1990.[136]

Beginning in 1989, NPS conducted several informal investigations into the structural integrity and general condition of the lighthouse.[137] Historical Architect and Chief of Historic Preservation for the North Atlantic Regional Office of NPS, E. Blaine Cliver, conducted a field investigation of the lighthouse in April of 1989. His work included a condition assessment, recommendations, and analysis of mortar and paint samples. (Cliver's field report and an abridged version of his mortar analysis are included as an appendix to this 2015 report.)[138]

Among other findings, Cliver's mortar analysis identifies rectangular, similarly-sized and evenly-spaced mortar patches on the interior of the lighthouse wall just below the masonry dome supporting the lantern deck. The composition of the mortar indicates that they were patched well after the lighthouse was constructed. His mortar samples from the masonry wall at the base of the lantern corroborate the mid-nineteenth-century date of the present lantern.[139]

Cliver's field report notes that paint analysis cannot be performed on the wood elements of the lighthouse due to lack of original material. It does note that:

> Paint samples taken from a piece of wood facia [*sic*] found under the floor of the old tool house show a crème followed by greys, grey-greens, red and black. Since the context of the facia is unkown, the sample is of little value. However, it should be pointed out that because of the length of the facia it was most likely from a door and because of the sand found imbedded in the paint layers, it probably came from an exterior door frame.[140]

136. Lighthouse Grant Project, Ocracoke Lighthouse, Phase I & II Completion Report, July 1990.
137. Ibid.
138. Memorandum from Blaine Cliver, Chief of Historic Preservation, North Atlantic Regional Office, to Regional Historic Architect, Southeast Regional Office, May 11, 1989.
139. Ibid.
140. Ibid.



Figure 59. 1989 structural investigation of masonry wall at base of lantern. (CAHA-5035, Box 1, Folder 3)

His field report highlights several condition issues:

- Interior cracks in the masonry above the windows and door suggest that the lintels have deteriorated and are failing.
- The presence of algae on only the upper portions of the walls is a result of poor ventilation. Algae resulting from rising damp would be present on the lower half of the tower walls. The algae present suggests that the lack of ventilation at the top of the tower allows moisture from the air to rise and condense on the surface of the walls without means of escape.
- The cast iron lantern has experienced extensive rust jacking from constant exposure to salt water. This has cause seams of the lantern to open allowing water penetration.[141]

Another phase of physical investigations started in late August of 1989, focusing on inspecting the masonry wall at the base of the lantern and the door and window lintels. Inspections were completed by mid-September 1989 allowing for preparation of a scope of work. Work was performed in three phases as further funding became available (*Figs. 59-60*).[142]

The first phase of work was conducted from mid-September 1989 to mid-February 1990. The following work was undertaken:

- The steel stair support brackets were so deteriorated that they were replaced by stainless steel brackets reportedly fabricated to match the originals (*Fig. 61*).

141. Ibid.
142. Lighthouse Grant Project, Ocracoke Lighthouse, Phase I & II Completion Report, July 1990.

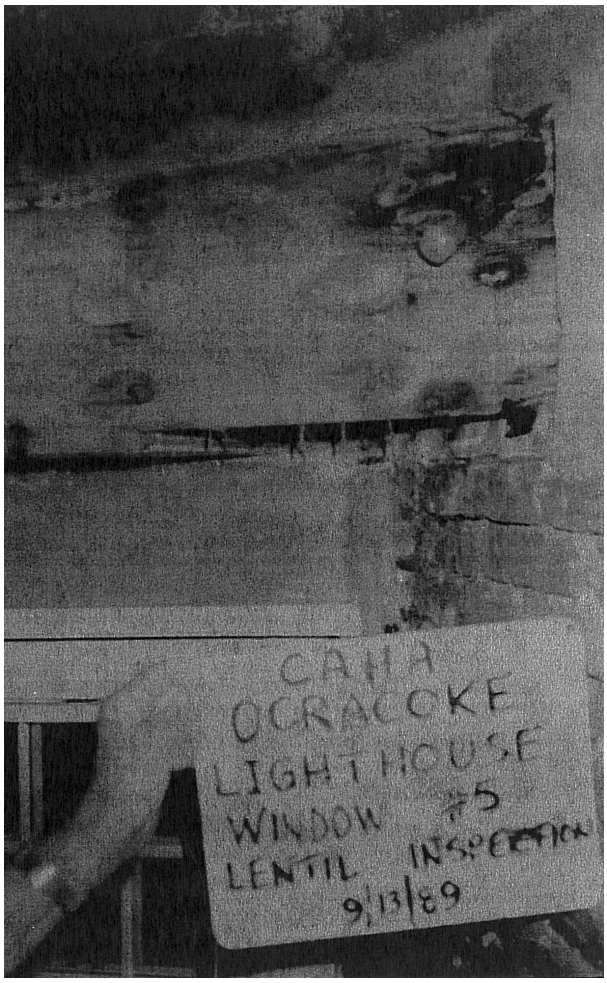


Figure 60. 1989 structural investigation of timber lintels at tower window number five. (CAHA-5035, Box 1, Folder 3)

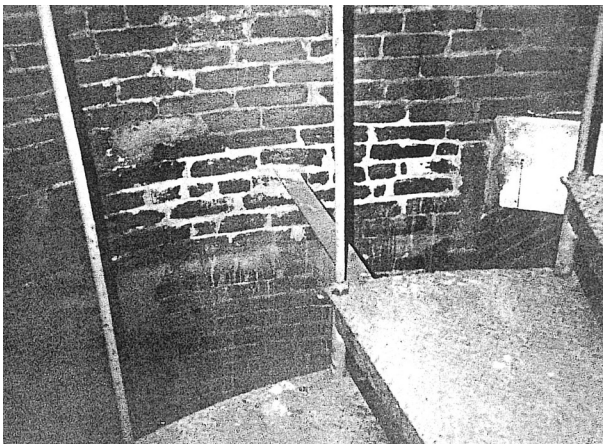


Figure 61. Replacement stainless steel stair support bracket and new mortar at masonry wall, 1989. (CAHA-5035, Box 1, Folder 3)

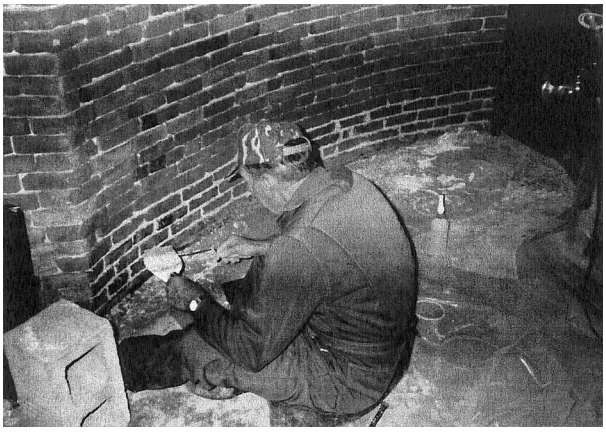


Figure 62. Repointing of interior of masonry wall at base of tower, 1989. (CAHA-5035, Box 1, Folder 3)

- Algae build-up on the interior of the tower, mostly near the top, was removed using water and soft bristle brushes.
- The joints of fifteen courses of brick encircling the interior base of the lighthouse were raked and repointed (*Fig. 62*).
- Mortar joints around the door were also repointed.
- Acrylic panels that had at some point replaced the original glass in the lantern room were removed, measured for possible future replacement with tempered glass, and reinstalled.
- Areas of the exterior shotcrete coating that appeared deteriorated were removed, and exposed areas were repaired with a mortar patch.
- The pargeted stone lantern deck was treated to stop water migration into the structure, and numerous cracks in the floor were raked out, packed with lead wool where necessary, and repointed.
- Other areas of potential water migration were sealed with a silicone caulk.
- The exterior hatch door to the balcony was removed, its broken hinge repaired, and the door reinstalled.[143]

Moisture in the building was found to be worse than anticipated. In addition to the algae on the interior surface of the masonry, efflorescence was found to be present. Large areas of grout were wet, with some having the texture of mud. A note in a weekly field report states that when workers opened a hole in the masonry where a deteriorated stair bracket had been anchored to investigate the

143. Ibid.

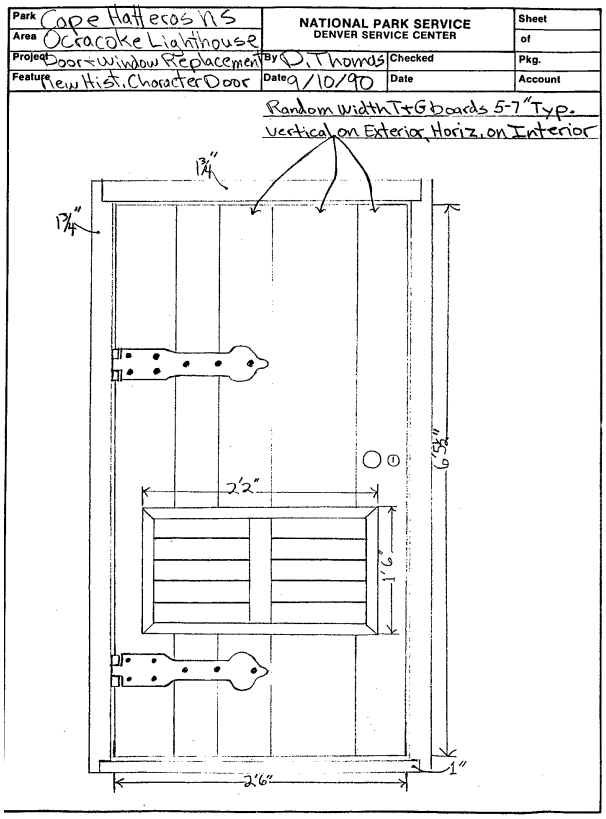


Figure 63. Design for "New Historic Character Door" for Ocracoke Lighthouse, dated September 10, 1990 (CAHA-5036, Box 1, Folder 1)

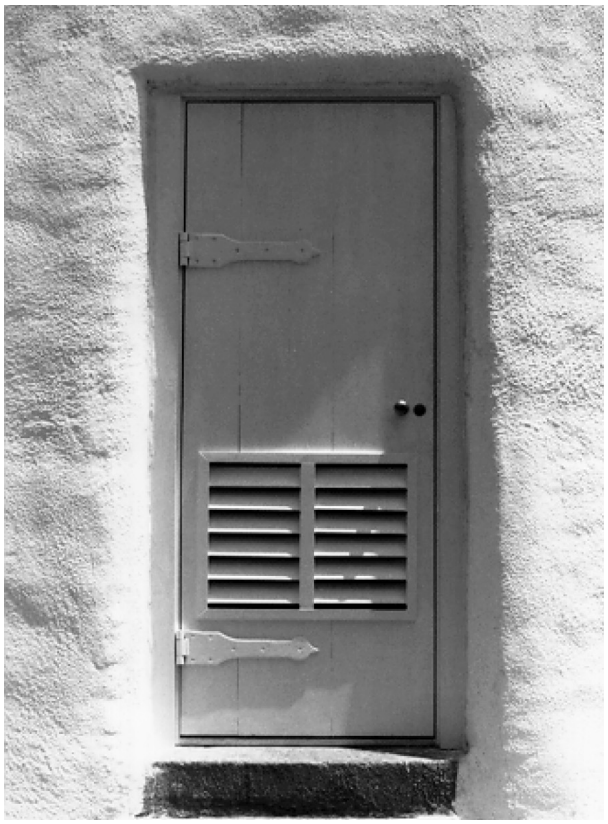


Figure 64. Louvered wood door of historic design installed at Lighthouse entry, 1990. (Historic Lighthouse Preservation Handbook, NPS, USCG, August 1997, Part IV.F, p. 2)

masonry construction technique, they "found unexplained wet wood and broken bricks."[144]

In a letter of February 26, 1990, the commander of the USCG implored NPS to consider taking ownership of the Ocracoke Light Station, with USCG maintaining the light. The letter notes that this arrangement would be in the best interest of both agencies for the preservation of the buildings. Such a transfer would not occur for another ten years.[145]

The second phase of work, begun mid-June 1990 and finished later that same year, focused on the tower windows and entry door. Five of the rescued wood sash were repaired, and seven more were manufactured to match. The rescued sash may be as early as the 1890s, but more likely date to 1929, when windows of the same design were installed at the keeper's quarters.

In the 1990 Phase II project at the lighthouse, four new wood window frames were constructed to match the existing, and the two remaining frames, windows five and six, the upper windows under the NPS numbering system, were repaired. The new and repaired sash replaced the Coast Guard's 1989 vinyl-clad sash. The rescued and repaired sash were installed as the lower sash of windows one, two, five, and six, and the upper sash of window four.[146] Solid brass sash locks were sourced from Ball and Ball, a reproduction hardware manufacturer located in Pennsylvania.

Care was taken in the design of a new, historically appropriate door for the lighthouse (*Figs. 63-64*). The new door was of random-width tongue-and-groove cypress boards in two layers, oriented vertically on the exterior and horizontally on the exterior. The boards were held together with specially manufactured wrought iron cut nails made by Saugus Iron Works of Maine.[147] In a process called clinching, the nails were driven

144. Ibid.
145. Letter from J. C. Malmrose, Commander, USCG, to Thomas L. Hartman, Superintendent, CAHA, February 26, 1990.

146. Completion Report, Ocracoke Lighthouse Window and Door Replacement Project, 1990, citing Dave Thomas, drawings of "Ocracoke Lighthouse window and door replacement," NPS Denver Service Center, July 10, 1990.
147. Ibid., citing correspondence from Paul B. Hartwig to Dr. William S. Price, Jr., April 11, 1990. Thomas drawing. Thomas, Weekly Field Reports Nos. 1, 2, and 5.

cleanly through both boards, bent in two 90-degree angles and driven back into the door. This practice was common for board-and-batten doors to prevent the nails from slipping out or the boards from loosening with repeated use of the door. The practice of clinching died with the introduction of modern machine-made nails, as they do not easily bend.[148]

In the bottom half of the door was a large panel of fixed louvers. The door was hung on a pair of large cast brass strap hinges riveted to the exterior of the door. The new installation reversed the swing of previous doors. Ball and Ball also supplied a reproduction solid brass rim lock.[149] A non-historic door frame, likely installed with either the ca. 1980 or 1988 door, was removed and replaced with a more historically appropriate cypress frame.[150] This design was intended to emulate the door of the 1823 specifications with the exception of the louvers.

A third phase of work was completed in about six months, from mid-July through September 1991. The focus was the repair of the lintels above the tower door and the six tower windows. Blaine Cliver's inspections in 1989 determined that a series of heavy timber lintels notched into the brick at both sides of the masonry openings support the entire weight of the brick above. The masonry is not arched at the openings. These structural lintels were found to be deteriorated from water and termite damage (*Fig. 65*).[151]

Above the door were seven lintel beams corresponding to the depth of the tower wall. Six of these were replaced with treated timbers. The innermost lintel was shored and left in place. Only six lintel beams were found at the first window opening, with an open void where the seventh lintel beam should have been. These lintels were found to have been previously replaced and poorly installed. When removed, a large area of brick roughly five feet by four feet by four feet (eighty square feet) collapsed and was relaid. All six

148. Jay D. Edwards and Tom Wells. *Historic Louisiana Nails: Aids to the Dating of Old Buildings* (Geoscience Publications, Louisiana State University, 1993).
149. Completion Report, Window and Door, 1990, citing Thomas, Weekly Field Reports Nos. 1 and 5.
150. Ibid., citing Thomas, drawing of "Ocracoke Lighthouse new historic character door," Denver Service Center, September 10, 1990.
151. Completion Report, Ocracoke Lighthouse Phase III Project, 1991.

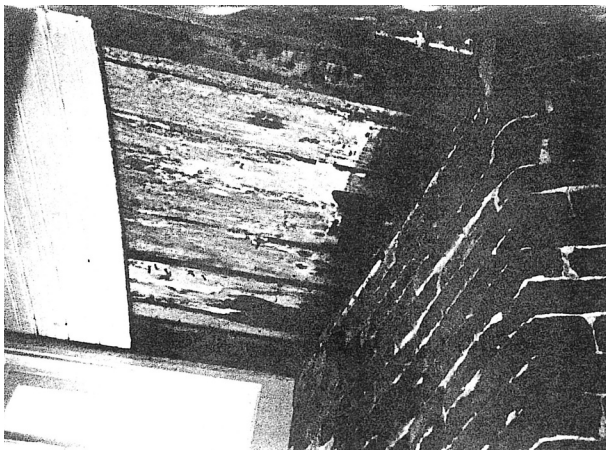


Figure 65. Replacement and shoring of timber lintels, beaded-board, and fascia boards at masonry openings of tower, 1991. (CAHA-5035, Box 1, Folder 2)

lintels were replaced and a seventh was fabricated. Existing window lintels in windows three through six were found to be in better condition and were shored as necessary. One lintel beam was replaced at the second window, and two each at the third and fifth windows. Several more voids found above lintels were infilled with newly laid brick and mortar. Intact brickwork above the windows was raked and repointed. Masonry adjacent to the lintels was repaired. At each window, the double-beaded tongue-and-groove ceiling board and fascia boards were replaced in kind.[152]

An August 1990 newspaper article in a Norfolk, Virginia newspaper, *The Virginian Pilot*, highlights the USCG's struggle to maintain the Ocracoke Light Station. John R. Walters, Chief of Waterways and Management for USCG, stated, "[Ocracoke] lighthouse is in very good condition compared to some of the other lighthouses we hold. We've got our hands full just trying to maintain the light. It will always be a struggle to maintain the historicity while keeping the lights burning." In 1990, Ocracoke Lighthouse was one of seven North Carolina lighthouses owned and operated by the USCG. Walters makes it clear that the operational goal of the USCG had been to modernized the lighthouse and maintain its operation. The interagency agreement between USCG and NPS was a compromise to ensure preservation of the building with the eventual goal of transferring ownership of the property to NPS.[153]

152. Ibid.
153. Elizabeth Thiel, "Lighthouse Restoration Ends 4th Phase But $100,000 Still Needed," *The Virginian Pilot*, August 12, 1990.



Figure 66. Four-panel wood replacement door with louvers, ca. 1995-2004. Original Stone or pargeted brick step at Lighthouse entry. (CAHA Coll.)

About twenty years passed before work continued. Sometime between 1995 and 2004, the door was once again replaced, this time returning to a four-panel wood design. The upper two panels were solid, while the bottom two had small, tightly spaced louvers. All four panels were set off with high profile moldings (*Fig. 66*).[154]

In 2000, the Ocracoke Lighthouse was transferred to the National Park Service with the Coast Guard retaining the light itself.

In 2009 through 2010, a new phase of work focused mainly on the lighthouse's cast iron and steel elements. The cast iron railing on the balcony was replaced with a new railing in the same design. The new railing components were soldered to the existing cast iron anchors embedded in the lantern deck. The cracked and deteriorated vented finial and lighting rod of the lantern were removed, repaired, and reinstalled. The cast-iron framing and roof of the lantern were commercially surface blasted. All metal elements were repainted black. Work on metal components was performed by Alex Klahm Architectural Metal and Design of Florida (*Figs. 67-71, 76-77*).[155]

154. Historic Lighthouse Preservation Handbook, NPS, USCG, August 1997, pp. 2, 7.
155. "Ocracoke Lights Return," NPS press release, March 2, 2010, http://www.nps.gov/caha/learn/news/ocracoke-lights-



Figure 67. Cracked and rusted cast iron lantern finial and lightening rod, 2009-10. (CAHA Coll.)



Figure 68. Repaired cast iron lantern lightening rod before reinstallation, 2009-10. (CAHA Coll.)



Figure 69. Repair of cast iron lantern dome component, 2009-10. (CAHA Coll.)



Figure 70. Commercial sandblasting of cast iron lantern, 2009-10. (CAHA Coll.)



Figure 73. Corroded brass lantern room wall vent removed from wall, 2009-10. (CAHA Coll.)



Figure 71. Repainted lantern before reglazing, 2009-10. (CAHA Coll.)



Figure 74. Newly manufactured brass wall vents for lantern room, 2009-10. (CAHA Coll.)



Figure 72. Corroded brass lantern room wall vent *in situ*, 2009-10. (CAHA Coll.)



Figure 75. Newly designed and fabricated handrail at lantern room floor hatch, 2009-10. (CAHA Coll.)



Figure 76. Horizontal cast iron railing anchor embedded in parge coat of stone lantern deck, 2009-10. (CAHA Coll.)



Figure 77. Newly fabricated iron railing soldered to existing cast iron anchors, 2009-10. (CAHA Coll.)



Figure 78. Deteriorated 1989 stainless steel stair support brackets, 2009-10. (CAHA Coll.)



Figure 79. Repair of 1989 stainless steel stair support bracket, 2009-10. (CAHA Coll.)



Figure 80. Assembly of replacement wood lighthouse entry door, 2009-10. (CAHA Coll.)



Figure 81. Replacement wood lighthouse entry door installed, 2009-10. (CAHA Coll.)



Figure 82. Newly installed acrylic lantern glazing, 2009-10. (CAHA Coll.)



Figure 83. Newly painted 1950s steel staircase, 2009-10. (CAHA Coll.)

All acrylic window panels were replaced with new acrylic. In November 2009 during this work, the light was darkened for the first time since the Civil War, and relit on March 3, 2010. The 1890s Fresnel lens remained in the lighthouse during the restoration work, protected in a specially designed enclosure (*Figs. 71, 82*).[156]

The three brass wall vents in the masonry wall at the base of the lantern were removed. New vents were reconstructed based on the original design and installed. The railing above the floor hatch was removed and one of a new, more secure design was installed. The lantern drum and deck were painted inside and out (*Fig. 72-75*).

Masonry was repointed on the interior of the tower as necessary, and deteriorated window frames were repaired. A portion of the brick dome was relaid. The deteriorated 1989 stainless steel stair brackets were repaired and reinstalled. The 1950s steel stairs

return.htm.
156. Ibid.



Figure 84. Ocracoke Lighthouse photographed upon completion of 2009-10 work phase. (CAHA Coll.)

were sandblasted and repainted. The ground floor door was replaced yet again. The worn four-panel door was used as a template; however, the scale of the panels was increased, the moldings of the upper panels are not as pronounced, and the louvers of the bottom two panels are thicker and larger in size. This door, at least the seventh design to grace this doorway, remains in place (*Fig. 78-81, 83*).[157]

A new entrance ramp for visitors meets the building just above the level of the original stone/masonry step seen in early photographs. Whether the step was removed or simply covered is not clear (*Fig. 84*).

The physical appearance of the lighthouse today reflects the many changes it has experienced since its construction in 1823. Most notable among the changes are the replacement of the lantern and lens in the 1850s and the shotcrete coating and replacement of the stairs in the 1950s. Although the basic form of the structure has not changed in its nearly two-century history, alterations large and small have altered nearly every aspect of the lighthouse. Historic material that remains has either been concealed or its finish has been altered.

157. "Lighthouse Renovation and Fog," *Ocracoke Island Journal*, December 15, 2009.

The lighthouse and keepers' quarters face southwest. For the purposes of this report, the front elevations are said to face west.

The quarters is identified as the singular "keeper's" until 1929 when a second residence was added, and it became the plural "keepers' Quarters."

A Proper Home for the Keeper

Keeping a lighthouse was a twenty-four-hour proposition in the years before automation, requiring the lighthouse keeper to live on or very close to the lighthouse property. Since many lighthouses were located at remote sites, the Federal government provided a house for the keeper and his family. Being a keeper required commitment to what was a difficult and often lonely job, so it was advantageous to the government to provide comfortable and up-to-date housing that might encourage the keeper to remain in his job.

Eleven principal keepers tended the Ocracoke Light and occupied the keeper's quarters. In 1829, Anson Harker became the first lightkeeper of record. His tenure was long, until 1847. He was followed from 1847 to 1853 by John Harker, possibly Anson's son. Starting in 1853, Thomas Styron filled the post until 1860. William J. Gaskill was briefly the lightkeeper from 1860 to 1862. Enoch Ellis Howard succeeded Gaskill and served thirty-five years, from 1862 to 1897, the longest of any of the keepers. He was there long enough to enjoy one notable change to the dwelling and left just as the house was being significantly enlarged. Howard was followed by the brief tenure of J. William Gillikin, who served only from May to December 1897. Tillman F. Smith took over in December and remained at the Ocracoke Light Station through the first decade of the twentieth century.[158]

Four principal keepers served the light station in the twentieth century. A. B. Hooper followed Smith in 1910, followed in 1912 by Capt. Leon Wesley Austin. Joe Burrus replaced Austin in 1929, and in 1946 Clyde Farrow became Ocracoke's last keeper.[159]

158. "Lighthouse Keepers," *Ocracoke Island Journal*, January 11, 2012, http:/villagecraftsmen.blogspot.com/2012/01/lighthouse-keepers.html.
159. Ibid.

Like the lighthouse, the keepers' quarters at Ocracoke went through many changes. Fortunately, plans and photographs provide some documentation of these changes.

In the Beginning

Noah Porter's 1823 contract for construction of the station included the keeper's house, outhouse and well. Its specifications were Winslow Lewis's standard design with minor regional deviations and one apparent error.

> The Dwelling House to be of brick, thirty four feet by twenty, one story eight feet in the clear. The foundation of the walls to be sunk as deep as is necessary to make the house secure, and laid in lime mortar. The walls to be twenty inches thick. The roof to be rectangular. The house to be divided into two rooms, with a chimney in the middle, and an entry six feet wide, in front of the chimney. A fire place in each room, and closets back of the chimney. Stairs to lead from the entry into the chambers, which are to be partitioned off, and lathed and plastered and double floored and well nailed. One window in each chamber. The inside wall and ceiling to be lathed and plastered. Three windows in each room, each to contain sixteen lights of ten by eight glass. All the timbers to be of Georgia pine and well seasoned. The roof to be shingled with good cypress shingles. The doors to be all four panels and to have good hinges and thumb latches, and the outside door to have a good lock. Attached to the house to be a porch, fourteen feet by twelve. The walls brick the same as the house, double floored, the inside walls and ceilings lathed and plastered, two windows twelve lights each, ten by eight. Two doors four pannelled, one to lead into the house, and the other outside. The doors to have good hinges and thumb latches. A chimney with an iron crane, trammels and hooks. On one side of the chimney an oven of a middling size, with an iron door, on the other side a sink with a gutter to lead through the brick wall. The roof to be covered the same as the house, with spouts to lead off the water. An outhouse five feet by four, boarded and shingled. All the wood work inside and out to be painted twice over.
>
> A well to be sunk sufficiently deep to procure good water, a convenient distance from the Light House, to be stoned or bricked, and furnished with a [curb?] windless and chain and a strong iron hooped bucket.

The house as built did not follow the specifications insofar as the chimney was concerned. The specifications called for "the house to be divided into two rooms, with a chimney in the middle, and an entry six feet wide, in front of the chimney." This is the wording found in most of Winslow Lewis's widely used contracts. No written

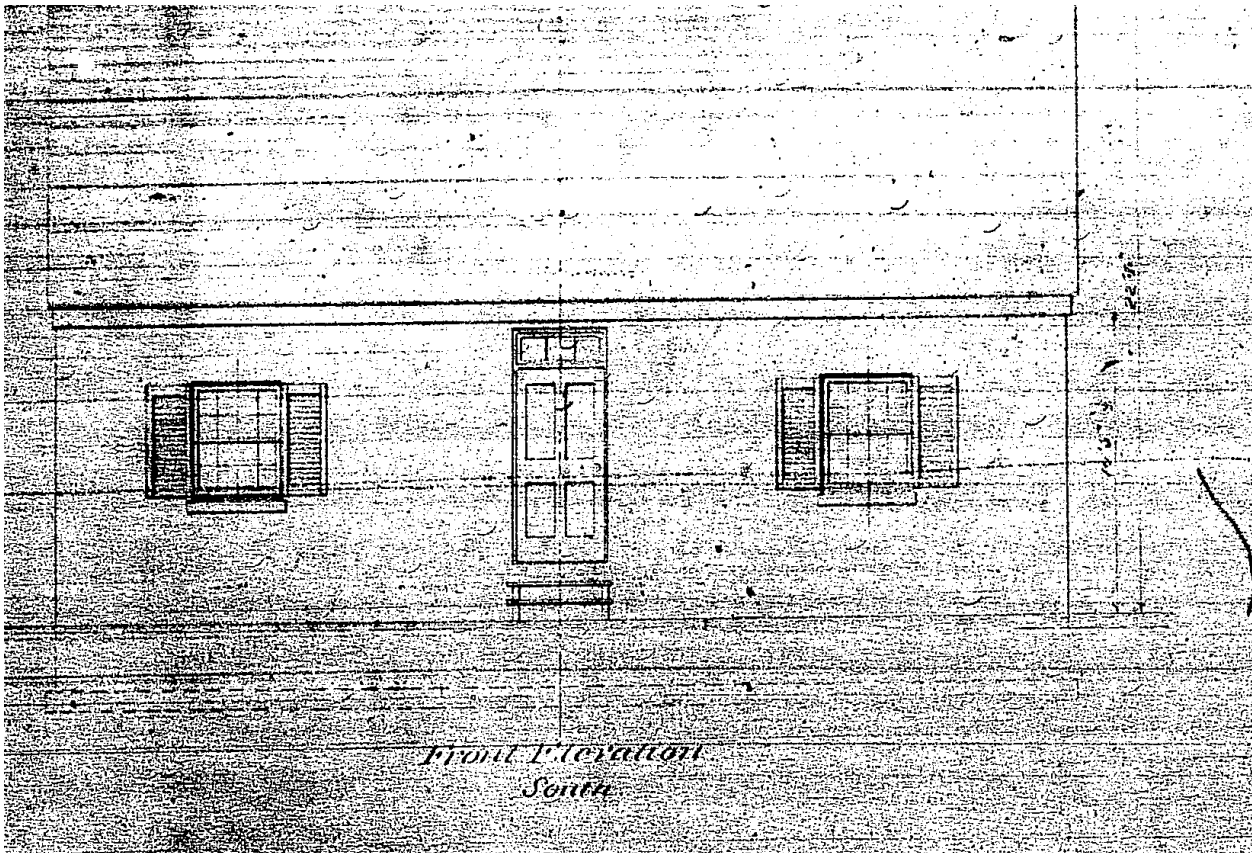


Figure 85. Front Elevation, Keeper's Dwelling, Ocracoke Light Station, 1889, showing "sixteen-light" windows (eight-over-eight). (CAHA MRC, Rm. 1, Map Case 4, Dwr. R) See larger version in *Appendix B*.

documentation indicates that Noah Porter strayed from the specifications in terms of the placement of the chimney, and the post-construction complaints made no mention of the chimney. It is likely that the plan was changed before or while the house was being constructed to reflect its location in the Southeast, although no documentation verifies this, either. Instead of being built in the plan of a small New England house of the period with a central chimney and an entry in front of the chimney that opened to flanking rooms, the keeper's quarters at Ocracoke was built with two separate chimneys located on the rear walls of the two first-floor rooms.

A seemingly curious section of the contract calls for a porch to be attached to the house—and the house may, in fact, have been built with a porch at the rear corner. However, what is described is clearly a kitchen—a well-equipped one at that. Like the main body of the house, it was to be brick, double floored, with plastered walls and ceiling. Its fireplace with iron crane, trammels and hooks; oven "of a middling size;" and sink with a gutter leading through the brick to the outside, were on the rear wall. As discussed in *Part I.A*, Winslow Lewis's universal specifications were almost identical with regional variations in materials, stone *vs*. brick, Georgia pine *vs*. good pine, and the like. The phrasing for kitchen amenities is identical in all; however, some use the word kitchen while others specify porch. The contract clearly describes a kitchen. The word porch may have been an error that was copied in some contracts and corrected in others.

Despite the contract's call for a one-story dwelling to be divided into two rooms, the house in fact had an upper living level. Imbedded in the description of the ground level are two short sentences stating "Stairs to lead from the entry into the chambers. . . . One window in each chamber." Specifics of wall, ceiling, and floor materials are given. The contract continues, "Three windows in each room," apparently distinguishing a "room" from a "chamber." Drawings made in 1889 show this original upper level, and the one-and-one-half-story configuration of the 1823 house is also seen in 1893 photographs (*Figs. 85-88*).

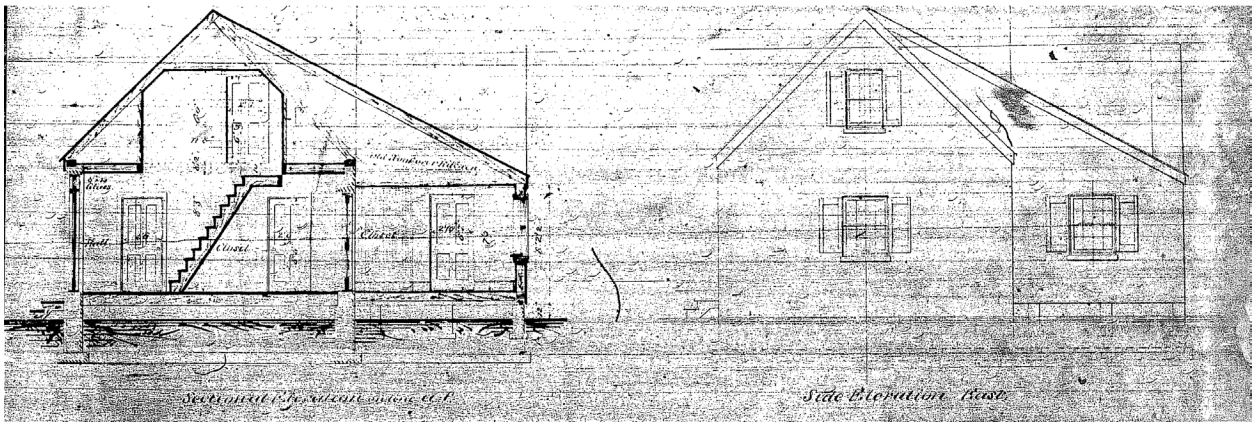


Figure 86. Section and East Side Elevation, Keeper's Dwelling, Ocracoke Light Station, 1889. (CAHA MRC, Rm. 1, Map Case 4, Dwr. R) See larger version in *Appendix B*.

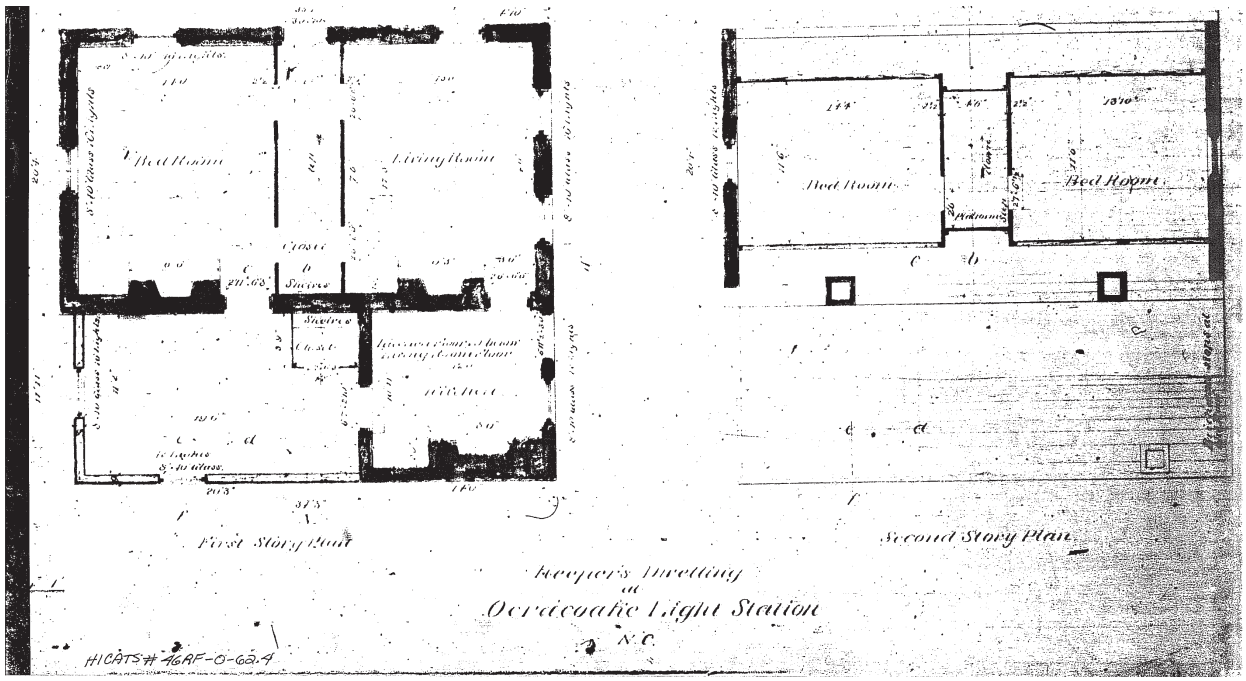


Figure 87. First- and Second-Story Plans, Keeper's Dwelling, Ocracoke Light Station, 1889. (CAHA MRC, Rm. 1, Map Case 4, Dwr. R) See larger version in *Appendix B*.

Early Years and First Expansion

As with the lighthouse, period documents contain frequent references to painting and whitewashing of the keeper's quarters through the years. Records also provide evidence of various repairs. In addition, there is documentation for three major remodelings—in 1889, 1897, and 1929—all of which changed the character of the quarters. A remodeling plan was drawn in 1896, but may have been superseded by later 1897 plans.

The first documented work was in 1868, forty-five years after the keeper's quarters was built, when one slope of the roof was reshingled and the other side was repaired. All the fireplace hearths were relaid, and the plastering, door sash, hardware, and floors were repaired where needed. All woodwork on both inside and outside was painted, and the exterior walls received two coats of whitewash.[160]

The first major change to the keeper's quarters came in 1889, when a frame shed room was added to the back of the house. Changes shown on plans filed February 5, 1889 are supported by two

160. Correspondence from W. J. Newman, Acting Engineer, to Gen. O. M. Poe, Secretary of the U. S. Light-House Board, October 14, 1868.

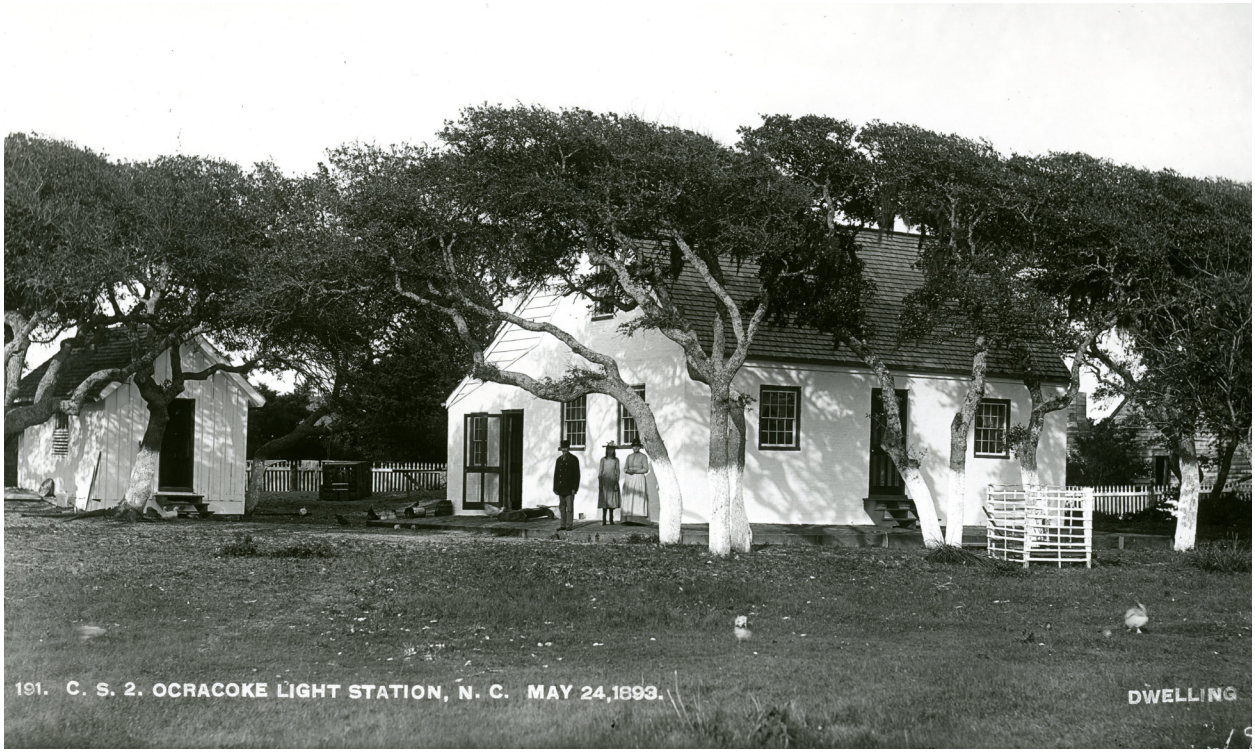


Figure 88. Keeper's Quarters at Ocracoke Light Station showing rear frame addition, brick terrace, and frame store house, May 24, 1893. Keyed to camera station 2 on 1905 light station plat, *Fig. 115*. (Herbert H. Bamber, photographer. CAHA MRC, Rm. 1, Map Case 4, Dwr. R)

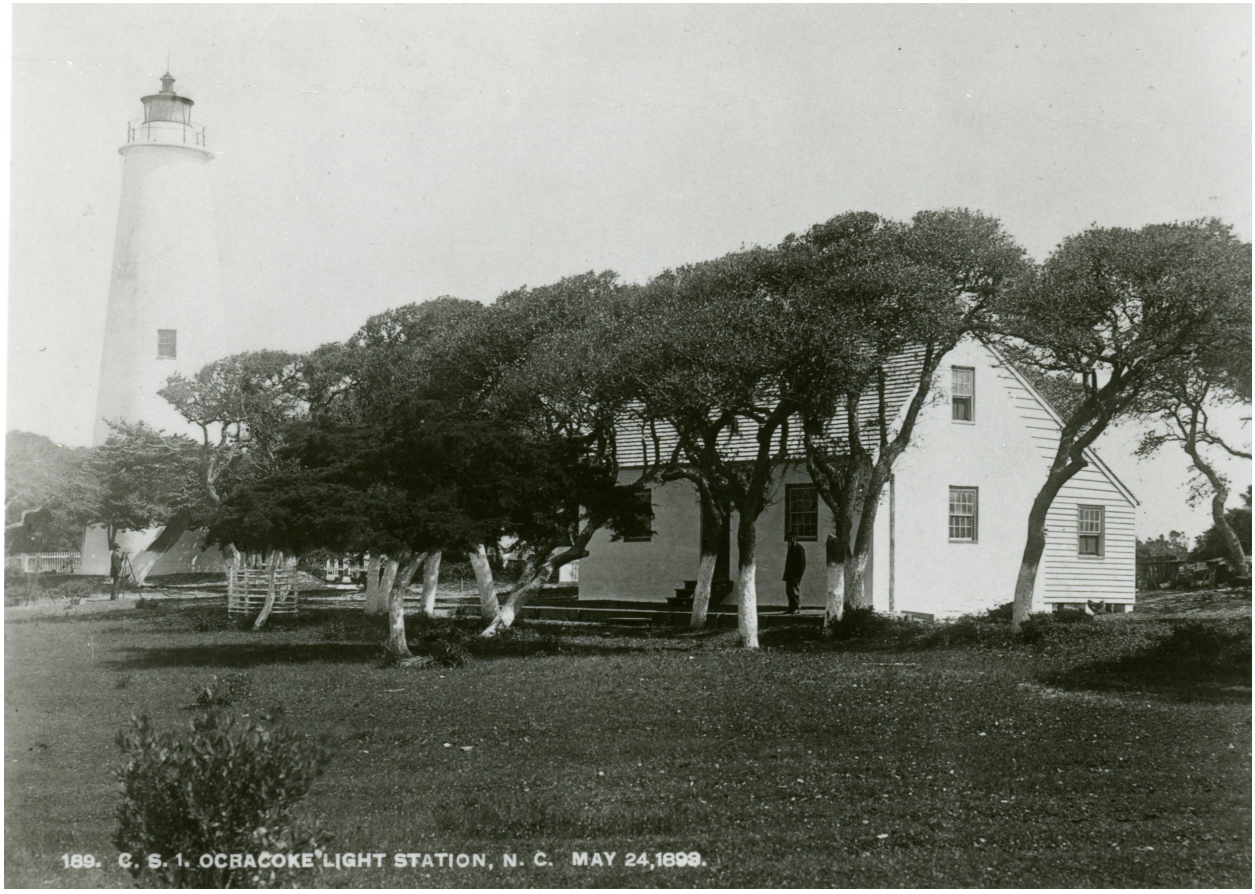


Figure 89. Keeper's Quarters at Ocracoke Light Station showing rear frame addition, May 24, 1893. Keyed to camera station 1 on 1905 light station plat, *Fig. 115*. (Herbert H. Bamber, photographer. CAHA MRC, Rm. 1, Map Case 4, Dwr. R)

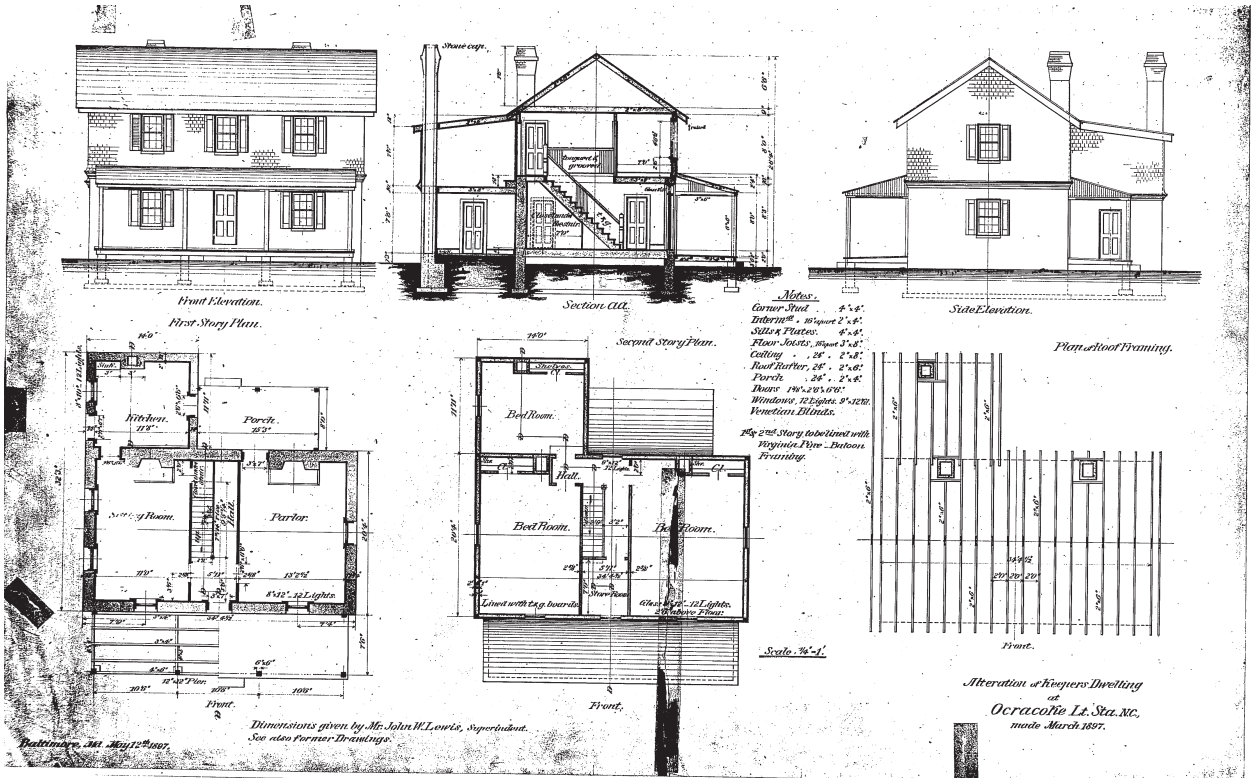


Figure 90. Plans for "Alteration of Keepers Dwelling at Ocracoke Lt. Sta. N.C.," completed March 1897, dated May 12, 1897. (CAHA MRC, Rm. 1, Map Case 4, Dwr. R) See larger version in *Appendix B*.

photographs made by Herbert H. Bamber on May 24, 1893 (*Figs. 85-89*). The new room was behind the parlor and extended from the south wall of the kitchen to the southeast corner of the house, forming a long rectangle. A closet is shown in the northwest corner of the room. To accommodate the new room, the pitch of the roof was revised by extending its rear slope to encompass the addition and the kitchen ell, so that it ran continuously across the rear of the house. The 1893 photographs show that the upper walls within the gables were sheathed with wide weatherboards, while narrow weatherboards covered the shed room from the top of the window down. The shed room rested on short piers, presumably of brick or concrete. The photographs also show that a brick terrace carried across the front of the house and down the west, kitchen, side. Curiously, the front elevation and the section of the house in the 1889 plans show a transom window above the front door, however, no transom is present in the 1893 photograph (*Figs. 85, 88*).[161]

Raising the Roof

Only four years after the addition of the rear shed room, discussions began about enlarging the keeper's quarters to a full two stories. For three years, money was added to the appropriations list for properties overseen by the U. S. Light-House Board for raising the Ocracoke keeper's dwelling to provide additional quarters for the keeper and his family. The first year, in 1893, the requested appropriation was for $2,000. In 1894, the cost had risen to $2,500, and in 1895, it had increased again to $3,500.[162] Finally, on October 28, 1896, the Engineer Secretary of the U. S. Light-House Board wrote to Major E. H. Ruffner, Engineer for the Fifth Light House District, authorizing him to add an additional story to the keeper's quarters for a cost not to exceed $3,500.[163]

Work on the quarters followed soon after its authorization, and on March 13, 1897 Ruffner reported to the Light-House Board that "The reconstruction of the keeper's dwelling there

161. Plans of Keeper's Dwelling at Ocracoake [*sic*] Light Station, N.C., accompanying Engineer's letter of January 30, 1889, filed February 5, 1889; [H. H. Bamber], Photographs 189 (C. S. 1) and 191 (C. S. 2), Ocracoke Light Station, N. C. May 24, 1899.

162. Annual Lighthouse Appropriations, 1893 (Vol. 421, p. 61), 1894 (Vol. 422, p. 50), 1895 (Vol. 423, p. 229).

163. Correspondence from Engineer Secretary of the Light-House Board to E. H. Ruffner, October 28, 1896.



Figure 91. Ca. 1900 photograph of keeper's quarters showing wood-shingled second story and window shutters. Although shutters appear on 1889 and 1897 elevation drawings, this is the only photograph in which they appear. (Herbert H. Bamber, photographer. CAHA MRC, Rm. 1, Map Case 4, Dwr. R)

[Ocracoke] was finished on March 10th." He continued:

> This work is highly creditable to Assistant Engineer John Murdoch for planning out the details of an alteration that has changed an old, inconvenient and cramped station into an ample, attractive, and convenient dwelling. The Superintendent, Mr. John W. Lewis, has in his usual careful manner attended to every trifling detail, and the change made has been remarkable.[164]

Plans dated May 12, 1897, but perhaps drawn earlier, reflect the alterations completed in March (*Fig. 90*). These show an open porch in place of the 1889 rear shed addition. An earlier set of plans drawn in 1896 (included in *Appendix B*) showed fewer alterations, including the retention of the 1889 rear shed room and the "sixteen-light" (eight-over-eight sash) windows specified in the 1823 contract (*Figs. 85, 89*).[165] While the eight-over-eight windows were likely replaced, it is unclear whether the 1889 shed addition was removed and a smaller open porch built. The photographic record from this period is incomplete. What remains today is an enclosed shed addition of approximately the same proportion as the 1889 addition.

According to the final plans, the second floor repeated the layout of the first-floor rooms, creating three comfortable bedrooms upstairs. Although a note on the plans indicates "Baloon [*sic*] Framing," the second story is platform-framed on the brick walls of the 1823 first level. Oddly, a lower shed-roofed porch with a smaller footprint replaced the 1889 rear porch.

The kitchen also was updated in 1897. It appears that the large kitchen fireplace, described in the 1823 contract and shown in the 1889 plan, was replaced with a flue stack, likely for an iron stove. A new sink is shown west of the flue. The plans indicate that both first- and second-floor rooms were lined with tongue-and-groove boards and that a closet was built at the rear wall of each bedroom. The tongue-and-groove boards noted on the 1897 plans were beaded boards, which remain today on the walls of the rooms and closets and on the closet ceilings. On the first floor, the closet under the stairs retains its beaded boards.[166]

In a major change to the appearance of the house, a one-story, shed-roofed porch with chamfered posts was added across the front. Six-over-six sash windows replaced the earlier eight-over-eight sash windows. The new windows were narrower and taller, requiring alteration to the surrounding brick walls and visible patching. Square-cut wood shingles covered the exterior walls of the second story. A photograph that probably dates from ca. 1900 shows that the windows had shutters (*Fig. 91*).[167]

For the next three decades, until the late 1920s, work at the keeper's quarters consisted of small improvements and routine maintenance, such as the installation of lattice at the ends of the front porch for climbing vines (1898); the installation of bronze wire cloth window screens (1899); repairs to gutters, flashing around the chimneys, replacement of downspouts leading to cistern (1911); and painting at various times. This work was completed under keepers Enoch Ellis Howard (1862-1897) A. B. Hooper (1910-1912).[168]

164. Correspondence from E. H. Ruffner, Fifth District Lighthouse Engineer, to Light-House Board, March 13, 1897.
165. Alteration of Keepers Dwelling at Ocracoke Lt. Sta. N.C., May 12, 1897; Alteration of Keepers Dwelling at Ocracoke Lt. Sta. N. C., October 28, 1895; First- and Second-Story Plans, Keeper's Dwelling, Ocracoke Light Station, 1889.
166. Alteration of Keepers Dwelling, 1897; Plans, Keeper's Dwelling, 1889.
167. Alteration of Keepers Dwelling, 1897; photograph of keeper's quarters, ca. 1900.
168. Fifth District Inspector Correspondence: Ocracoke Light Station, National Archives RG 26, Entry 3 (NC-63) "Records of the Fifth Light-House District (Baltimore),

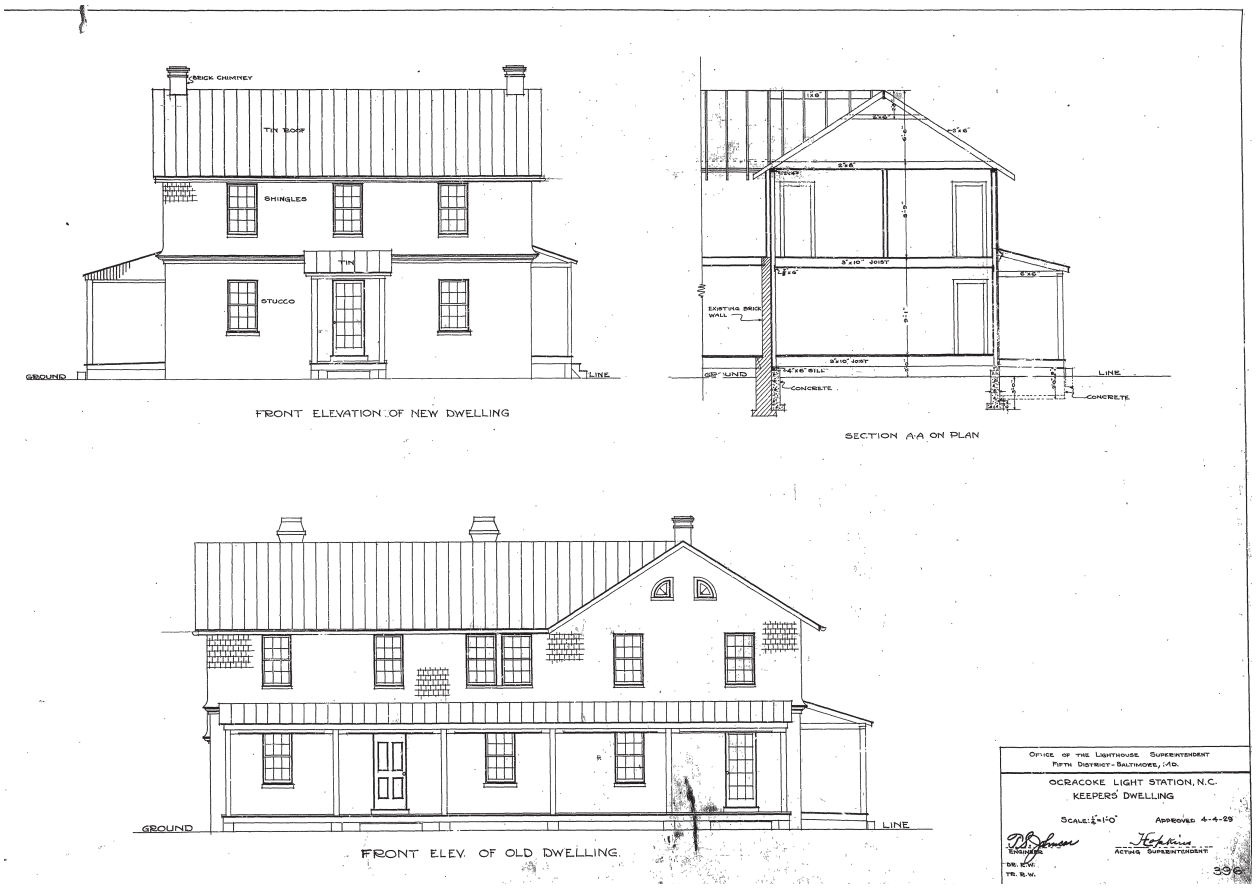


Figure 92. Plans, Ocracoke Light Station Keepers' Dwelling, 1929. (CAHA MRC, Rm. 1, Map Case 4, Dwr. R) See larger version in *Appendix B*.

Making Room for an Assistant Keeper

A major change to the keeper's quarters came in 1929, the year that Joe Burrus replaced Wesley Austin as keeper. Because of the workload associated with the keeping of a light and the need for keepers periodically to be away from the light station, most stations employed not only a lightkeeper, but also an assistant keeper. Practicality called for separate housing facilities for the two keepers and their families. Thus, in 1929 the keeper's quarters at the Ocracoke Light Station was nearly doubled in size, and the singular Keeper's Quarters became the plural Keepers' Quarters.

Plans and specifications from 1929 indicate the changes to be made (*Fig. 92*). The whole was to cost an estimated $10,500. The project called for repairing and "improving" the existing quarters to accommodate two families by means of a side addition. Though attached, the two quarters were to function independently. The old dwelling would be improved, and, except for the attachment of the new dwelling at its south end, would retain its original configuration. Work on the old dwelling included the installation of a bathroom on the second floor with hot and cold running water and new windows in both the bathroom and the southwest room of the second floor, where a double window replaced the previous single window. The latter doubtless was to provide additional natural lighting, since the side window in that room was covered by the new addition.

The two-story frame addition—the assistant keeper's dwelling—measured 22 by 35 feet. It was oriented at a right angle to the previous quarters with a similar exterior design, its front door facing south. The shed-roofed porch across the façade of the old dwelling was extended across the west end of the new dwelling, providing visual continuity.[169]

1851-1912," Vol. 160, No. 7627, Inspector's Monthly Report of Operations, August 24, 1911; "Lighthouse Keepers," *Ocracoke Island Journal.*

169. Plans of Dwelling, Ocracoke Light Station, N. C., Office of the Lighthouse Superintendent, Fifth District, Baltimore, March 27, 1929 and April 4, 1929; Specifications for

Although similar in design, the first story of the new dwelling had a cement stucco surface applied to metal mesh on the balloon-frame construction. Matching that of the old dwelling, the second story of the new dwelling was sheathed in square-cut, heart-cypress shingles measuring six-by-sixteen inches. A molded belt ran horizontally between the two stories and connected with an identical belt on the old dwelling. The shingled second story flared out above the edge of the belt. The new dwelling stood on a poured concrete foundation. Instead of chimneys built at the back wall of the house, the two brick chimneys of the new dwelling were located at the interior ends of the east and west gables. Six-inch-wide terra cotta thimbles were installed in the chimneys in all rooms, enabling heating stoves to be connected.

A new standing-seam metal roof was installed on both the new and old quarters, except for the shed addition on the rear of the old quarters, which remained shingled. Quarter-circle windows flanking the chimney were installed on each gable end of the new quarters. A six-inch galvanized gutter was hung at the eaves of the main roof and pitched to run water to the back of the house.

There is a conflict between the specifications and the plans for the exterior doors. Since the specifications are of a later date than the plans, it would seem that its description of the doors would rule, but that is not certain. The plans show exterior doors with a grid of fifteen lights, while the specifications call for a single light of double-thick glass in the top and three cross panels in the bottom. The plans show the windows of the first and second stories to be six-over-six sash like the 1897 windows of the old quarters. In addition to the west-end porch that connected with the porch of the old dwelling, specifications called for two small porches—a single-bay entrance porch on the south side and a small back porch on the east end opening to the kitchen. The porch floors were to be of tongue-and-groove boards.[170]

Like the old quarters, the interior of the new dwelling was organized with a center-hall plan with open stair. The first floor contained a living room that ran the full depth of the house on the west side of the stair hall; the east side was divided into two rooms—the dining room and the kitchen. On the second floor were two bedrooms on the west and one bedroom and a bathroom on the east.

The flooring was to be of yellow pine. All interior walls and ceilings were to be covered with wallboard laid in symmetrical panels with joints covered with a flat wood molding. The doors were to be hung with loose pin ball tip cast brass butt hinges and fitted with mortise locks. The closets were to have brass latches. The windows were to be fitted with brass pulleys, brass flush sash lifts, and brass crescent sash locks. Between the kitchen and dining room was to be a "double acting" (swinging) door.[171]

The bathrooms of the old and new dwellings were to be equipped with porcelain bathtubs on legs, vitreous china toilets with low tanks, and vitreous china sinks, all with nickel-plated fittings. The kitchens were to have porcelain-lined sinks and kitchen ranges. A vertical hot water boiler provided hot water for the kitchen and bathroom sinks and bathtubs. The new dwelling was to be equipped with an electric pump, a cast-iron soil pipe, and an exterior terra cotta pipe to carry the soil to a nearby cesspool. Both dwellings were to be wired and electrified.[172]

Carrying On

The 1930s and 1940s saw little activity at the keepers' quarters that would result in changes to the building, save for a small single-story shed addition to the east side of the assistant keeper's quarters in 1938. Roughly equal in size and scale to the shed addition on the east of the original keeper's quarters, this new shed was given the same board-and-batten siding and a wood shingle roof (*Fig. 94*).[173]

Coast Guard engineering plans—the date of which is obscured but can be placed at the time of construction of the 1938 shed addition and

Improvement and Repairs to Keeper's Dwelling at Ocracoke Light Station, N. C., Office of Lighthouse Inspector, Lighthouse Service, Department of Commerce.
170. Plans of dwelling; specifications.

171. Ibid.
172. Ibid. According to the 1958 Plot Plan, the cesspool was located southwest of the house, across the fence line, and on the edge of the swamp.
173. Completion Report, "Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase I," Williamsport Preservation Training Center (National Park Service, 1987). While performing foundation work, a worker found the date "3-11-38" (March 11, 1938) inscribed on floor joist of the shed addition.

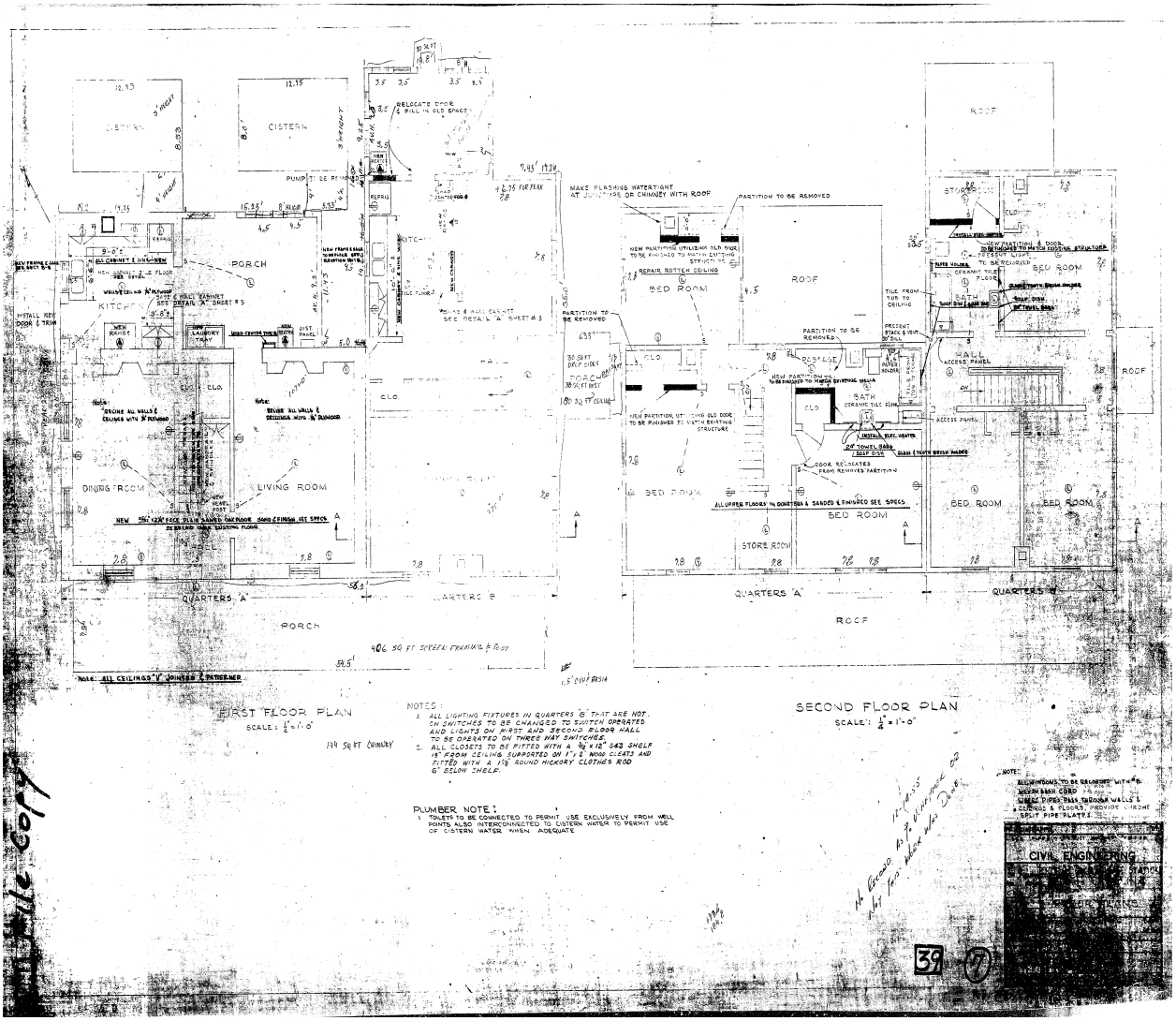


Figure 93. U.S. Coast Guard Civil Engineering floor plan, date obscured. Date between 1938 shed addition and before December 1955 handwritten notation. Indicates major renovation of 1823 Keeper's Quarters including new flooring, new stair elements, new doors and windows, new kitchen and bath facilities, and enlarged second-floor closets. (CAHA Coll., 603-9024) See larger version in *Appendix B*.



Figure 94. Photograph of keeper's quarters taken from light tower and showing unpainted wood shingles on second story. Office of Southern Inspector, May 29, 1941. (CAHA Coll.)

before a handwritten notation dated December 1955—show a large-scale interior renovation of the quarters. Work on both residences included the installation of updated bathroom and kitchen facilities; new water heaters; major electrical work including new wall outlets and wiring of existing light fixtures to wall switches; and the limited replacement of damaged window sash (*Fig. 93*).

In the original residence, new oak floors were laid in the front rooms of the first floor; a new door was installed in the north exterior doorway; the newel posts, balustrade, and treads of the staircase were replaced; the walls and the ceilings of the first floor and the second-floor hallway were lined with plywood paneling; all second-floor closets were



Figure 95. Light Station showing painted second story of Keepers' Quarters, December 1952. (CAHA typed photo id sheet)

expanded and the existing doors relocated; and the existing second-story pine floors were refinished. Limited changes to the assistant keeper's quarters included the relocation of the 1929 east exterior door to be more or less centered on the east shed addition, and the construction of a large closet at the east end of the second-floor bathroom.

The first keeper to enjoy the remodeled older dwelling was Capt. Joseph Wesley Burrus. He served for seventeen years, from 1929 to 1946.[174] No information on an assistant keeper was found in available records. Like the quarters, the lighthouse was electrified in 1929, and this had a great impact on the work of the keeper. No longer did he have to climb the tower at least twice daily to light the lamps at sundown and darken them in the morning.

In 1939, the duties of the Lighthouse Service were turned over to the U. S. Coast Guard, which took over management of the keepers' quarters and the lighthouse.[175] A 1941 photograph provides information on the appearance of the quarters at that time. A white-painted board-and-batten shed room had been added to the east end of the 1929 addition, and the wood shingles that covered the second story were unpainted (*Fig. 94*).

In 1946, Clyde Farrow became lightkeeper, the last to fill that position at the Ocracoke Light Station. He remained until 1954, the pivotal year when the lighthouse was automated and keepers were no longer needed.[176]

According to the 1977 National Register nomination, the majority of the work on the interior of the keepers' quarters, as well as the screening of its full-length west porch, was completed in the early 1950s, a period of substantial alteration to the lighthouse.[177] A 1952 photo clearly shows the framed screens. The photo also shows that by that time, the wood shingled second-story had been painted (*Fig. 95*).

The nomination also suggests that the interior walls of the 1929 quarters were lined with gypsum board at the same time the walls in the original quarters were lined with plywood panelling.[178] However, no such work is indicated for the newer quarters on the Coast Guard plans.

174. "Lighthouse Keepers."
175. "Lighthouses: A Brief Administrative History," http://www.michiganlights.com/lighthouseservice.htm.
176. "Lighthouse Keepers;" Ocracoke Light Station, National Park Service.
177. Warfield, National Register nomination.
178. Ibid.

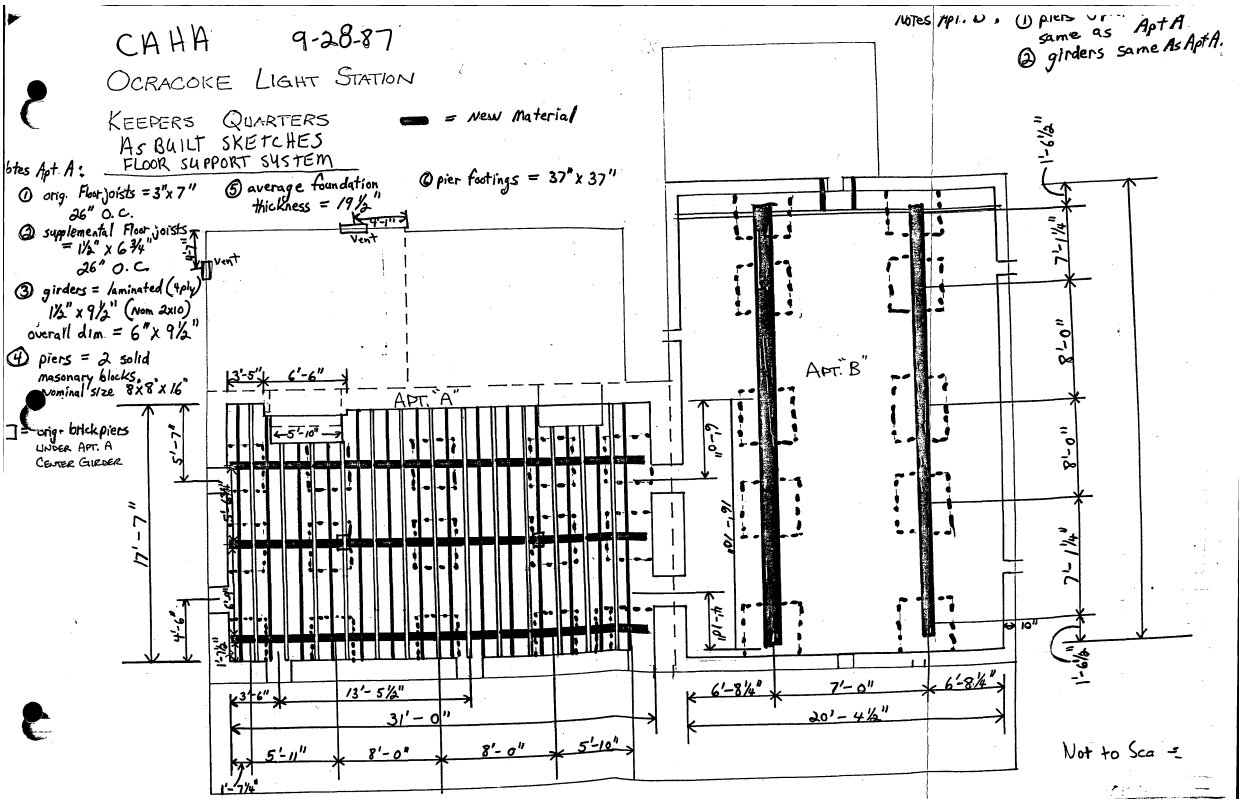


Figure 96. Ocracoke Light Station Keepers [*sic*] Quarters As Built Sketches Floor Support System dated September 28, 1987. Indicates where additional supports were added. (Completion Report, "Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase I," 603-D143) See larger version in *Appendix B*.

On May 17, 1955, with no keeper position at the station, the Coast Guard granted the National Park Service permission to use and occupy the keepers' quarters. Two years later, that revocable permit was amended to include the garage, chicken house, carpenter shop, and store house/pump house, with the stipulation that the National Park Service would keep all buildings in good repair.[179]

In 1972, NPS replaced the standing-seam metal roof on the quarters with one of the same type.[180] Routine maintenance continued during the rest of the decade.

Catching Up: Phased Work

In the late 1980s, several preservation projects were completed at the light station and included substantial work at the quarters. With the exception of the roof replacement in 1972, more than two decades of only routine repairs had left the building with a list of concerns to be addressed. The work was divided into phases.

Phase I was executed during the summer of 1987, the variety of work performed by a crew from the NPS Williamsport Preservation Training Center and local labor. This project included an archaeological survey. Sand was removed from the building's crawl space, and utility trenching excavations were monitored. Both operations uncovered artifacts. An electric service line was buried from the power pole to a newly constructed service board located on the north elevation of the building.[181]

A previous termite infestation had affected the structural system of the house, and this dictated much of the work of Phase I. The building's floor support system was supplemented. In the crawl space beneath what was termed Apartment A (1823), fifteen new piers were constructed, three girders were placed on top of the piers, and fifteen supplemental floor joists were installed on top of the girders between the existing floor joists.

179. Revocable Permit (Amendment) from Commander, Fifth Coast Guard District, Treasure Department to Superintendent, Cape Hatteras National Seashore, May 6, 1957.
180. Warfield, National Register nomination.
181. Completion Report, "Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase I," Williamsport Preservation Training Center, NPS, 1987.



Figure 97. Keepers' Quarters foundation repairs, 1987. (Completion Report, "Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase I," 603-D143)



Figure 99. Keepers' Quarters foundation repairs, 1987. (Completion Report, "Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase I," 603-D143)



Figure 98. Keepers' Quarters wall stud replacement, 1987. (Completion Report, "Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase I," 603-D143)

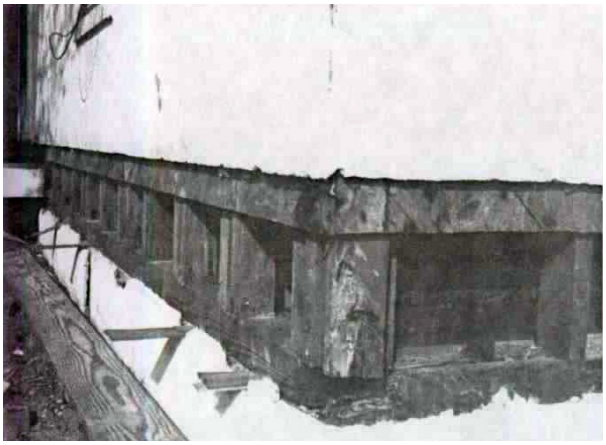


Figure 100. Keepers' Quarters sill plate replacement, 1987. (Completion Report, "Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase I," 603-D143)

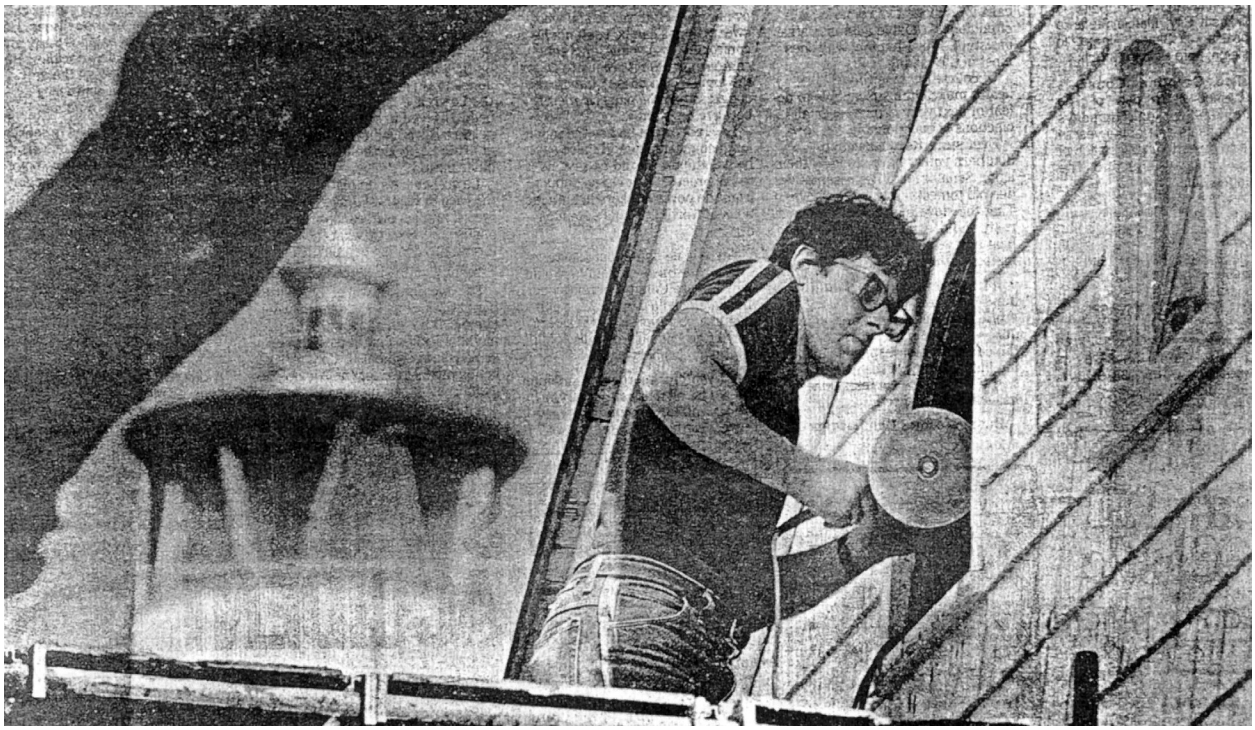


Figure 101. Removal and reconstruction of quarter-circle attic-level windows of Assistant Keeper's Quarters, 1987. Lighthouse lantern seen in background. (Completion Report, "Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase I," 603-D143)

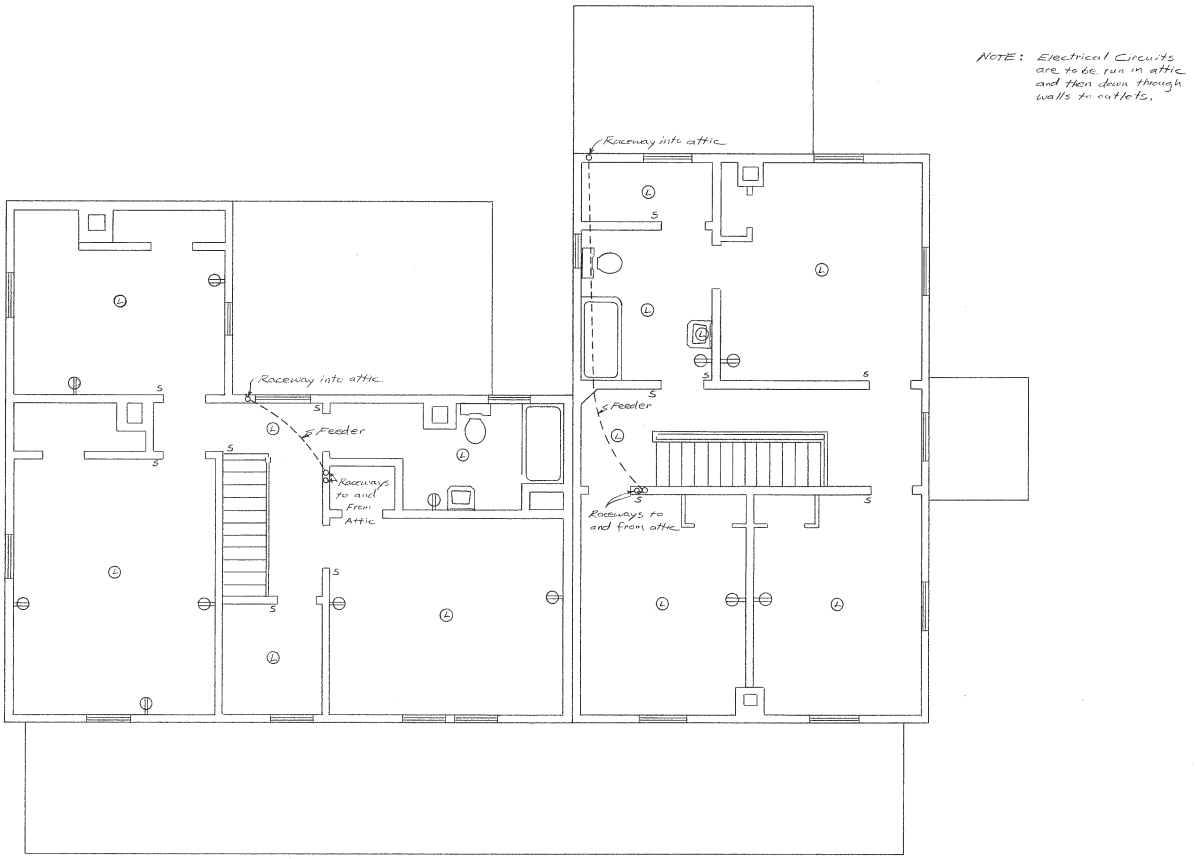


Figure 102. Electrical Plan, Keepers' Quarters, May 1987. (CAHA MRC, Rm. 1, Map Case 4, Dwr. R) See larger version in *Appendix B*.

Beneath Apartment B (1929), ten new piers were constructed and two girders were positioned on top of them, supporting the existing floor joists. Termite damage had compromised the sills, and three-and-a-half wall lengths had to be replaced. Stucco was removed to access the sills, and after the sill work was completed, the stucco was patched using the specifications from the 1929 plan. Significant termite damage was found in Apartment B in the framework of several elevations. In some places the damage extended from the sill plate to the rafter plate. Restoring structural stability to Apartment B required that the damaged framing be supplemented and replaced as needed (*Figs. 96-100*).[182]

To provide greater ventilation beneath the house, seven stainless-steel vents were installed in new openings in the brick walls of Apartment A. Four vents were installed in existing openings beneath Apartment B. In addition, two openings were cut in the common wall between Apartments A and B, and vents were placed in the new openings.[183]

Window repair was also undertaken during Phase I. The quarter-round attic windows in the gable ends of Apartment B were rebuilt, installed, and painted (*Fig. 101*). Four second-story windows that had been scheduled for repair were paint-stripped, but beyond that, the work was delayed until Phase II, when all other windows would be repaired.[184]

In preparing a budget for fiscal year (FY) 1988, a scope of work was prepared for additional work needed on the keepers' quarters. The list was extensive. For the interior of both dwellings, work included the repair/replacement of plumbing and wiring systems; kitchen and bathroom floors as needed (including replacing linoleum floor covering); and kitchen appliances. The HVAC system was to be replaced. The windows, chimneys, fireplaces, and bathroom wall and floor tile were to be repaired. The walls and trim were to be painted and finished, and the floors were to be sanded and finished. In Apartment A, the bathtub was to be repaired or replaced. In Apartment B, the sheetrock was to be removed, insulation added,

182. Ibid.
183. Ibid.
184. Ibid.

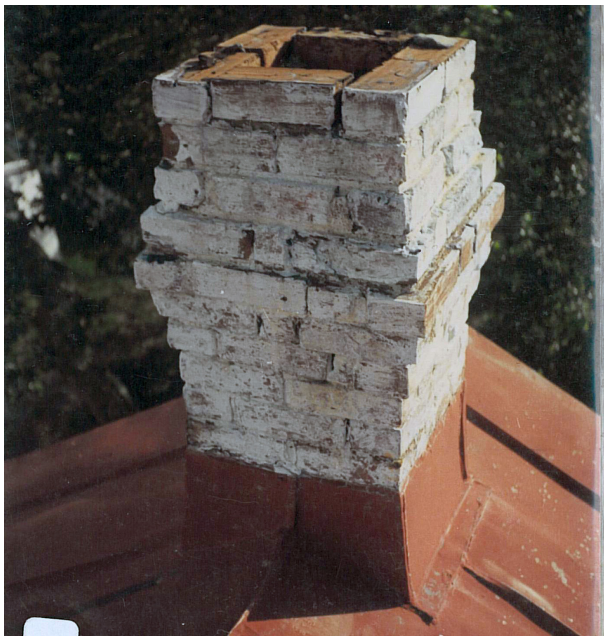


Figure 103. Assistant Keeper's Quarters chimney before repointing and relining, 1988. (Completion Report, "Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," 603-D142)



Figure 106. Assistant Keeper's Quarters chimney after repointing and relining, 1988. ("Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," 603-D142)



Figure 104. Removal of deteriorated wood shingles on shed additions of Keepers' Quarters, 1988. ("Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," 603-D142)



Figure 107. Installation of new flashing and wood shingles on shed additions of Keepers' Quarters, 1988. ("Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," 603-D142)



Figure 105. Repair of roof decks and fascia of shed additions of Keepers' Quarters, 1988. ("Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," 603-D142)



Figure 108. Newly completed wood shingle roofs of shed additions of Keepers' Quarters, 1988. ("Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," 603-D142)



Figure 109. Repair, reglazing, and cleaning of window sash of Keepers' Quarters, 1988. ("Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," 603-D142)

and sheetrock replaced; the tub/shower system was to be replaced; the kitchen cabinets, door lock and hinges were to be repaired or replaced; and, in the shed-roofed frame addition, the floor joist system and floor were to be repaired or replaced, and supplemental rafters were to be added to the roof (*Fig. 102*).

Exterior work included replacement of the wood-shingle roofs on the utility room additions and the gutters; cleaning and painting the windows; repairing and painting the first floor; and repairing and replacing the wood trim and front porch screen, battens, and lattice. Storm windows and screens were to be added to Apartment B, as well as flashing to the east porch. This was a budgetary wish list, but it indicates the work needed on the keepers' quarters at that time (*Figs. 103-109*).[185]

Although the Phase II Preservation Project took on important work at the quarters, the amount of work actually authorized was greatly diminished from what had been proposed. The project took place in the summer of 1988. Some of the work in the proposed scope of work was delayed until a later phase. On the other hand, additional work was accomplished beyond the FY88 proposed scope of work. The project was carried out through a cooperative effort between the personnel of the Williamsport Preservation Training Center and the Cape Hatteras National Seashore.[186]

Three items in the original scope of work were accomplished in whole or in part. For each apartment, the wood shingles of the utility porch roof were replaced with new wood shingles, the double-hung windows were repaired (50% for Apartment A and 80% for Apartment B), and chimneys were repaired. For Apartment B, the chimneys were dismantled and relaid, with new brick added above the roofline. Additional work included the repair or replacement of the sidewall shingles; the replacement or addition of flashing; repair of the roof sheathing; repair of metal-roof

185. Scope of Work, Ocracoke Light Station Keepers Quarters, FY88.

186. Completion Report, "Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," Williamsport Preservation Training Center, NPS, 1988.

leaks around the chimneys; and new chimney flashing. In Apartment B, attic vents were installed in the chimneys below the roof line, signifying that the chimneys were not to be used in the future. The exterior stucco patches installed during Phase I were feathered, rubbed, cleaned, and painted, and the utility porch floor framing was repaired with supplemental joists added to strengthen the floor system (*Figs. 103, 106-107*).[187]

Phase II also included work on the store house/ pump house, described below in the discussion of outbuildings.[188]

In 2000, the National Park Service acquired the Ocracoke Light Station by transfer from the U. S. Coast Guard. The former double keepers' quarters is now used to house NPS employees.

NPS photographs from 2002 show the exterior of the quarters being painted. The masonry, stuccoed, shingled, and sided walls were scraped and repainted white (*Figs. 110-111*).

In 2006, a scope of work was prepared for reconditioning the interior floors of the quarters, which had become quite worn, especially on the first floor. No further information is available.[189]

In 2008, a scope of work and specifications were prepared for another round of work at the quarters. This project was for exterior work and was to be conducted in 2008-2009. The project proposed to:

- Restore and clean four chimneys and two brick cisterns;
- Repair all wood siding, sheathing, shingles, windows, doors, associated trim, and exterior wood deck flooring;
- Replace all roof areas with standing-seam metal and repair rafters, joists, and lathe as needed;
- Rework gutters and downspouts to better carry rainwater away from the building;
- Repair and make operable all doors, including hardware;



Figure 110. Repainting of Keepers' Quarters in 2002. View inside west porch. (Outer Banks Group, Facility Management & Engineering Services, 2002 photographs in black binder)



Figure 111. Repainting of Keepers' Quarters in 2002. View of Assistant Keeper's Quarters. (Outer Banks Group, Facility Management & Engineering Services, 2002 photographs in black binder)

- Repair and make operable all windows, including proper hardware, in preparation for painting;
- Restore period hardware to original condition; and
- Prepare and repaint exterior surfaces.[190]

An unfortunate component of the work list was the roof. The entire roof of both sections of the keepers' quarters was replaced with a metal roof with oversized standing seams, and painted a bright red that dominates the station (*Fig. 112-113*).

187. Ibid.
188. Ibid.
189. "Ocracoke Lighthouse Station Double Keepers Quarters," PMIS No. 102199: Re-condition of Interior Floors – Scope of Work, May 30, 2006.
190. Outer Banks Group, "Ocracoke Double Keepers Quarters," 2008 Restoration – Scope of Work, January 15, 2008.



Figure 112. Roof of Keepers' Quarters before 2008 replacement. (CAHA Coll.)



Figure 113. Roof of Keepers' Quarters after 2008 replacement. (CAHA Coll.)

Supporting the Light Station: The Outbuildings

When the Ocracoke Lighthouse was built in 1823, it was necessary to construct a dwelling to house the keeper who would operate and maintain the lighthouse. At the same time and increasingly as the years passed, outbuildings were needed to support the lighthouse and the keeper's life.

Well & Privy

The first outbuildings and structures, and the most essential, were a well and an outhouse, or privy, which were included in Noah Porter's 1823 contract for the construction of the lighthouse and keeper's quarters.

The outhouse was to be:

> five feet by four, boarded and shingled. All the wood work inside and out to be painted twice over.

The well was to be:

> sunk sufficiently deep to procure good water, a convenient distance from the Light House, to be stoned or bricked, and furnished with a [?] windless and chain and a strong iron hooped bucket.[191]

The location of the well is shown on a 1905 plat map between the house and lighthouse, closer to the lighthouse. Plat maps show that the privy was always located along the property line behind the house although, typical of privies, it was moved several times in the general area (*Figs. 114-117*). A new privy may have been built in the early 1880s, for in 1881 the Light House Engineer provided the Chairman of the U. S. Light-House Board with an estimate "for new outhouse" as well as other work.[192] Although the privy was repaired in 1913, a new privy with a concrete foundation was built in 1916.[193] The privy that currently stands on the property was built new in about 2010 to replace an earlier storm-damaged privy (*Fig. 118*).

Oil House

Helpful to the operation of the lighthouse was a proper oil house. Beginning in 1885, official documents note the necessity for such a facility. This need was repeated in 1888 and 1895, and at the end of 1913, a request for funds for this project was still being made. Although that request was for a concrete structure, gravel was not readily or cheaply available, so it was proposed that sand be used to build the oil house with cement mortar. Finally, in March 1914, the oil house was constructed of poured concrete just south of the

191. "Contract for Ocracock [*sic*] Light House," June 20, 1823, Noah Porter, Contractor.

192. Correspondence from O. E. Babcock, Light House Engineer, to Rear Admiral John Rogers, Chairman, U. S. Light-House Board, June 14, 1881.

193. Austin, Lightkeeper's Logbook, 1912-1929.

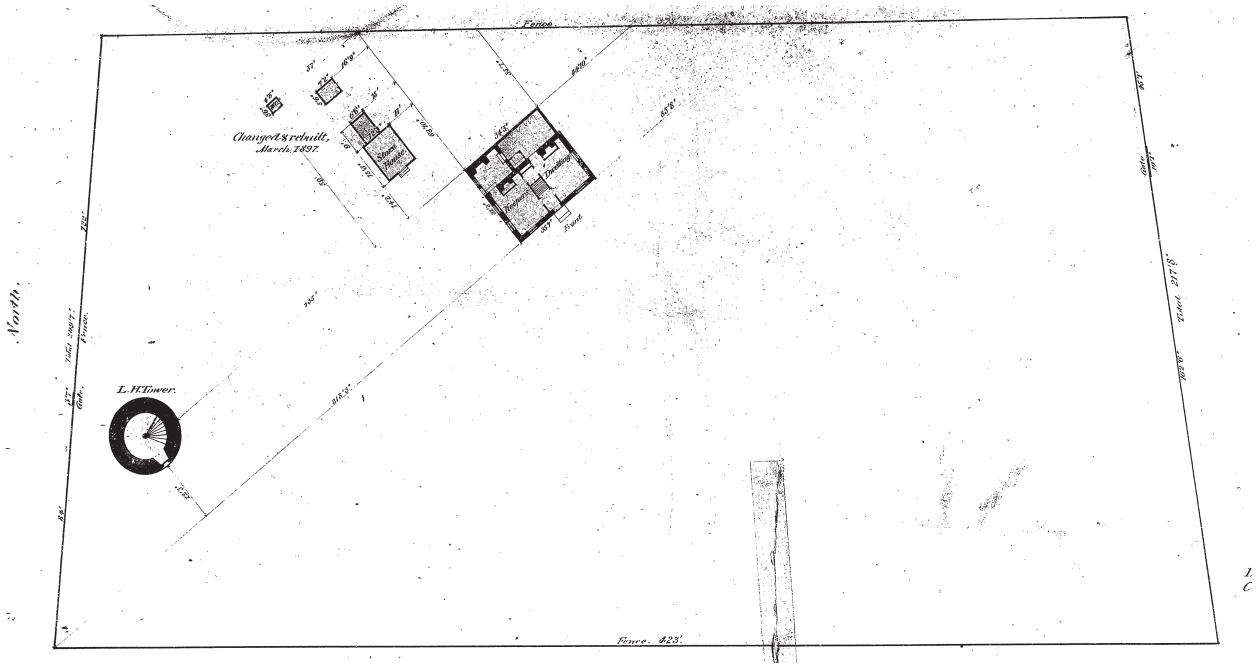


Figure 114. Plat of Ocracoke Light Station, 1892. (USCG, cf2800161) See larger version in *Appendix B*.

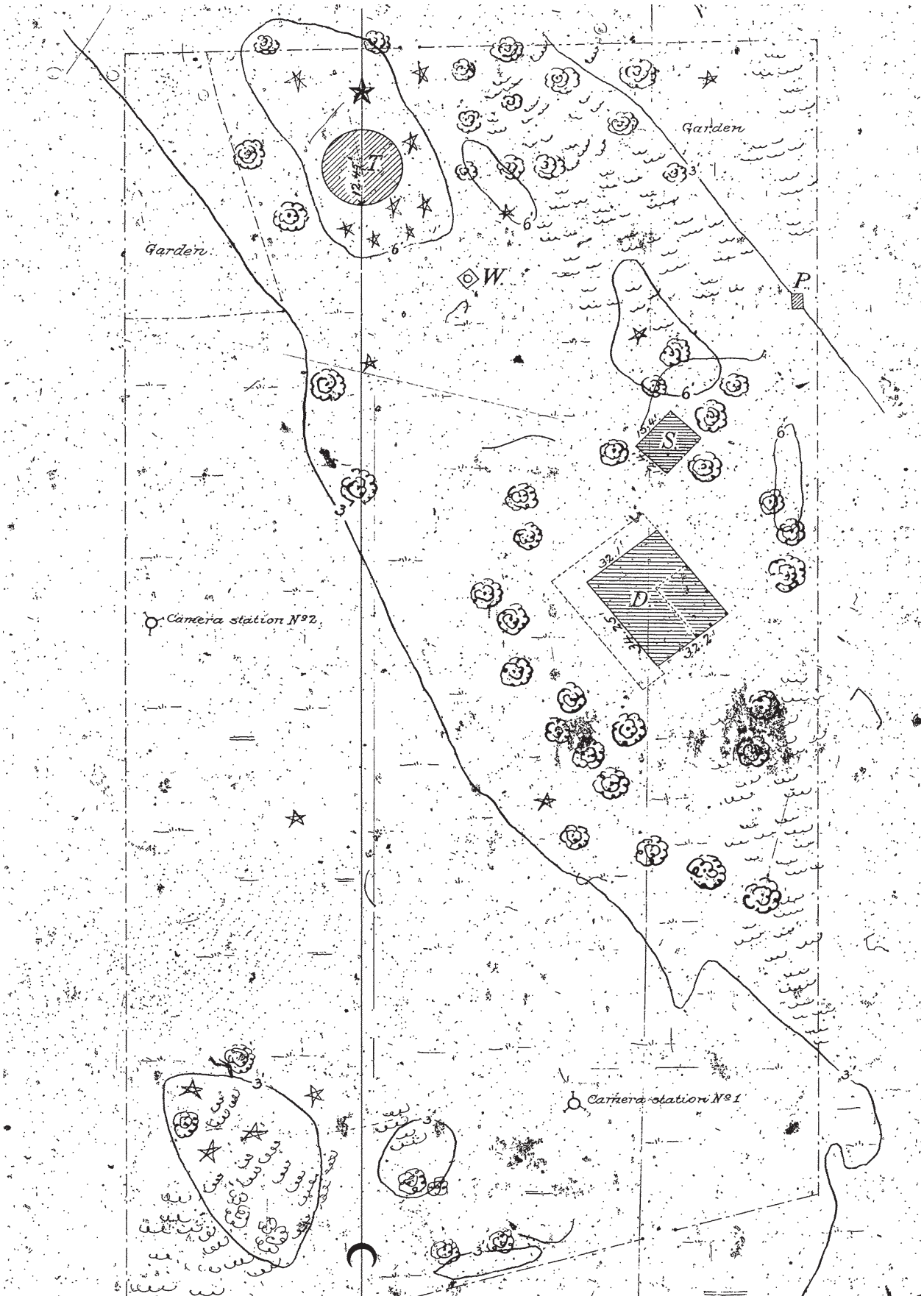


Figure 115. Plat of Ocracoke Light Station showing well. Based on 1893 survey by Herbert H. Bamber. Camera stations 1 and 2 keyed to *Figs. 49, 88-89*. Office of the Light-House Board, 1905. (USCG, cf2800164) See larger version in *Appendix B*.

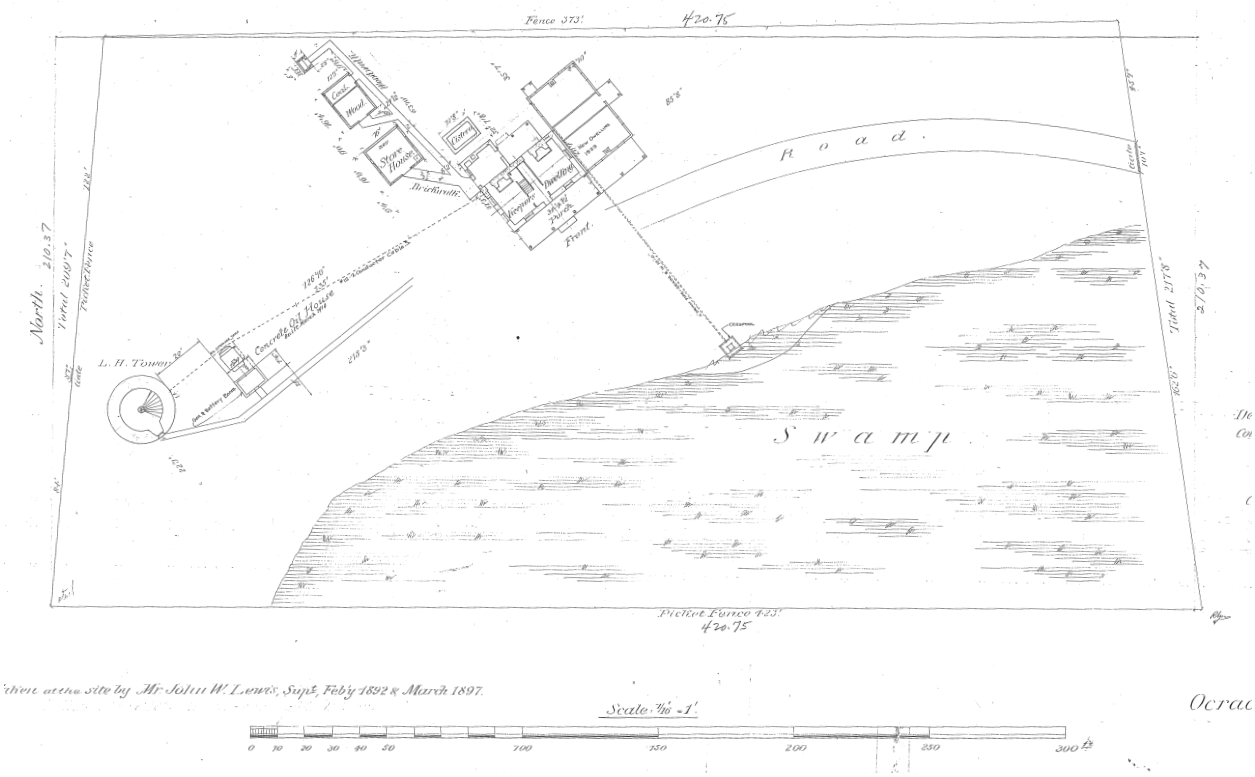


Figure 116. Plat of Ocracoke Light Station, 1897 updated to 1929. (USCG, cf2800162) See larger version in *Appendix B*.

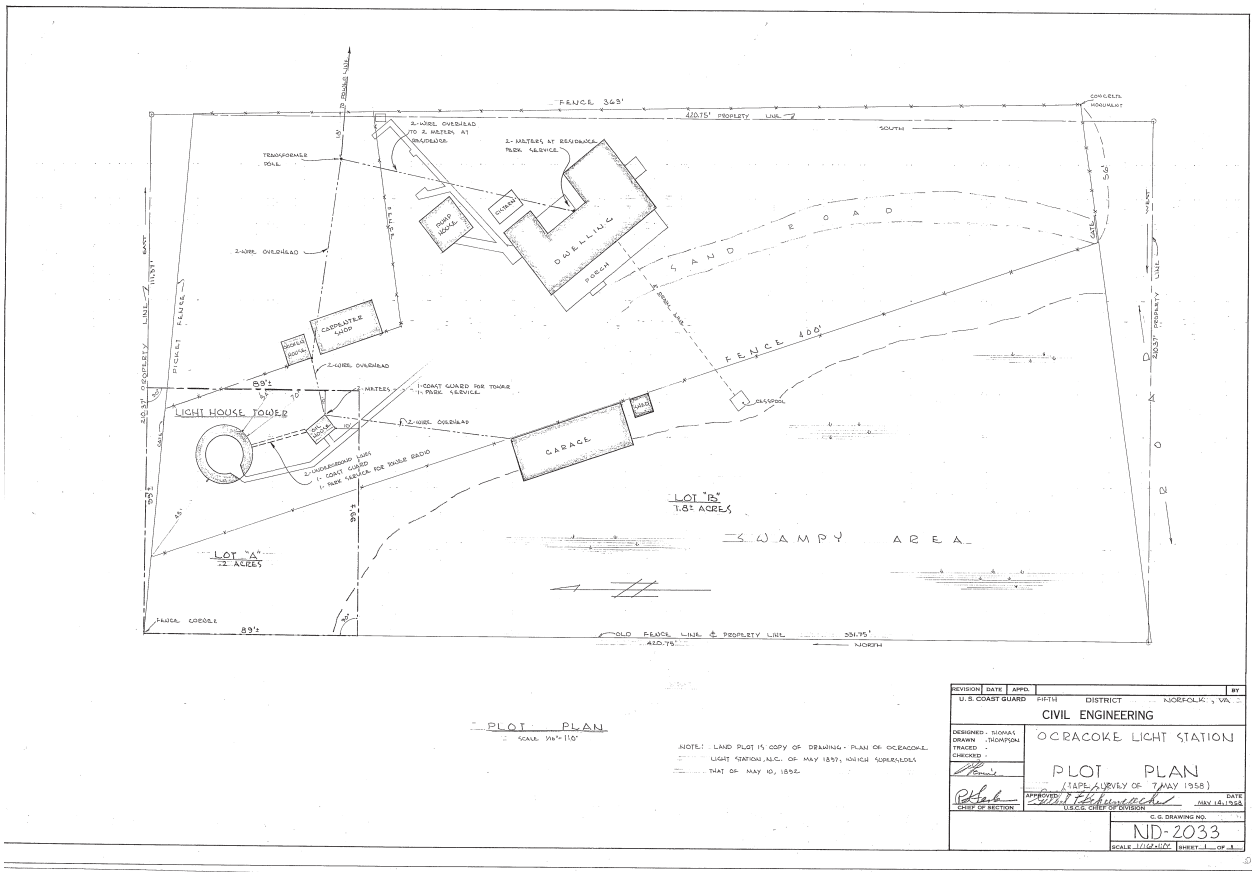


Figure 117. Plot plan, Ocracoke Light Station, May 1958. (USCG, cfnd203301) See larger version in *Appendix B*.



Figure 118. Newly reconstructed privy, 2010. (CAHA Coll.)

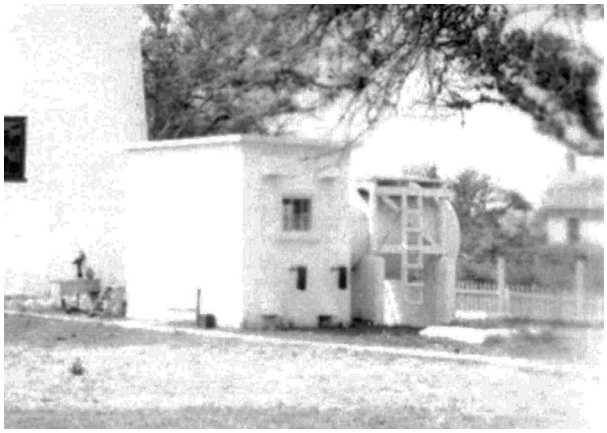


Figure 119. Oil house, 1936. Oil storage tank is visible to the right, adjacent to east wall of oil house. (CAHA Coll.)

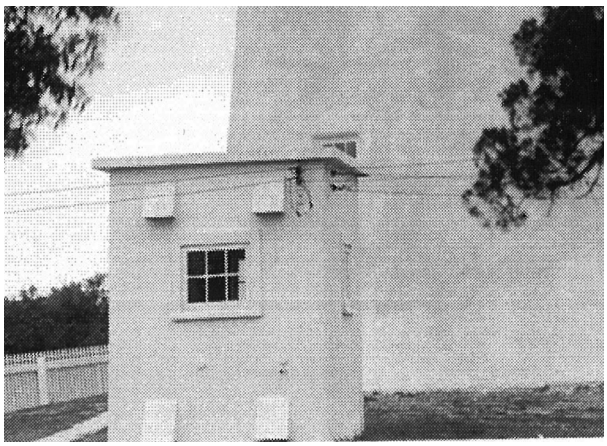


Figure 120. Oil house, 1952. Oil storage tank no longer present; building and trim remain white. (CAHA typed photo id sheet)

lighthouse.[194] At an unknown date, the windows were replaced with vinyl-clad thermal windows (*Figs. 116-117, 119-120, 129-131*).

Store House/Pump House

It has been assumed that the current building is the same structure consistently shown on property plats, perhaps built as early as 1875 and therefore the oldest outbuilding at the light station. The one-story, board-and-batten frame building is near the north side of the quarters, the location of a structure known for much of its history as the store house. In December of 1875, official correspondence mentions "build store house."[195] The building is shown on the 1892, 1905, 1908, and 1929 plat maps, where it is labeled "Store House."[196] However, a comparison of the building shown in Herbert Bamber's 1893 photograph with the current building shows that the façade of the present building is wider and its footprint more square than the building shown in the earlier photograph (*Figs. 121-122)*. Still, by the 1929 plat (1892 updated to 1897 updated to 1929), the building appears to have its present configuration (*Figs. 114-117*).[197]

The storage building may have been used for a time around the turn of the twentieth century as a summer kitchen. In 1899, Keeper T. F. Smith wrote to the Light House Engineer about the kitchen.

> It is so hot in the kitchen in the Summer time it is next to impossible to bear the heat. Consequently we have to use one of the store houses for a Summer Kitchen it is a nice little house except it needs ceiling. Very many insects gets into it making it a very hard job to keep them out of our victuals.

194. Correspondence from Jared A. Smith, Light House Engineer, to Chairman, Light-House Board, June 25, 1885; Correspondence from J. C. Mallery, Light House Engineer, to Chairman, U. S. Light-House Board, October 19, 1888; Correspondence from Eric Bergland, Light House Engineer, to Light-House Board, August 28, 1895; Recommendations for Repairing Aids to Navigation, Office of Lighthouse Inspector, Fifth District, December 16, 1913; Plat of Ocracoke Light Station, N.C., 1897 updated to 1929. This plat shows the oil house with a note stating that it was built in March 1914. At that time (1929), although the building was labeled Concrete Oil House, the plat also said that it was being used as the generator and battery room. Immediately adjacent to the oil house was an oil storage tank, which is still present in a 1936 photograph. Beginning in 1929, the lighthouse was electrified by a Delco generator.

195. F. T. Harwood, Light House Engineer, to Capt. Joh E. Wyatt, Master tender Tulip, December 12, 1874.

196. Plat of Ocracoke Light Station, Baltimore, May 10, 1892; Ocracoke Light Station, N.C. (Plat), Office of the Light-House Board, 1905, from survey by H. Bamber, 1893; Ocracoke Light Station, N.C. (Plat), Office of Light House Engineer, Baltimore, December 1908, buildings surveyed 1897 by John W. Lewis; Plat of Ocracoke Light Station, N.C., 1897 updated to 1929.

197. Bamber photograph No. 191; 1897/1929 Plat.



Figure 121. Detail of 1893 Bamber photograph showing proportions of store house. (CAHA MRC, Rm. 1, Map Case 4, Dwr. R)



Figure 122. Store house/pump house in 2013.

Keeper Smith proceeded to submit a proposal for having the store house ceiled, including an estimate of the cost. In a letter of 1901, Smith again referred to the summer kitchen.[198]

Changing names over the years suggest changing uses, or perhaps a new or greatly altered building. On a plot plan of 1944, the building is labeled "storage," and in 1958 it carried the label "pump house." In 1988 it still was referred to as the pump house in the Preservation Project Phase II Completion Report, although a Utilities Plan of the same year listed it simply as "outbuilding."[199]

198. Correspondence from T. F. Smith, Keeper, to W. A. Jones, Light House Engineer, April 1, 1899 and May 31, 1901.
199. Plot Plan, Ocracoke, N. C. Light Station, United States Coast Guard, May 10, 1944; Plot Plan, Ocracoke Light Station, U. S. Coast Guard, May 14, 1958; Phase II Completion Report; Utilities Plan, Ocracoke Light Station Keeper's [*sic*] Quarters, National Park Service, May 1987.



Figure 123. Removal of store house/pump house concrete floor, 1988. ("Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," 603-D142)



Figure 124. Original wood floor of store house/pump house exposed below concrete floor, 1988. ("Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," 603-D142)



Figure 125. Replacement of store house/pump house sill plates, 1988. ("Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," 603-D142)

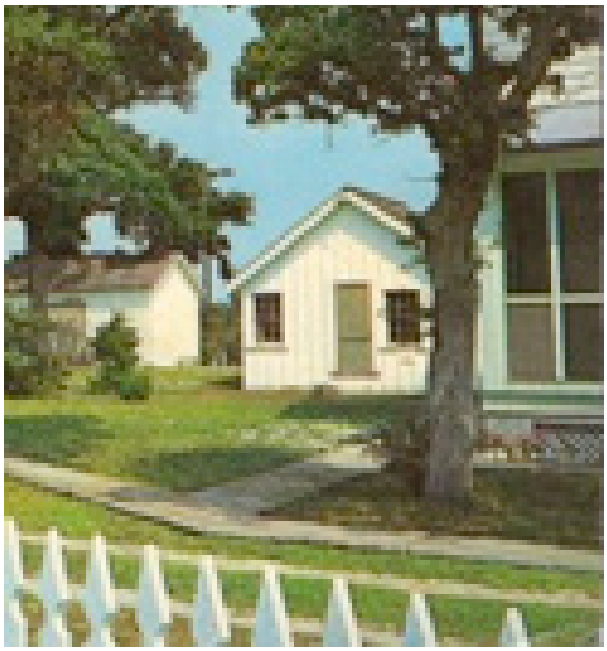


Figure 126. Vertical board door on store house/pump house is visible despite blurry image. This door and the doors of other outbuildings is an olive green. Detail from postcard at Figure 130.

The 1988 Phase II Preservation Project included a considerable amount of work on the store house/pump house. Surprisingly, when the concrete slab floor was removed, a tongue-and-groove wood floor was revealed underneath. The deteriorated wood floor was removed, and replacement flooring was milled to match. The building was found to be heavily termite infested, and in response, some floor joists were repaired or replaced, seventy-five percent of the sill plates were replaced, wall studs were repaired, and the concrete steps were removed, to be replaced in a later phase of work by wood steps to match the older steps seen in photographs (*Figs. 123-125*).

Still other work was accomplished on the building. The double-hung windows were reglazed, painted, and new aluminum balances were installed; deteriorated siding was repaired or replaced; existing utility lines and hookups were removed; and the grade around the building was lowered.[200] During the project, two new factory-made exterior doors were installed. They were chosen to approximate the deteriorated doors on the building at that time; however, a postcard photograph probably taken in the 1970s shows a vertical board door with exterior horizontal batten (*Fig. 126*).

200. Phase II Completion Report.

Cisterns

Immediately behind the keepers' quarters are two low, rectangular concrete cisterns with sloped tops (*Fig. 127*). The first served the original dwelling, but its date of construction is not clear. In response to a request from Keeper T. F. Smith in June 1901, W. A. Jones, the Lighthouse Engineer, responded with authorization to procure a pump and pipe for the cistern. However, the first appearance of the cistern on a plat map was not until 1908.[201] Previous cisterns were likely of brick or wood.

The date of the second cistern, which served the 1929 dwelling, also is not known. The plat maps of 1958 and 1961 give the impression that the second cistern was built between those years. And yet, a 1941 aerial photograph clearly shows the cistern (*Fig. 94*).[202]

201. Correspondence from W. A. Jones, Light House Engineer, to T. F. Smith, Keeper, July 8, 1901; Plat of Ocracoke Light Station, 1908.
202. Plot Plan, 1958; Topography of Ocracoke Lighthouse, National Park Service, August 28, 1961; Photograph of Ocracoke Light Station, Office of Southern Inspector, May 29, 1941.



Figure 127. Cisterns behind keepers' quarters, 2008 before restoration work. (CAHA Coll.)

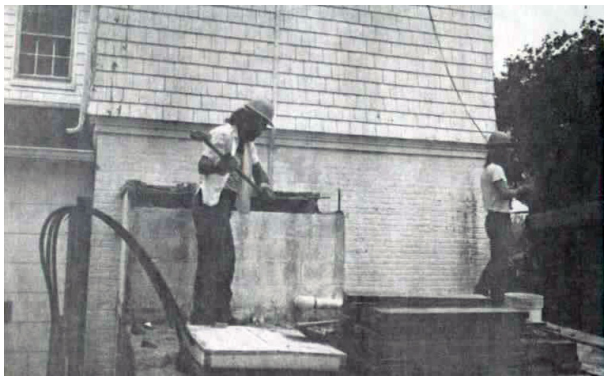


Figure 128. Repair and reapplication of parge coat on cisterns, 1987. ("Ocracoke Light Station Keeper's [*sic*] Quarters Preservation Project Phase II," 603-D142)

In 1987, Phase I of the Keeper's [*sic*] Quarters Preservation Project included work on the cisterns. Both were cleaned and pargeted on the inside for waterproofing, and modern cistern filter boxes were removed (*Fig. 128*).[203]

Both cisterns were cleaned, repaired, and painted as part of the 2008 restoration of the keepers' quarters.[204]

Carpenter's Shop

Approximately halfway between the lighthouse and the keepers' dwelling is a long, rectangular board-and-batten frame building known as the carpenter's shop. It is believed to have been built in 1929 as a shop and construction office for the new assistant keeper's addition.[205] However; its construction date is unclear. It is not included on a 1944 plot plan, though it is shown on a 1958 plan. Physical evidence indicates that it was extended to the north at a later date. (*Figs. 117, 129-131*).

At an unknown date, the windows were replaced with vinyl-clad thermal windows. The building is currently used for storage.

203. Completion Report, Preservation Project Phase I.
204. "Ocracoke Double Keepers Quarters," 2008 Restoration – Scope of Work
205. Untitled typed report, post-1992. (CAHA 248 box 3)



Figure 129. Carpenter's Shop, northwest oblique. (2013, JKOA)



Figure 130. Postcard showing outbuildings. Doors of oil house, store house/pump house and carpenter's shop are olive green. Undated, postmarked 1977. (Personal collection)

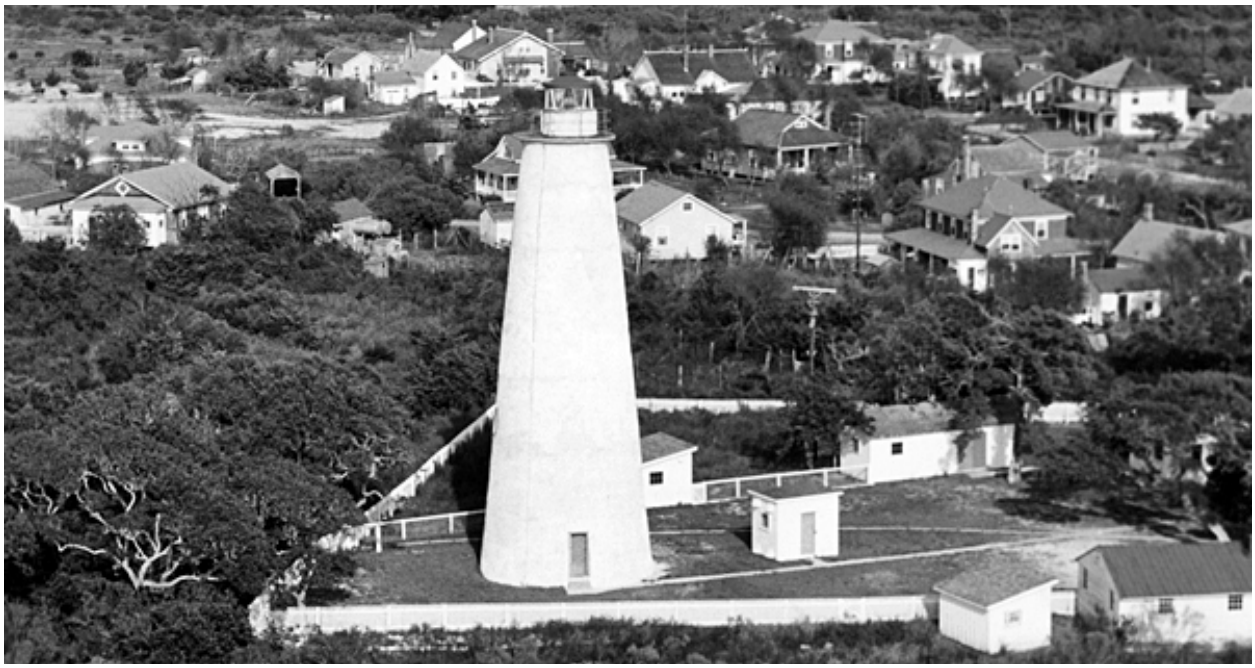


Figure 131. Undated U.S. Coast Guard aerial of Light Station, probably 1970s, showing oil house, generator house, and carpenter shop. The visible doors are painted a darker color than the white of the buildings. Also visible in the foreground are a garage and shed, no longer extant. (lighthousefriends.com/ocracoke_aerial_ca.jpg)

Generator House

Close to the lighthouse and oil house is the generator house, a small board-and-batten frame building with shed roof similar to other buildings previously at the station. This building was built in 1994 or soon thereafter. An NPS sketch dated 1994 shows a "proposed generator shed" (*Fig. 133*). Photographs show that the 1990s design was based on an earlier structure in the same location. The sketch identifies the site as the "last known location of chicken house," and the 1958 plot plan identifies a "chicken house" at that location (*Fig. 117*).

The first documentation of the earlier structure is a 1954 photograph (*Fig. 132*). The building is also seen in an undated aerial photograph of the light station (the door of the lighthouse in the photograph suggests a 1970s date) and a postcard with postmark date of 1977 (*Figs. 130-131*). An aerial view of the light station on another postcard, this one mailed in 1982, shows the structure no longer present (*Fig. 136*), suggesting the building stood until at least the 1970s. The reason for its disappearance is unknown.

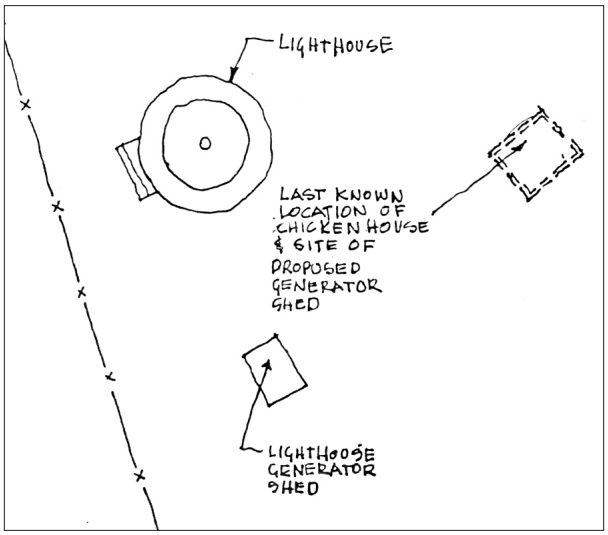


Figure 133. Portion of NPS sketch for a proposed "generator shed," dated July 22, 1994. (CAHA Coll., Acc. 360, #5608, folder 61805)



Figure 134. Generator House built ca. 1994. (2013, JKOA)

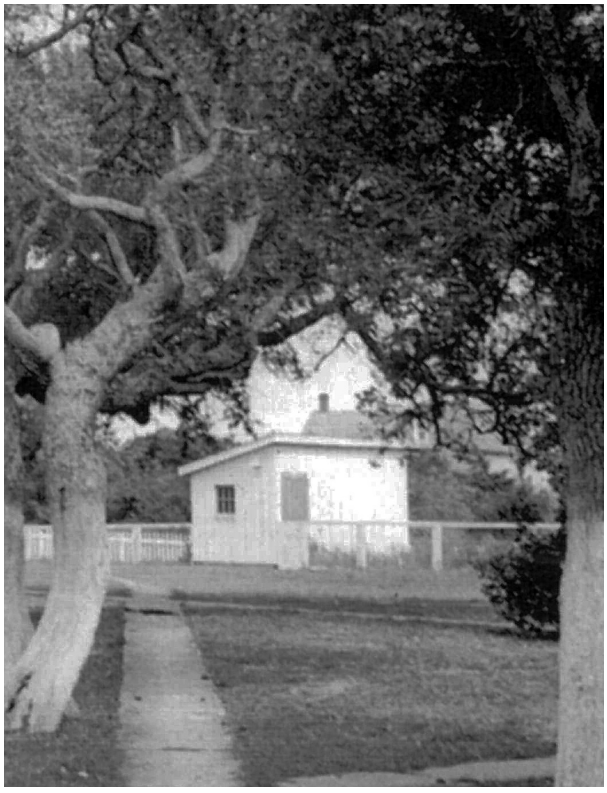


Figure 132. Former structure (possibly used as chicken house) on site of current generator house, 1954. (CAHA typed photo id sheet, negative no. 54-9)

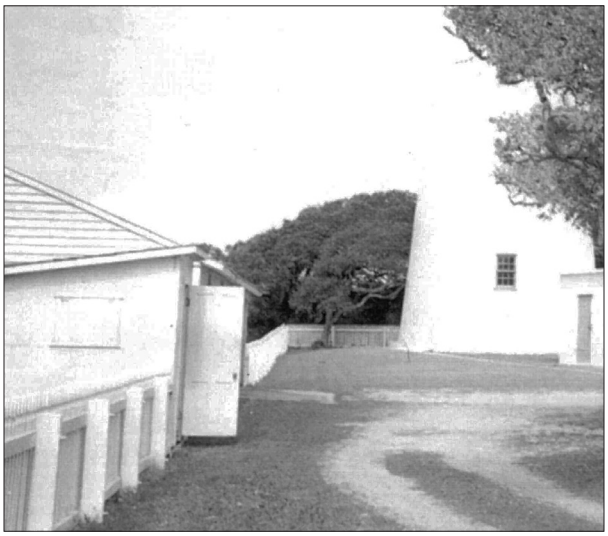


Figure 135. Former garage and north shed, 1954. (CAHA typed photo ID sheet, negative no. 54-9)



Figure 136. Postcard showing oil house and the no longer extant garage and south shed, postmarked 1982. (Personal collection)

Previous Outbuildings

Several other outbuildings once stood on the light station property but are no longer extant.

A considerable amount of documentation provides information on a woodshed, constructed in either December 1903 or January 1904. In early November 1903, Keeper Smith asked the Lighthouse Engineer for authorization to build a woodshed. The work was authorized a week later and W. D. Gaskill was hired to build the shed. Gaskill sent his bill on December 21, suggesting that the building was completed; however, the 1904 Annual Report of the Lighthouse Board states, "A small woodshed was built in January." The building is shown as a coal and wood shed behind the storehouse on the 1892 and 1897 plats, but by 1944, was gone (*Figs. 114, 116*).[206]

A large garage and a small shed once stood just outside the fence near the marsh. Their dates of construction are not known. They do not appear on the 1929 plat, but are shown in photographs of 1936, 1952, 1954, 1956, and 1977 as well as on the 1958 plot plan (*Figs. 116-117, 130-131, 135-136*).

The garage was a long frame building with a broad side-gable roof, nine-light windows, and vehicular and pedestrian doors facing the keepers' quarters. The shed, similar in design to the former outbuilding near the carpenter's shop and used as a chicken house, was a shed-roofed frame structure with a door facing the quarters.[207] An undated Coast Guard aerial photograph shows the two similar sheds (*Fig. 131*). A second shed is shown south of the garage in a postcard mailed in 1982 (*Fig. 136*).

206. Correspondence from T. F. Smith, Keeper, to W. A. Jones, Lighthouse Engineer, December 21, 1903; 1929 Plat; 1944 Plot Plan.

207. 1929 Plat; 1958 Plot Plan; H. R. Gregg, photograph of Ocracoke lighthouse and keepers' quarters, December 1952; Dillahunty Photograph, 1954; Watson, Photograph of Ocracoke Lighthouse, July 1956; Vintage postcard, 1977.

Timeline

1781	Francois-Pierre Ami Argand designs lighthouse lamp.
1787	Newly created Federal government addresses navigational safety.
1789	Congress passes Lighthouse Act of 1789. Oversight given to Treasury Department.
1789	NC General Assembly passes act to build lighthouse on Ocracoke Island.
1794	Congress authorizes construction of lighthouse on Shell Castle Island at Ocracoke Inlet; completed 1798.
1810	Winslow Lewis patents lighthouse lamp and reflector design. Treasury Department purchases patent in 1812 and contracts with Lewis to install lights in all US lighthouses.
1818	Lightning destroys Shell Castle Island Lighthouse.
1818	Lewis designs and builds first lighthouse. Acquires contract to supply specifications for lighthouses of east coast and Great Lakes.
1820	Federal lighthouse program placed under Stephen J. Pleasonton, frugal Fifth Auditor of the Treasury.
1822	Augustin Fresnel invents complex prism lens far superior to Argand and Lewis lamps. Becomes the standard in Europe and elsewhere.
1822	Congress authorizes $20,000 for lighthouse and keeper's quarters on Ocracoke Island;
1823	Lewis's standard specifications for lighthouse, keeper's dwelling, well and privy used at Ocracoke. Noah Porter of Massachusetts is awarded construction contract. Lewis has contract to equip tower with his light system of lamps and reflectors.
1829	Anson Harker is first lightkeeper of record (1829-46).
1834	Report of "partial destruction of the light house at Ocracock [*sic*] by fire."
1838	Continued complaints made to Congress over Pleasonton's resistance to Fresnel lens leads to successful testing.
1847	John Harker becomes keeper (1847-53).
1850	Ocracoke population 536; light station part of community.
1851-52	Congress creates study commission to investigate Pleasonton's worrisome lighthouse program; relieves Pleasonton of duties; creates Light-House Board to oversee lighthouse program; implements aggressive campaign to install Fresnel lenses nationwide.

1853 Thomas Styron becomes keeper (1853-60).

1854 Fourth-order Fresnel lens with fixed beam is installed at Ocracoke; replaces out-of-date reflecting illuminating apparatus. Lewis-designed birdcage lantern room removed from top of tower and replaced by new lantern designed for Fresnel lens. New lantern is smaller, requires off-center placement to accommodate existing floor hatch into lantern room.

Italics below identify the subject building.

1860 William J. Gaskill becomes keeper (1860-62).

1862 *Lighthouse*: Confederate troops remove lens.

1862 Enoch Ellis Howard becomes keeper (1862-97--longest tenure).

1863-64 *Lighthouse*: Union troops reinstall lens, later "establish" the light.

1867 *Lighthouse*: Lantern fuel updated from whale oil to lard oil.

1868 *Lighthouse*: large portion recemented and whitewashed; lantern and woodwork painted; lantern deck and sash and frames repaired; stairway renovated; general repairs.

Keeper's Quarters: woodwork painted; one side of roof reshingled and other repaired; fire hearths relaid; plaster, doors, sashes, hardware, and floors repaired where necessary; exterior whitewashed.

1873 *Lighthouse*: whitewashed and painted outside, lantern deck cemented.

Keeper's Quarters: painted inside and out.

1877 *Keeper's Quarters*: plaster fallen in one room.

1878 *Lighthouse*: Lantern fuel updated from lard oil to kerosene.

1881 *Keeper's Quarters*: estimates for reshingling roof, new steps, and new privy.

1882 Engineer's report states that "no repairs of value have been made during the last ten years."

Lighthouse: portion of wooden stairway and landing decayed. (Needs stated as: new window frames and sash, door and door frame, repointing, cement work)

1883 *Keeper's Quarters*: plaster renewed and two new floors laid.

1885 (Need for detached *oil house*.)

1888 (Need again expressed for *oil house*.)

1889 *Keeper's Quarters*: rear frame shed addition built. (Windows, steps, and shutters needed.)

(*Cistern* needed.)

1892 *Lighthouse*: Earliest known plans and elevations. Plat map drawn.

1893	Herbert Bamber photographs of light station show frame shed addition on rear of house.
1893-95	*Keeper's Quarters*: appropriations increase each year for constructing additional upper-level space for Keeper's family.
1894-95	(Need again expressed for detached *oil house*.)
1895	*Lighthouse*: new lamps and lantern glass supplied.
1896	*Keeper's Quarters*: authorization for additional story to dwelling.
1897	*Keeper's Quarters*: plans and elevations of proposed alterations; work completed: roof removed; three-room second story and front porch added; old flooring renewed; structure thoroughly repaired.
	Lighthouse: new sash and window frames, storm door for gallery.
	Updated plat of station.
1897	J. Wilson Gillikin becomes keeper (May-Dec. 1897).
1897	Tillman F. Smith becomes keeper (1897-1910).
1898	*Keeper's Quarters*: lattice installed at ends of front porch for vines.
1899	*Lighthouse*: new Fresnel lens replaces 1854 lens.
	Keeper's Quarters: bronze wire cloth furnished for door and window screens.
	One store house in use as summer kitchen.
ca. 1900	Photograph shows features of light station.
1901	*Keeper's Quarters*: authorization to procure pump and pipe for cistern.
1903	*Lighthouse*: lightning rod damaged.
1903-04	Coal and wood shed built.
1904	*Lighthouse*: new lightning rod installed; exterior cement recently applied. (Need expressed for two coats of whitewash; need for repointing outside brick course and part of next (inner) course around 10' down from top of tower and halfway around.)
1905	*Lighthouse*: Request made for glass to replace cracked and broken panes in lantern.
1908	*Keeper's Quarters*: (Need for painting of trimmings and porch columns and interior of kitchen and kitchen porch.)
1910	U.S. Bureau of Lighthouses (Lighthouse Service) replaces Light-House Board.
	A. B. Hooper becomes keeper (1910-12).
1911	*Keeper's Quarters*: downspout to cistern replaced, gutter repaired, flashing in two chimneys replaced and pointed with cement mortar.

1912 Capt. Leon Wesley Austin becomes keeper (1912-29).

1913 *Keeper's Quarters*: roof and shutters painted.

Lighthouse: tower exterior scraped and whitewashed; exterior and lantern deck painted; cement coating applied to top of tower.

Outbuildings repaired.

Concrete *oil house* built.

Privy repaired.

1914 *Keeper's Quarters* painted.

Lighthouse: tower interior whitewashed; stair painted; old paint cleaned off inside lantern.

1915 *Lighthouse*: interior and exterior of lantern painted.

1916 *Keeper's Quarters*: kitchen and cistern top repaired; kitchen porch painted.

Lighthouse: closet built in tower.

New *privy* built.

Outbuildings painted.

1917 *Lighthouse*: lantern exterior painted black.

Telegraph poles installed in station; telephone installed in office.

1929 Update of 1897 plat of station.

Lighthouse: converted to electricity, powered by Delco generator.

1929 *Keeper's Quarters*: second dwelling for assistant keeper & family built at south side of original keeper's quarters (two-residence structure becomes the plural *Keepers' Quarters*);
• Original Keeper's Quarters (1823): new bathroom, new windows in bathroom and downstairs room.
• Assistant Keeper's Quarters (1929): two-story balloon-framed, added to old dwelling, first-floor stucco, second-floor wood shingles, roof standing-seam metal, full-length porch.

Lighthouse: Sash probably replaced.

Tower and dwellings to be electrified by generators in *oil house*.

Carpenter's Shop likely constructed.

1929 Capt. Joe Burrus becomes keeper (1929-46).

1936 Photograph shows features of lighthouse.

1937 or 38	*Lighthouse*: electrified by town electrical co-op.
1938	*Keepers' Quarters*: east shed addition to 1929 quarters.
1939	U.S. Coast Guard takes over management of America's lighthouses.
ca. 1944	Wooden spiral staircase removed after hurricane; temporary ladders installed.
1946	Clyde Farrow becomes the last keeper (1946-54).
1950	*Keepers' Quarters*: interior work to both dwellings: modern kitchen and bathroom facilities installed; closet space increased; full-length porch screened. • Original Keeper's Quarters (1823): floors replaced or refinished; ceilings and walls lined with plywood paneling. • Assistant Keeper's Quarters (1929): beaded walls covered with painted wallboard.
ca. 1952	*Lighthouse*: exterior coated using gunite process.
1953	*Lighthouse*: ladders removed; new clockwise metal stair replaces counterclockwise wooden stairs; whitewashed interior is sandblasted; new steel and concrete floor installed at lantern level.
1954	*Lighthouse* automated; lightkeepers no longer needed.
1955	Coast Guard (CG) issues revocable permit granting NPS permission to use and occupy keepers' quarters.
1957	CG permit amended to include use of garage, chicken house, carpenter shop, and pump house; NPS must maintain.
1972	*Keepers' Quarters*: metal roof replaced.
1974	*Carpenter's shop* and *pump house*: roofed.
1977	*Keepers' Quarters*: interior painted. *Carpenter's shop* and *pump house*: painted.
1978	*Keepers' Quarters*: exterior painted.
1987	*Lighthouse*: public concern over condition.
1987	*Keepers' Quarters* Preservation Project – Phase I: • Archaeology with sand removal from crawl space. • Electric service line buried. • Supplemental floor support and foundation vents added beneath both dwellings; foundation vents installed in common wall. • 1929 Assistant Keeper's Quarters: partial replacement of termite-damaged sills; supplemental wall framing; stucco patches; gable-end attic windows rebuilt; second-story windows stripped for scheduled Phase II repairs. *Cisterns*: interiors cleaned and pargeted for waterproofing; modern filter boxes removed. Drawings accompany project completion report.

1988 Coast Guard agreement allows NPS to apply for grants and conduct work on USCG-owned light station.

1988 *Keepers' Quarters*: interior work proposed: replace HVAC system; repair/replace plumbing and wiring; repair windows; repair fireplaces;
- 1823 Keeper's Quarters: repair/replace bathtub; repair bathroom wall and floor tile.
- 1929 Assistant Keeper's Quarters: replace sheetrock and insulate. Paint/finish interior walls and trim; sand and finish floors; repair/replace kitchen and bathroom floors; replace linoleum; ; replace fiberglass tub/shower system; repair tile; repair/replace kitchen cabinets, door hardware, floor joists and floor of shed addition; add supplemental rafters.

1988 *Keepers' Quarters* Preservation Project – Phase II:
- Both quarters: utility porch reroofed with wood shingles; sidewall shingles repaired/replaced; flashing replaced and added; roof sheathing, leaks around chimney, many window units repaired.
- 1929 Quarters: chimneys relaid with new brick above roofline; flashing and attic vents installed; utility porch floor framing repaired and supplemented.

Store house/*Pump house*: tongue-and-groove wood floor revealed beneath concrete floor; windows repaired; new doors installed; siding repaired/replaced; utility lines and hook-ups removed; grade lowered to avoid raising building. Termite infestation necessitates repair/replacement of floor joints and most sill plates; wall studs repaired; wood floor replaced with matching mill flooring; concrete steps removed.

1989 *Lighthouse*: door replaced with metal door; windows mistakenly replaced with vinyl-clad sash; citizens rescue six existing sash. Deteriorated steel stair brackets replaced with stainless steel brackets; algae removed from walls; joints at base of tower repointed; cracks in lantern deck repointed; hatch door repaired; metal surfaces bead blasted and painted; acrylic panels in lantern removed, measured and reinstalled.

1989-90 *Lighthouse*: Physical investigations, mortar analysis , condition assessment. Historic Structures Report recommends treatments

Vinyl windows replaced with the six repaired sash and six new sash; window frames repaired or replaced; metal entrance door replaced with wooden door based on 1823 design, but with louvered ventilation panel. Severe moisture penetration found.

1990 *Lighthouse*: lintels repaired; area of brick collapses during the process, is relaid.

1994 Current *Generator House* constructed.

2000 *Lighthouse*: transferred to NPS, Coast Guard retains light.

2002 *Keepers' Quarters*: exterior painted.

by 2004 *Lighthouse*: 1990 door replaced with four-panel wood door.

2008 *Keepers' Quarters*: proposed exterior "restoration" to include:
- Clean masonry of chimneys and cisterns, repoint mortar as necessary.
- Repair wood siding, sheathing, shingles, wood sash and storm windows, doors.
- Replace all roof coverings with metal panel system.
- Rework gutters and downspouts.

- Repair doors and hardware.
- Repair windows.
- Restore period hardware, replace later exterior hardware to match original.
- Paint exterior.

2009-2010	*Lighthouse*: portions of dome rebuilt; acrylic window panels in lantern replaced with new acrylic; cast iron gallery railing replaced; new railing above floor hatch installed; lantern drum and deck painted; interior brick repointed; deteriorated window frames repaired. Sixth replacement door installed.
ca. 2010	New *privy* built; cast iron door of *oil house* repaired.
Unknown	All outbuilding windows except pump house replaced with vinyl windows.

I.C Physical Description

General Description

Locale

Ocracoke Light Station is located in Ocracoke, North Carolina and is part of Cape Hatteras National Seashore (CAHA). Stretching more than 70 miles from Bodie Island to the north to the southern tip of Ocracoke Island, CAHA is part of the string of barrier islands forming the Outer Banks. While most of the east coast's barrier islands are close to the mainland, North Carolina's "Outer Banks" jut out into the Atlantic as much as thirty miles to form an eastern barrier to a series of bays and sounds.

Ocracoke Island is one of the most remote of the Outer Banks. A true island, not connected by sand bars, it is reached only by public ferry, private boat, or private plane. The island marks the northern boundary of Ocracoke Inlet connecting the Atlantic Ocean and the shallow Pamlico Sound.

Ocracoke, part of Hyde County, is an unincorporated town on the southern end of Ocracoke Island and is the island's only settlement. The town is situated at the widest part of the island at a small harbor known as Silver Lake. Ocracoke has an area of about 9.6 square miles and a population of just under 1,000 as of the 2010 census.

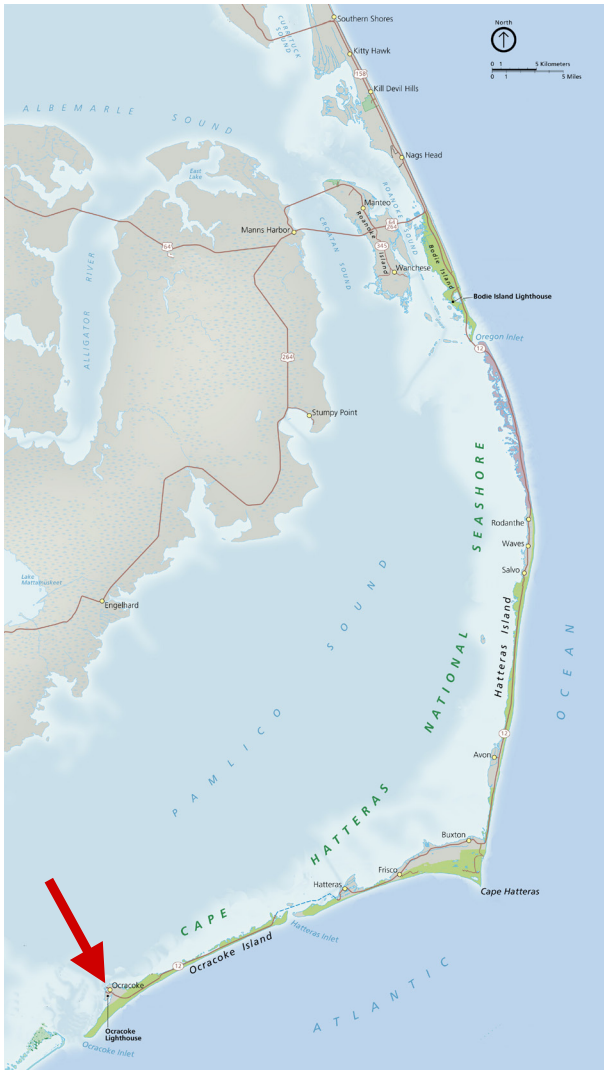


Figure 137. Map of Cape Hatteras National Seashore. (CAHA Coll.) Location of Ocracoke marked with red arrow.

Climate

The climate is temperate and seasonal. Summers are hot and humid with cooler evenings. The warmest month is July with an average high temperature of 86°F and average monthly nighttime lows of 74°F. The coldest month is January with an average high of 50°F and low of 38°F. The hottest and coldest temperatures on record are 99°F and 14°F, both recorded in the 1970s.

The wettest seasons are spring and fall, with an annual rainfall of over 58 inches, the heaviest in August, with an average of just under eight inches. The humidity of the salt-laden air is high through the year, typically staying between 80 and 85 percent RH. Snow is not uncommon in January and February.



Figure 138. Storm surge flooding at light station, early October 2015. (Ocracoke Preservation Society)

Rising Sea Levels

The terrain of Ocracoke ranges from three to five feet above sea level, making the town especially vulnerable to damage from storms. The soil is sandy, with the water table just a few feet below grade. From early summer through fall, tropical disturbances are typical, with hurricanes the most powerful, causing damage from both wind and flood. Strong winter storms called Nor'easters are also common. The location of the Outer Banks so far from the mainland makes it the most hurricane-prone area north of Florida. The buildings of the Outer Banks have suffered repeated devastation from these storms, which with climate change and resultant sea level rise are projected to be more severe and more frequent.

Estimates of sea level rise have been published by a variety of sources. Global estimates from the Intergovernmental Panel on Climate Change, used by several parks in their Foundation Documents, make estimates for 2100; however, projections for the next several decades are more pertinent for current planning and decision making. The National Oceanic and Atmospheric Administration (NOAA) has published sea level rise scenarios for the United States, but these are not readily useful for localized decisions.[208]

The NPS has developed the Climate Change Response Program (CCRP), a cross-disciplinary program to preserve the natural and cultural resources and values under NPS stewardship.[209] The CCRP has collaborated with the University of Colorado at Boulder to develop scenarios of sea level rise based on local tide gauges and near-term timeframes. UC Boulder scientists used the U.S. Army Corps of Engineers (USACE) Sea-Level Change Curve Calculator to develop high, intermediate, and low scenarios for 2030, 2050, and 2100.

In general, a "high" scenario reflects current rate of increase of greenhouse gases, or "no change." "Intermediate" scenarios reflect a reduction in greenhouse gases through changes in human behavior and choices. "Low" scenarios reflect historic rates of sea level rise, achieved by dramatic changes in human behavior and choices. This level of change is not anticipated in the near future; therefore, the NPS Southeast Region does not recommend the use of "low" scenario predictions for current planning or decision-making. More details about the scenarios can be found at http://www.corpsclimate.us/ccaceslcurves.cfm.

208. Part of NOAH'S National Climate Assessment.

209. http://www.nps.gov/orgs/ccrp/index.htm



Figure 139. Lighthouse viewed from Silver Lake harbor.

The Ocracoke Light Station is vulnerable to sea level rise and storm surge. Scenarios based on the Beaufort NC tide gauge predict, under current rates of increase in greenhouse gas emissions, that Ocracoke will experience a little less than a foot of sea level rise by 2030, approximately 1½ ft. sea level rise by 2050, and about 5¼ ft. of sea level rise by 2100.

If the rate of greenhouse gas emission increase slows, and renewable energy technologies are embraced, it is projected that an intermediate scenario of sea level rise could unfold at the Beaufort tide gauge, the closest point of reference for Ocracoke. With the intermediate scenario applied for all projections, results show about ½ ft. of sea level rise by 2030, approximately ¾ ft. of sea level rise by 2050, and almost 2 ft. sea level rise by 2100. A high, or no-change, scenario shows a rise of 0.86 feet by 2030.

Storm surge is also expected to increase with sea level rise. The CCRP and UC Boulder scientists have modeled storm surge under a low and high tide scenario. In general, tomorrow's low tide scenario of surge will be similar to today's high tide scenario.

Their research indicates that the current no-change trajectory or "high" scenario and the high tide scenarios of storm surge are the most realistic for near-term planning, because dramatic changes in global behavior are unlikely in 15 years. In contrast, the intermediate scenario is suggested for 2050 planning.

These figures are projections and the future may or may not unfold according to these estimates, additionally, the science surrounding the projection of climate change and sea level rise is rapidly advancing, and the Climate Change Response Program is already working to revise and update these figures.

Seismic Zone

The site is close to an active seismic zone located near Charleston, South Carolina. The last major quake, recorded by the lightkeeper at the Cape Hatteras Lighthouse, was in 1886. Sporadic seismic activity may again affect the coast.

The Light Station Site

Set back from Pamlico Sound approximately one-tenth of a mile, from the ocean about one-and-a-quarter miles, and from the mainland about thirty miles, Ocracoke Light Station is near Ocracoke Inlet. The light station is located in the southwestern portion of the town and is surrounded by residential properties. The roughly 1.5 acre site is bounded to the north by a fence and to the south by Lighthouse Road. The only access is from the south. The site has a number of mature oak trees and is bordered on the north, east and west by dense vegetation.

The complex is composed of seven structures; the Lighthouse at the northern boundary and the Original Keeper's Quarters near the middle of



Figure 140. Aerial image of Ocracoke Light Station, viewed from southwest. (CAHA Coll., June 2015)

the property, both date to 1823. A 1929 Assistant Keeper's Quarters adjoins the south wall of the Original Keeper's Quarters. Five outbuildings serve these primary structures. Just south of the Lighthouse are a 1914 oil house and a 1994 generator house. Slightly further to the south is a ca. 1929 carpenter's shop; an 1890s store house/ pump house is located just north of the keepers' quarters. At the eastern edge of the property, north of the keepers' quarters, is a privy rebuilt in 2010 after a storm.

Lighthouse

The Architecture

The lighthouse faces west-southwest. For the purposes of this report, the front door of the lighthouse will be said to face west.

Ocracoke Lighthouse was designed and constructed in 1823. The tapering conical tower is of brick, the exterior of which is coated in shotcrete (a pneumatically applied mixture of cement or mortar also known by the trade name Gunite) and painted white.

The original 1823 contract stated that the lighthouse be constructed on a foundation of laid brick or stone. The first known construction drawing of the lighthouse, which dates to 1892, shows the foundation to be of cut stone. The foundation is not visible above grade.

The conical tower wall tapers on both the interior and exterior to the base of the lantern deck. On the interior, the brick wall ends in a masonry dome, while on the exterior the brick corbels out for several rows; both function to support the lantern deck.

An 1850s replacement lantern at the top of the tower houses a modern fourth-order Fresnel lens. The cylindrical lantern is constructed atop a circular stone deck serving as a balcony extending just beyond the edge of the tower below. While the lantern deck is more or less centered on the tower, the lantern is off-center by about 9" to the south. The original lantern would have almost certainly been centered on the tower. The offset probably originated with the replacement lantern, and was due to a discrepancy in size between the new, smaller prefabricated lantern and the larger original. The location of the preexisting masonry opening for the floor hatch dictated the placement of the new lantern 9" off center to accommodate for the opening.

The base of the lantern is a short brick wall coated in shotcrete on the exterior face. A north-facing access hatch in the wall provides entry out to the



Figure 141. Ocracoke Lighthouse southwest elevation viewed from boardwalk.

balcony. Atop the wall sits the iron-framed lantern composed of twelve panels of glass. The lantern is topped with an iron finial and lightning rod. The lantern room houses a fourth-order Fresnel lens installed in 1854. The focal plane of the lens sits at an elevation of about 73'-10".

The recessed lighthouse entrance doorway faces west, reached by a modern wood ramp. Inside, a modern steel spiral staircase connects the three landings inside of the brick tower. The tower is pierced by five window openings which fall counterclockwise along the path of the original wood staircase. Ghost marks of the original wood stairs can be seen on the interior face of the masonry shell. A sixth window, the lowest on the tower, is directly across from the entrance door at entry level.

Construction Characteristics

Structural Systems

Foundations

Both the original 1823 contract and 1892 architectural drawings indicate that the lighthouse rests on a foundation of cut stone blocks extending

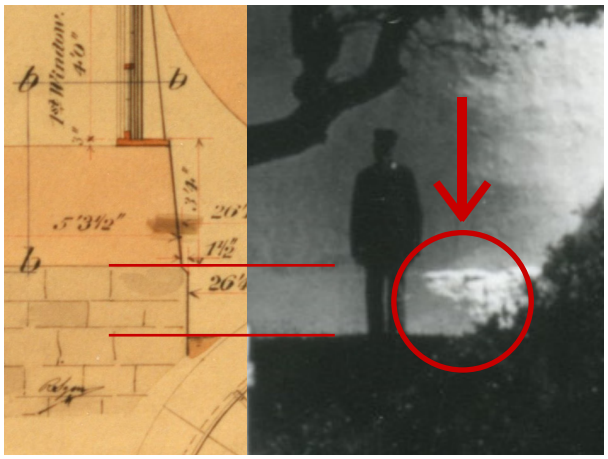


Figure 142. Comparison of 1892 architectural drawing and 1893 Bamber photograph, both showing the formerly exposed cut-stone foundation above grade.

several feet into the ground. A comparison of the 1892 drawings and the earliest known photograph, taken in 1893, show the stone foundation extending about 2'-0" above grade. The foundation is no longer exposed, having been concealed when the tower was coated in shotcrete in the early 1950s.

Exterior Walls

The tower shell wall is of load-bearing masonry. The interior and exterior diameters of the wall taper as it rises forming a conical shape. Measuring about 26'-0" at grade, the exterior diameter of the wall tapers to about 13'-8" and corbels out to approximately 14'-7" at the base of the lantern deck. At grade, the exterior wall measures about 5'-6" thick, tapering to about 2'-0" thick just below the base of the interior dome. The exterior wall tapers to a height of about 67'-5", reaching a height of about 68'-9" at the level of the balcony. The masonry wall encircling the bottom portion of the lantern room, offset from center about 9", has an exterior diameter of approximately 7'-11". The wall is 1'-2" thick, and does not taper, rising 3'-7" from the top of the lantern deck.

Although the 1892 architectural drawings do not describe it, the exterior of the masonry walls were at some point pargeted and painted white. The original 1823 contract merely refers to the exterior being painted and whitewashed. The earliest mention of possible pargeting comes in 1868, when a list of work reports that a large portion of the lighthouse was "recemented." The earliest known photo of the lighthouse, taken in 1893, shows the exterior walls to be pargeted. The exterior was coated in shotcrete by late 1952. It is



Figure 143. Obvious taper of tower shell wall.

unknown whether a metal wire mesh was used as reinforcement in this process.

Interior Walls

The load-bearing masonry is exposed to the interior. Originally whitewashed, the bricks have been sandblasted and are now bare. The brick is in a 7:1 common bond, with some instances of six or eight courses of stretchers between header courses. The header courses are often broken with stretchers. A course of headers is directly above and below all masonry window openings. Bricks measure 7" to 7½" wide by 2" tall by 3" deep with flush mortar joints measuring 3/8" wide. Ranging in color from most to least prevalent, the bricks appear in orange red, medium red, brownish red, and black-brown and red. The diameter of the brick shell wall tapers as the wall rises, reflecting the conical design of the exterior. The places where the original wood stairs were anchored into the wall have been patched with mortar, leaving clear indications of the location of the original stair and landings. The majority of the interior has been repointed.

Just below the masonry dome are regularly-spaced rectangular patches around the circumference of the tower. Mortar in these patches dates well after



Figure 144. Shotcrete-coated lower brick wall of lantern room.

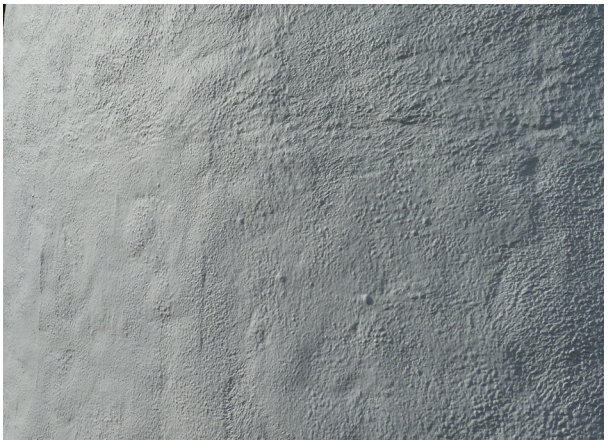


Figure 145. Uneven texture of shotcrete coating on exterior of tower shell wall.



Figure 146. Sandblasted surface of bricks of interior side of tower shell wall.



Figure 147. Regularly-spaced, regularly-sized rectangular patches in tower shell wall just below masonry dome.



Figure 148. Regularly-spaced, regularly-sized rectangular patches in tower shell wall just below masonry dome.



Figure 149. Mortar patches where original wood steps were anchored into the tower shell wall. Original staircase originated just to the south of the entry door opening. Windows fell along path of wooden staircase.



Figure 150. Mortar patches where original wood steps and landing were anchored into the tower shell wall. Original staircase ran counterclockwise. Modern metal staircase runs clockwise.

the tower's construction. These patches indicate a prior use, possibly an early ventilation system as suggested by an NPS mortar analysis report completed in 1989. These patches could also be early joist pockets.

Flooring Systems

The modern entry-level floor is cast-in-place concrete that sits directly on top of the stone foundation. Four roughly-orthogonal expansion joints radiate out from a central square measuring 2'-0" by 2'-0". At the middle of the central concrete square are two ¾" thick, 12" square steel plates sandwiched together to which the central support of the spiral staircase is welded. Both the steel plates and the concrete are painted grey.

At each of the three intermediate levels of the circular staircase, a quarter-circle shaped steel plate ¼" thick, with a textured surface serves as the landing. The inner edge of the steel plate of the landing is welded to a steel core ring fitted on a steel pipe forming the central support of the staircase. The landing and all of its supports are painted grey.

The floor of the lantern room is an steel plate and the balcony surrounding it of segmented stone 4½" thick with a parge coat on all exposed surfaces. The steel plate and the stone deck segments are supported by the domed terminus of the tower shell wall below which is 1'-6" thick at its center. Although contracted to be of soapstone, the lantern deck is of freestone (an oolitic sedimentary stone favored by masons for its spherical graining in concentric layers that can be worked in any direction with hand tools), likely limestone. From ground level to the lantern deck measures approximately 68'-9". The lantern deck measures approximately 14'-7" in diameter. Both the iron floor plate and the pargeted stone deck are painted white. The vertical face of the stone lantern deck is painted black.

Staircase

The open-tread spiral staircase installed in the early 1950s begins on the entry-level of the lighthouse and continues to the third landing, just below lantern level. Each pie-shaped tread is a ¼" thick steel plate with a textured surface, measuring 3" deep at its inner edge and 1'-8½" deep at its outer edge 3'-9½" from its inner edge. The riser height is 8". Each tread is supported in the same way as the landings, with a 1¼" diameter steel pipe



Figure 151. Modern, cast-in-place concrete entry-level floor with expansion gaps.



Figure 153. Modern steel spiral staircase with central column support.



Figure 152. Pargeted freestone Lantern deck.



Figure 154. Stair connections and textured surface of treads.

running from the forward edge of the steel plate to the back edge of the preceding tread, and by a core ring at the inner edge connected to the central column support.

Four treads make up the same area of each quarter-circle landing. Thirty steps precede the first landing, placing it at an elevation of 20'-8" above entry-level. Including the first run of stairs and the first landing, fifty-seven treads precede the second landing, placing it at an elevation of 38'-8". At a height of 53'-4", the third landing is preceded by seventy-nine treads including both preceding runs of stairs and landings.

The central pipe support of the staircase extends from entry-level to about 32" above the level of the third landing. The top end of the central pipe support is unattached.

All lateral support of the staircase is provided by ten 2" by 2" steel angle brackets. Spaced irregularly, the brackets are bolted to a steel plate strip welded to the back edge of the corresponding tread, and span



Figure 155. Quarter-circle intermediary landing, continuous handrail, and supporting steel brackets anchored in brick wall.



Figure 156. Unattached top of central stair support.



Figure 157. Galvanized steel ladder provides entry to lantern room from top landing of spiral stair.



Figure 158. Domed terminus of brick shell wall below lantern deck. Ladder leads to access hatch in lantern room floor.

out to the brick shell wall where they are anchored and mortared in place.

A continuous 1¼" diameter round steel handrail 32" above tread height runs from the front edge of the first tread to the back edge of the third landing where it is bolted to the central steel pipe support. The rail is bolted to ¾" diameter steel balustrades that in turn are bolted to each tread. All components of the staircase are painted grey.

A modern galvanized steel ladder 1'-10" wide with seven rungs connects the third landing of the spiral staircase to the lantern room via a hatched opening in the domed brick ceiling of the tower. The ladder is painted the same grey as the staircase.

Lantern Framing and Roof

The lantern framing, which forms the twelve-sided walls, is constructed of cast iron. Trapezoidal acrylic glazing panels are fitted between the framing members. The alternating orientation of the trapezoidal panes makes the lantern cylindrical in form. The lantern is topped with a domed ferrous-based roof topped with a venting finial. All cast iron elements are painted black. The full height of the lighthouse (to the finial) is about 80'-6".

Utility Systems

Heating and Cooling

Operable windows and vents are integral components of the original passive ventilation system. There are six double-hung windows at intermediate levels between the base of the tower and the lantern room level. Three operable 7" round brass vents with cross shaped turnstiles are installed at lantern room level. Also in the lantern room, the door to the balcony and the cupola atop



Figure 159. Lantern exterior



Figure 160. Lantern framing and glazing.

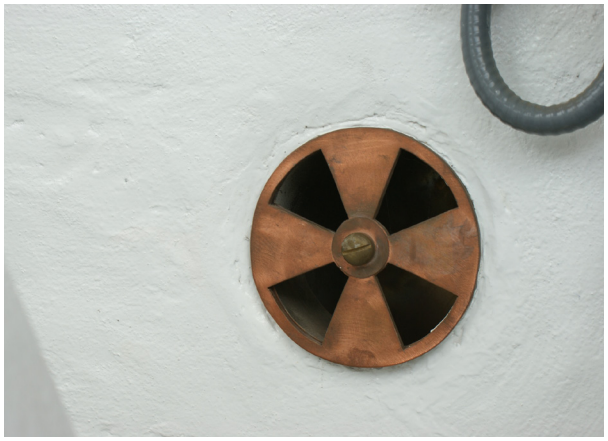


Figure 161. One of four original brass vents in lantern room.



Figure 162. Vent in cast-iron door to lantern balcony.



Figure 163. View of lantern room ceiling from access hatch in floor. Vent in ceiling leads to ventilated finial atop lantern.



Figure 164. Ventilated finial atop lantern.

the domed roof are vented. The lighthouse is not mechanically heated or cooled.

Electrical System

Electricity was first used at the lighthouse in 1929, provided by two Delco generators placed in the oil house. Today, 110/220 volt electrical service is provided to the lighthouse. The wiring enters the Lighthouse through the jamb of the second lowest window and is contained in ¾" rigid PVC conduit running vertically along the interior face of the brick wall. At the height of the second window, the wiring transitions to flexible 1¼" PVC conduit to a sealed panel. The wiring runs from the sealed panel to the beacon in 2" rigid conduit, entering the lantern room via a 2'-0" by 6" rectangular opening in the center of the domed brick ceiling of the tower. It is likely that this masonry opening was the anchor point of the original central support for the 1823 wood staircase and the opening through which the counterweight for the clockwork rotational system of the original reflector system ran.

Plumbing System

The lighthouse does not have a plumbing system.

Exterior Features

Entrance Ramp

A wood ramp installed in 2009-10 provides entrance to the entry-level of the lighthouse. The ramp extends from the southern border of the property to the entrance doorway of the lighthouse creating a boardwalk nearly 400' long with the only means of public entrance or egress at the southern end. The ramp level at the doorway sits 5" lower than the threshold. The ramp conceals the original stone or brick entrance step.

Entrance Doorway

Facing west, the entrance doorway is recessed in the wall by 6". The doorway has a 2009-10 wood door of historic design measuring 2'-5" wide by 6'-2" tall by 2" thick. The bottom two panels each have nine louvers and the top two panels have raised panels with pillowed edges. Exterior door hardware includes a 2¼" diameter brass doorknob with a steel rosette, an external steel key escutcheon, and a chrome dead bolt. Interior hardware includes a matching brass doorknob and a 3½" tall, 6" wide brass rim lock. The door is hung with three brass-plated 4½" five-knuckle ball pin hinges. The door is painted white.



Figure 165. Entrance ramp/walkway, viewed from southwest of lighthouse.



Figure 166. Entrance ramp/walkway, viewed from lantern deck looking south.

The door jamb, composed of 2½ to 3" plank boards, is exposed on the exterior face of the doorway. The interior face of the doorway is trimmed with ¾" by 4¼" casing, the lintel of which is notched 1¼" to fit atop the jamb casing. Plank boards measuring 1" by 3¼" are set perpendicular to the outer edge of the jamb casing splay out following the brick side-walls of the recessed door opening. The ceiling of the interior recessed passage to the tower of the lighthouse has a beaded-board ceiling of 3¼" boards with 1/8" beads. The ceiling is trimmed in ¾" shoe molding. The masonry opening splays to 5'-0" wide by 7'-1½" tall on the interior face of the brick wall. The wood threshold is ¼" by 7½" deep and is set 6" back from the outer edge of the exterior wall. All molding, like the door, is painted white.



Figure 167. Entrance doorway with historically-designed wood door.

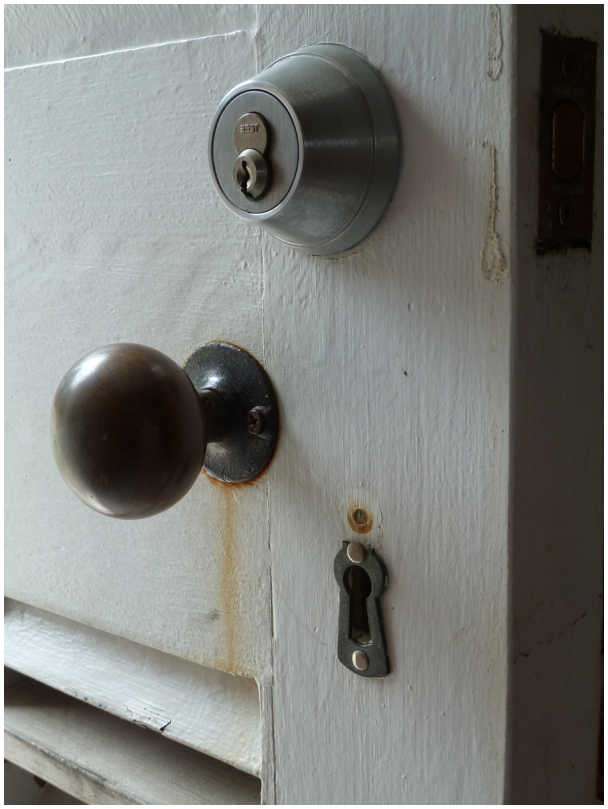


Figure 169. Mixture of modern and historically designed hardware on exterior face of entrance door.



Figure 168. Interior splayed masonry opening of entrance doorway with soffited header.



Figure 170. Five-knuckle, brass butt-hinge of entrance door.



Figure 171. Mixture of modern and historically designed hardware on interior face of entrance door.



Figure 174. Typical cementious coating on interior sill of masonry opening of window.



Figure 172. Historically designed wood double-sash window.



Figure 175. Typical soffited header of masonry opening of window.



Figure 173. Detail of exterior window sill and exposed profile of window frame.



Figure 176. Typical interior splayed masonry opening of window with soffited header.

Tower

The conical tower of the lighthouse appears to retain most of its original brick. The masonry rises to an ultimate height of about 72'-4" where the lantern glazing begins. The brick is coated in shotcrete and painted white. Further description walls can be found in the *Structural Systems* section above.

Tower Windows

The tower has a total of six identical six-over-six-light double sash windows. Repairs in 1989 included the removal of all six wood windows (thought to date between the 1890s and 1929), which were placed in storage, and replacement with vinyl-clad thermal windows. The next year, because of the concerns of local citizens, the vinyl-clad windows were removed. Five of the previous twelve wood sash were repaired, with another seven reconstructed in the same style. The jambs and sills of several windows were also replaced. The windows were again repaired in 2009-10.

All six windows measure 2'-2" wide by 3'-8" tall, have brass hardware, and are recessed 5" from the outer surface of the wall. Openings in the wall splay to the interior face of the brick wall.

The first window is directly opposite the entrance door, facing east, with an interior masonry opening of 4'-8" wide by 4'-5" tall at a depth of 3'-6½" from the interior face of the window and at a height of 3'-2" from the entry-level floor. The second window faces south, with an interior masonry opening of 4'-8" wide by 4'-7" tall at a depth of 3'-4" from the interior face of the window and at a height of 5'-5" from entry-level. The second window would have been more or less centered on the first landing of the original staircase. The third faces north-northwest and have been more or less centered on the first landing of the original staircase. The fourth faces southeast, with an interior masonry opening of 4'-7" wide by 4'-10" tall at a depth of 1'-11" from the interior face of the window. The fifth faces north, with an interior masonry opening of 5'-4" wide by 4'-11" tall at a depth of 1'-10" from the interior face of the window. The sixth and final window faces east-northeast, with an interior masonry opening of 4'-0" wide by 5'-2" tall at a depth of 1'-2" from the interior face of the window.

On the exterior face, the ¾" by 4" wood frames are exposed and sit atop a wood window sill projecting 2" from the outer face of the brick wall. On the interior face of the window, ¾" by 4¼" casing frames the opening. The ceiling of the interior opening is of beaded-board, with boards measuring 3¼" and 1/8" beads. A cementitious coating 1" thick forms the base of the interior masonry opening. All masonry openings are structurally supported by heavy timber lintels, many of which were replaced in 1991.

Lantern Room Door

A mid-nineteenth century cast iron door measuring 1'-8" wide by 2'-9" wide by 1½" thick sits in a masonry opening 4¾" from floor level and provides access to the lantern balcony. Door hardware included a turn latch 4¾" long and two 4" long three knuckle hinges. The door is recessed 8" from the exterior face of the wall and 3½" from the interior face. Painted black, the door has a vent that projects from its exterior face.

Lantern Glazing

Framed by 1" by 4½" cast iron mullions, the trapezoidal windows sit on an cast iron base 1 5/8" thick by 6" deep with a matching cast iron header. The twelve modern acrylic window panes measure 3'-0" tall. Alternating in orientation, the longer of the parallel sides measures 2'-3" and the shorter side measuring 11". Cast iron components date to the 1850s.

Lantern Balcony

The diameter of the balcony is 16'-6". It is composed of 4½" thick segmented freestone pargeted on all exposed surfaces. The stone segments span from the outer face of the brick wall forming the lower portion of the lantern room and cantilevers about 10" to 11" past the exterior face of the supporting brick wall below. Given that the lantern room is offset from center 9" to the south. The balcony depth of the balcony ranges from about 4'-0" to the north and about 2'-6" to the south. Eight iron posts 3'-8" tall hold three 1 3/8" round rails at 9", 2'-2", and 3'-6" above the level of the balcony. The railing has a diameter of about 9'-11" and is centered on the lantern room. All components of the railing are painted black.

Lightning Rod

A group of modern lightning rods is installed on the lighthouse including two at the top of the lantern dome and two along the top of the lantern balcony railing. Two grounded cables, one at the north and one at the south side, connect to this railing and run down the face of the masonry tower to grade.



Figure 177. Access hatch in floor of lantern room.



Figure 179. Outside face of cast-iron door to lantern balcony.



Figure 178. Inside face of cast-iron door to lantern balcony.



Figure 180. Trapezoidal lantern glazing.



Figure 181. Lantern balcony railing and modern lightning rod.



Figure 182. Detail of modern lightening rod.

Interior Features

Entry Level

Accessed only by the entrance door to the west, the entry level of the lighthouse is circular in plan and 15'-5" in diameter. The steel spiral staircase begins at this level, with the front edge of the initial tread oriented along the east-west axis perpendicular to the front door.

Central Staircase and Landings

A steel circular staircase extends from entry-level to the third and final landing, where it connects to a galvanized ladder providing access to the lantern room. Further description of the staircase, landings, and ladder can be found in the *Structural Systems* section above.

Lantern Room

The Lantern Room is circular in plan and 5'-9" in diameter. A hatch door in the floor centered on the room and against the south wall provides the only point of access to the room from the tower. The ¼" sheet metal door measures 2'-0" north-south and 2'-2" east-west. The door is attached to its frame by a single 12" long five-knuckle hinge. A ½" square iron handrail is located on the wall adjacent to the hatch opening at a height of 2'-9".



Figure 184. Entry-level of lighthouse as viewed from entrance doorway looking east. Modern spiral staircase begins at this level.

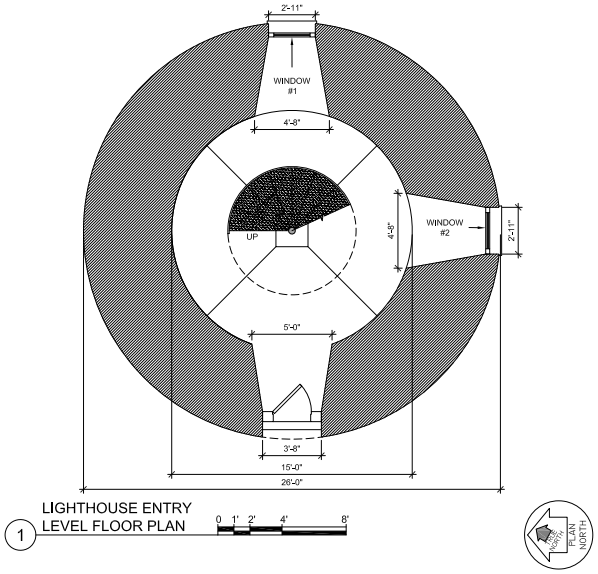


Figure 183. Entry-level floor plan. (*See Appendix A - Sheet 1*)

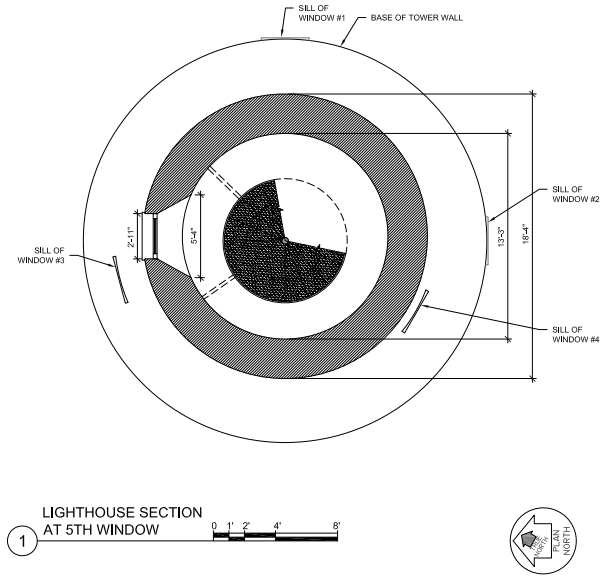


Figure 185. Section at 5th window, showing second landing. (*See Appendix A - Sheet 4*)



Figure 186. View of spiral staircase and tower interior looking up from entry level.

The rail is supported by a single ¾" diameter iron post centered on its length and a ¾" square pintel attaching it to the wall at each end. All components of the railing are painted black and date to 2009-10.

The painted masonry walls of the room rise to a height of 3'-7", where they are surmounted by the cast iron framing and acrylic glazing of the lantern. The top of the window frame is at a height of 6'-10" from floor level. The domed metal roof peaks at a height of 7'-2" from floor level. A northeast-

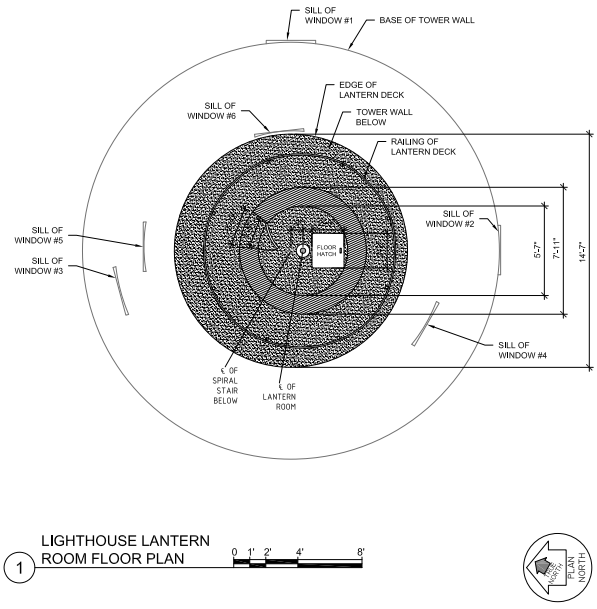


Figure 187. Lantern room floor plan, showing balcony and location of tower windows. (*See Appendix A - Sheet 6*)



Figure 188. Fourth-order Fresnel lens on pedestal.



Figure 189. "Chariot" wheels on base of Fresnel lens.

facing hatch door in the masonry wall provides access to the lantern balcony. The lantern framing and glazing, and the hatch door to the lantern balcony as well as the balcony itself are described in further detail in the *Structural Systems* and *Exterior Features* sections above.

The fourth-order Fresnel lens, manufactured in 1890 and installed in 1899, sits on a 5" diameter pedestal 3'-4" above floor level. The pedestal has a base 10" in diameter and a platform on which the lens sits that is 1'-6" in diameter. The lens is shaped like a beehive, measuring 2'-0" wide by 3'-2" tall. The electric light source is white in color and fixed. Though the light is presently retrofitted to be stationary, the 1899 lens was designed for rotation. The brass base has a series of wheels allowing for movement, known as a chariot system.

Keepers' Quarters

The two residential units of the Keepers' Quarters dwelling are discussed in sequence, with the Original Keeper's Quarters followed by the 1929 South Addition – Assistant Keeper's Quarters.

Original Keeper's Quarters

The Original Keeper's Quarters faces southwest. For the purposes of this report, the Original Keeper's Quarters is said to face west.

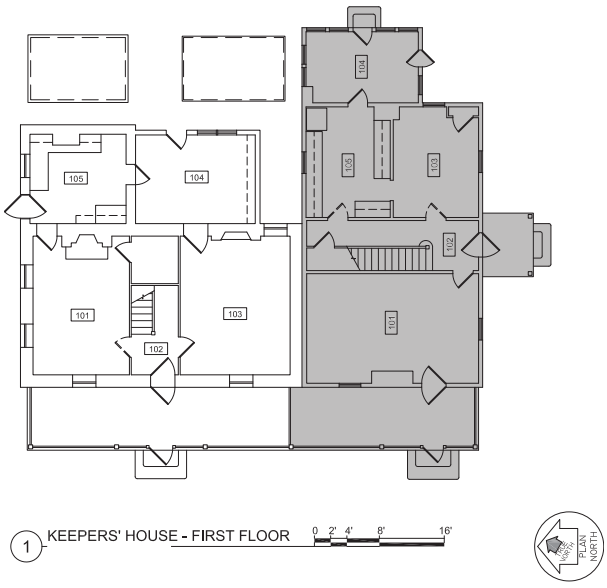


Figure 190. First floor plan of Original Keeper's Quarters (shown in white).

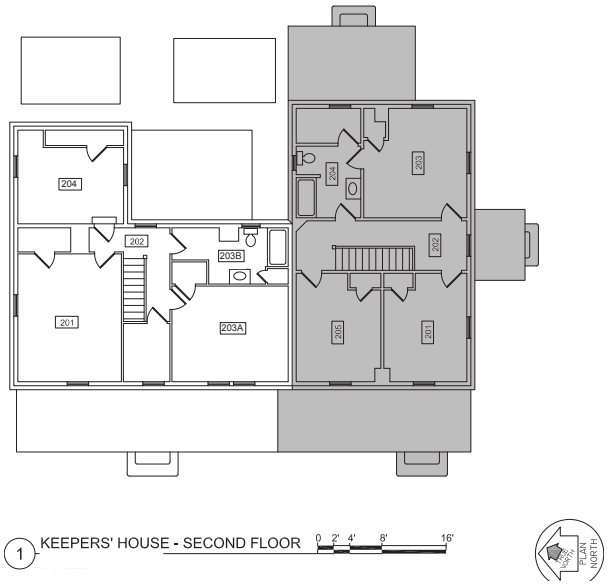


Figure 191. Second floor plan of Original Keeper's Quarters (shown in white).

The Architecture

The Original Keeper's Quarters faces west and is located near the middle of the Ocracoke Light Station. The Original Keeper's Quarters retains the entirety of the original 1823 footprint. The second floor and the first floor southeast corner shed addition were part of alterations made in 1897. The residence consists of a side-gabled two-story main block, a two-story rear shed ell attached to the northwest rear creating an L-shape, and a one-story shed addition inset on the inside angle of the L-shape.

The front door centered on the east wall of the three-bay main block. It is flanked by a single double-sash window in each adjacent bay. A three-bay screened porch runs nearly the full width of the front façade, offset from the north side by 10". The north façade of the main block is two bays wide, a single double-sash window centered in each bay. The rear ell has an exterior door and a single window on its north façade. On the shed addition, an exterior door and a double window face east.

The house has a central hall plan with a single room to either side; with a living room to the south and a dining room to the north. Accessed through the dining room is the ell, which contains the kitchen. The one-story addition is an enclosed porch used for storage and laundry. The central hall is reflected on the second floor. A single bedroom is to the north and a bedroom and full bathroom are to the south. The second floor of the ell contains a bedroom.

Construction Characteristics

Structural System

Foundations and Footings

The perimeter foundation wall of the main block and ell blocks views of the perspective foundation systems. Information on the foundation of the Original Keeper's Quarters therefore is taken from the original 1823 contract and the 1889 and 1940s architectural drawings of additions. From these documents it can be said that the foundation wall is solid masonry about 20" thick.

In 1987, work done to correct extensive termite damage to the foundation included the addition of fifteen new piers and three girders. The locations of these additions are unknown. Also part of this phase of work was the addition of seven stainless steel vents cut into the foundation walls, with an additional two vents in the shared wall between the two residences.



Figure 192. West elevation of Keepers' Quarters. The Original Keeper's Quarters is the side-gabled portion to the left and the Assistant Keeper's Quarters is the front-gabled portion to the right.



Figure 193. Northeast oblique of Keepers' Quarters. The Original Keeper's Quarters is on the right and the Assistant Keeper's Quarters is on the left.



Figure 194. Foundation vent.

Visible above grade are piers, presumably of concrete, that support the front (west) porch and the southeast shed addition both added in 1897. Set on spread footings, four piers are evenly spaced along the west edge of the front porch, with a single pier at the midpoint of the north and south sides. Two piers, also on spread footings, support the rear shed addition, one at the midpoint of the east side and the other at the northeast corner.

Exterior Walls

The Original Keeper's Quarters utilizes two structural systems. The 1823 structure, the exterior of which is now the entire first floor with the exception of the shed addition, is of brick. The circa 1940s shed addition is wood framed. Although it is noted in the 1897 architectural plans for the second floor addition to be balloon framed, it is actually platform framed. Drawings indicate that stud walls of 2" by 4"s spaced at 16" on center with 4" by 4" corner studs sit on 4" by 4" sill plates, all of Virginia pine.

Interior Walls

Interior walls on the first floor are 2¾" thick. Presumably the original wall were of beaded board with 5½" boards and 1/8" beads, as can be seen in the closet under the stairs. The original beaded-board walls were covered with 1/4" thick plywood panels in the 1950s. Second floor interior walls are 3" thick and of alternating 2½" and 3½" wide tongue-and-groove boards with a 1/8" bead.

Flooring Systems

The dimension of the floor joists on the first floor are unknown, however 1889 and 1897 drawings



Figure 195. Porch foundation pier.

indicate that they span east-west. As part of the 1987 work to correct termite damage, fifteen supplemental floor joists were installed, the locations of which are unknown. 1897 drawings indicate that 3" x 8" Virginia pine floor joists spaced 16" on center span east-west on the second floor.

Roofing Systems

The roof of the main block is side-gabled with a shed extension at a shallower angle covering the rear ell. The first-floor southeast shed addition and the west porch have shed roofs. 1897 drawings indicate that 2" by 6" Virginia pine roof rafters are spaced at 24" on center.

Porch Framing

Three 4" x 6" sill plates run between each of the four piers supporting the front (east) porch framing. Four 4" x 8" girders run from each pier to the west face of the main block where they rest on a ledger. 3" x 6" joists run north-south and are spaced at 24" on center. Like the rest of the 1897 framing, it is of Virginia pine.

Utility Systems

Heating and Cooling Systems

From documentary sources it is known that the house was outfitted with a central forced air system sometime prior to the 1950s. Currently, two Armstrong heat pumps, presumably serving zoned floor levels, are located to the east of



Figure 196. Red standing-seam metal roof.



Figure 197. Brick chimney with corbelled cap.

the house. The air handler for the first floor is located in the closet under the stairs. The second air handler, serving the second floor, is located in the attic.

Until the first mechanical system was installed, the house would have relied on three fireplaces for heat, two in the main block and one in the ell. An additional two fireplaces or flue opening were likely located in the second floor bedrooms of the original 1823 design, directly above the two fireplaces on the first floor of the main block. Operable window sash and open porches would have provided natural ventilation.

Electrical System

The dwelling was wired and electrified in 1929, when the Assistant Keeper's Quarters was constructed. A ceiling-mounted light fixture is located at the west porch and wall-mounted light fixtures are next to the north- and east-facing exterior doors.

Plumbing System

Originally reliant on cisterns for drinking and bathing, the house was plumbed and a modern bathroom was added to the second floor in 1929, when the Assistant Keeper's Quarters was constructed. The kitchen (Room 105) has a sink and the bathroom (Room 203B) has a toilet, shower, tub, and lavatory. The kitchen and bathroom were updated in the 1950s.

Exterior Features

Roof & Rainwater Collection/Dispersal

A metal standing-seam roof was installed during the 1929 phase of work and was replaced with a roof of similar design in 1972. The current roof, installed in 2008, has a distinctly pronounced panel system and is bright red in color. Galvanized gutters measuring 6" wide and 4 ½" deep run along the east and west sides, leading to 3" by 4" downspouts at the corners. Gutters and downspouts are white.

Chimneys

There are three chimneys, all part of the 1823 design. Based on early drawings, all three chimneys are full masonry. Originally, they were shorter than their current height and without a corbelled cap. The chimneys where presumably extended in height and the decorative corbelling at the top added when the second floor was expanded in 1897.

One chimney is located in each of the outer bays of the three-bay rear (east) façade of the main block, inset just behind the exterior wall framing. The third



Figure 198. Brick first story and shingled second story delineated by cornice.

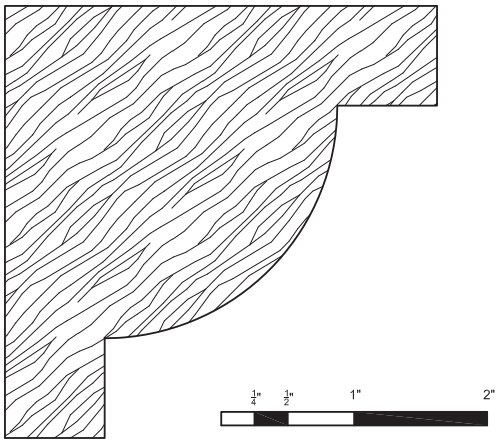


Figure 199. Detail of exterior wall cornice.



Figure 200. Front (west) porch, concrete stairs to porch level.

chimney is inset just behind the rear (east) wall of the ell, 4'-6" from the exterior face of the north wall. The three square chimneys are identical in design. The exterior surface of the brick was once painted or whitewashed, but the finish has been largely removed. At the top, the brick corbels out for seven courses before corbeling back to its original dimension. Each is topped with a stone cap.

Walls

The two-story body of the Original Keeper's Quarters is clad in three materials. The first floor of the main block and the rear ell, is constructed of brick laid in a 1:7 common bond pattern. The bricks are uniform in size and measure 7½" long by 2" high by 3½" deep. The 1889 shed addition has board-and-batten siding with plank boards measuring 1'-0" wide by ¾" thick and square-edge battens measuring 7/8" by 1¾". The second floor is clad in square-edge cypress shingles measuring 3" wide by 10" long by ¾" thick, with a 6½" exposure. The junction of the first and second floors is delineated by a cornice molding. The plane of the second-story walls is offset to the exterior from the brick walls of the first floor by about 3". All exterior siding is painted white.

Porches

The three-bay front (west) porch was constructed in 1897 and measures about 34'-0" long and 7'-9" deep. Four 6" by 6" chamfered wood posts inset 2" are spaced evenly and support the framing for the shed roof. 6" by 6" beams support rafters 1¾" by 3¾" with deck boards 6½" wide with an 1/8" bead. Rafters are chamfered with a box soffit.

Tongue-and-groove floorboards, measuring 2 3/8" wide by 1" thick, run east-west. A plank skirt board finished the bottom edge of the porch and orthogonally oriented wood lattice fills the voids between porch piers. All trim is painted white.

Originally an open porch, 2" wide wood frames with attached screens infill the spaces between the posts and between the posts and the face of the house. The screens were installed in the 1950s.

Entrance Steps and Landing

Two concrete steps with rounded vertical edges



Figure 201. Wood sash door and aluminum storm door at front (west) doorway. Typical modern brass hardware.



Figure 202. Aluminum storm door on rear Ell, double-sash window, brick landing.

provide access to the front porch. The first step is 6'-4" wide by 3'-6" deep with a 9½" rise. The second step, centered on the fist is 4'-4" wide by 2'-0" deep with a 7" rise. The porch is a total of 2'-3" above grade.

The north-facing doorway of the ell has a small landing of bare brick laid in a basket-weave pattern.

Doors

A screen door measuring 2'-11" wide by 6'-10 ½" tall is centered on the middle bay of the front porch. The entrance to the house has a wood sash door with six-lights-over-two-vertical-panels. The door measures 3'-0" wide by 6'-11" tall by 1¾" thick and is hung with brass-plated, 4" tall five-knuckle hinges. It has a modern brass-plated mortise lock with interior and exterior oval escutcheons and an exterior curved handle; this hardware is common to all three exterior doors.

The north wall of the ell has a wood sash door with a single-light-over-three-horizontal-panels. Measuring 2'-10" wide by 6'-6" tall by 1 3/8" thick and has the same hinges as the front door. A modern aluminum screen door opens on the exterior face.

A wood sash door with a single-light-over-three-horizontal-panels provides access to the southeast rear shed addition. Measuring 2'-6" wide by 6'-6" tall by 1 5/8" thick and is hung with three brass-plated, 3½" tall five-knuckle hinges. A modern aluminum screen door matching the one to the north opens on the exterior face. The east doorway only, has ¾" thick by 4" wide lintel-cut casing.

Windows

With the exception of the southeast rear shed addition and two windows on the second floor, all windows are of the same six-over-six double-hung wood sash design, measuring 2'-7" to 2'-11" wide by 4'-6" tall. A paired grouping of this window design is found on the second-story west wall of the main block.

A paired two-horizontal-light-over-two-horizontal-light double-sash wood window, each measuring 2'-4" wide by 3'-0" tall is centered on the south bay of the east wall of the shed addition. The paired window only, has ¾" thick by 4" wide plank lintel-cut casing.

On the second floor, a six-over-six-light double-sash wood window measuring 2'-3" wide by 3'-0" tall is located on the the east wall of the main block. A south-facing window on the second floor of the rear ell is a four-light single-sash that measures 2'-0" wide by 2'-4" tall.



Figure 203. Early fireplace mantle and brick firebox.



Figure 204. Early four-panel interior door design outlined in the 1823 specifications.



Figure 205. Early door hardware.

Interior Features

Common Design Elements

Given the number of additions and the extensive remodeling that has taken place since the Original Keeper's Quarters was built in 1823, there is little consistency of design elements throughout the house. Elements thought to be original are the two fireplace mantels. Also early, if not original, are the interior four-panel wood doors. Door hardware includes a mortise lock with a brass embossed knob, with a brass embossed circular back plate and a brass pyramidal keyhole escutcheon.

Description by Room

Room 101 – Dining Room

An original room of the 1823 Keeper's Quarters, this room now serves as the dining room. Rectilinear in plan, this room measures about 11'-7" by 17'-1".

Flooring

Red oak flooring measuring 2¼" wide dates to the 1950s-era remodeling and is typical throughout the first-floor rooms of the original house.

Baseboards

Baseboards are ¾" thick by 6" tall plank with a ¾" quarter-round shoe molding.

Walls and Ceiling

The walls and ceiling are clad in 4'-0" by 8'-0", ¼" thick plywood panels that were installed during the 1950s remodeling. A decorative groove separates each panel.

Crown and Picture Moldings

Framing the room are a 2" tall crown molding and 1½" picture molding. Found throughout the house, both of these are in found in Assistant Keeper's Quarters and probably date to the 1929 work.

Doorways

The room has three doorways – one off the Central Hall (Room 102), one leading to the Kitchen (Room 105), and one providing access to the mechanical closet underneath the staircase. Both the door to the Kitchen and the closet door are 1920s-era, two-panel wood doors measuring 2'-6" wide by 6'-6" tall by 1 3/8" thick. Door hardware includes 3½" tall, brass plated five-knuckle butt hinges, a brass mortise lock, and a brass knob. The door is no longer present in the doorway to the Central Hall. Throughout the house, the doorways have 7/8" thick by 4" wide lintel-cut casing, probably installed in the 1890s, when the house was expanded and remodeled.



Figure 206. Southeast oblique of Room 101 showing original fireplace mantel.



Figure 208. Typical crown molding found throughout the Keepers' Quarters.



Figure 207. Southwest oblique of Room 101.



Figure 209. Typical picture molding found throughout the Keepers' Quarters.

Windows
The room has a total of three windows, one facing west and two facing north. All are six-over-six-light wood double-sash with 7/8" thick by 4" wide plank-board, lintel-cut casing matching the doorways.

Finishes
The floor is varnished. The walls, ceiling, doors, mantel, and all trim are painted.

Mechanical System
A floor-mounted HVAC unit, and unused element of a former system, is centered between the windows against the north wall. Two active supply registers are set in the floor, one in front of the east north-facing window and one in front of the west-facing window. A modern ceiling fan provides air circulation.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A five-blade ceiling fan with a single globe light fixture is mounted in



Figure 210. 1920s-era two-panel door.



Figure 211. Early beaded-board walls of the mechanical closet under the stairs.

the center of the room. A round dimmer switch controls the fan.

Fireplace
On the east wall is an exposed-brick fireplace. The early, if not original firebox is intact. Its opening measures 3'-10" at the front face and 1'-0" deep, the beveled cheek walls forming a 2'-8" wide back wall. A tile hearth measuring 5'-2" wide by 1'-6" deep is level with the floorboards. The decorative wood mantel is probably an original feature.

Closet
Located below the staircase and accessed by a door on the east end of the south wall is a mechanical closet housing the first-floor air handler of the central HVAC system.

Room 102 – Central Hall
An original feature of the 1823 house, the central hall provides access to a single room on either side, the Dining Room (Room 101) to the north and the current Living Room (Room 103) to the south. A staircase along the north wall leads to the secondstory. This room measure about 5'-9" wide by 11'-0" long.

Flooring
The 1950s-era red oak flooring measures 2¼" wide.

Baseboards
Baseboards are ¾" thick by 6" tall with a ¾" quarter-round shoe molding.

Walls and Ceiling
The walls and ceiling are clad in the 1950s-era 4'-0" by 8'-0", ¼" thick plywood panels. A decorative groove separates each panel.



Figure 212. Northeast oblique of Room 102.



Figure 213. Modern flush-mount ceiling light fixture.

Crown and Picture Moldings
The typical 1920s-era style 2" tall crown molding and 1½" picture molding frame the room.

Doorways
The room has two doorways – one leading to Room 101 and one to Room 103. The door to Room 103 is a 1920s-era two-panel wood door measuring 2'-6" wide by 6'-6" tall by 13/8" thick. Door hardware includes 3½" tall, brass plated five-knuckle butt hinges, a brass mortise lock, and



Figure 214. Typical modern plastic receptacle cover.

a brass knob. The door is no longer present in the doorway to Room 101. Doors have 7/8" thick by 4" wide lintel-cut casing.

Finishes
The floor, risers, treads, newel post, balusters, and railing are varnished. The walls, ceiling, doors, and all trim are painted.

Mechanical System
A large return register measuring 1'-4" wide by 2'-2" tall is set into the east wall, leading directly into the mechanical closet.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern flush-mount 9" globe ceiling light fixture is centered in the west portion of the hall in front of the staircase.

Staircase
The wood staircase dates to 1950s-era remodeling. A wood railing supported by 1" by 1" balusters spaced at 4" on center leads from an oak newel post 4½" by 4½" square with a pyramidal top. Thirteen 8" risers with oak treads lead to the second story. The staircase is 2'-10" wide.

Room 103 – Living Room
A room of the original 1823 house, this room is now used as the living room. This room measures about 13'-3" by 17'-1".



Figure 215. Northwest oblique of Room 103. The six-light-over-two-panel wood sash front door is visible in the background.



Figure 216. Southeast oblique of Room 103.

Flooring
The 1950s-era red oak flooring measures 2¼" wide.

Baseboards
Baseboards are ¾" thick by 6" tall with a ¾" quarter-round shoe molding.

Walls and Ceiling
The walls and ceiling are clad in 1950s-era 4'-0" by 8'-0", ¼" thick plywood panels. A decorative groove separates each panel.

Crown and Picture Moldings
The 1920's-era style 2" tall crown molding and 1½" picture molding frame the room.

Doorways
The room has two doorways – one off the Central Hall (Room 102) and one leading to the Mud Room (Room 104). The door to the Hall is discussed with Room 102. The doorway to Room



Figure 217. Typical register cover found throughout the Original Keeper's Quarters.



Figure 219. Northeast oblique of Room 104



Figure 218. Early fireplace mantel with sealed firebox in Room 103.



Figure 220. Southwest oblique of Room 104.

104 is original to the house. The four-panel door is early, if not original, and retains early hardware, a description of which can be found in the *Common Design Elements* section above. Both doorways have typical have 7/8" thick by 4" wide lintel-cut casing.

Windows
The room has two windows, one facing west and one facing east. Both are six-over-six light, wood double-sash windows with typical 7/8" thick by 4" wide lintel-cut casing.

Finishes
The floor is varnished. The walls, ceiling, doors, mantel, and all trim are painted.

Mechanical System
Supply registers are set in the floor.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern five-blade ceiling fan with a single globe light fixture is mounted in the center of the room. A round dimmer switch controls the fan.

Fireplace
On the east wall is a fireplace. The firebox has been sealed off. A ceramic tile hearth measuring 5'-2" wide by 1'-6" deep is level with the floorboards. The decorative wood mantel is probably original.

Room 104 – Mud Room
The Mud Room was likely constructed in 1889. This room measures about 10'-9" by 14'-9". The floor level is 10" lower than Room 103 and 2" lower than Room 105.

Flooring
Sheet vinyl covers the floor.

Baseboards
A ¾" quarter-round shoe molding finishes the floor edge.



Figure 221. Modern semi-flush-mount ceiling light fixture in Room 104.

Walls and Ceiling
The walls and ceiling, with the exception of the exposed brick of the 1823 west and north walls (formerly exterior), are clad in 1950s-era 4'-0" by 8'-0", ¼" thick plywood panels. A decorative groove separates each panel.

Doorways
The room has three doorways – one exterior doorway discussed in the Exterior Features section, one leading to the Kitchen (Room 105) and one leading to the Living Room (Room 103). A wood sash door with a single-light-over-three-horizontal-panels provides access to the Kitchen. Measuring 2'-6" wide by 6'-6" tall by 1⅝" thick, the door is hung with three brass-plated, 3½" tall five-knuckle hinges. The door to Room 103 is discussed in section *Room 103 - Living Room*.

Windows
A pair of two-horizontal-light-over-two-horizontal-light, wood double-sash window faces east. This window pair has no interior casing.

Finishes
The walls, ceiling, doors, and all trim are painted.

Mechanical System
A formerly used floor-mounted HVAC unit is just north of the door to Room 103 against the west wall.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern flush-mount 14" globe ceiling light fixture is centered on the ceiling.

Built-In Cabinets
Built-in wood cabinets, probably contemporary to the addition, line the south wall.

Room 105 – Kitchen
Part of the original 1823 floor plan, the rear ell room now serves as the Kitchen. This room measures about 12'-8½" by 11'-9". The floor level of Room 105 is 8" lower than Room 101 and 2" higher than Room 104.

Flooring
Sheet vinyl covers the floor.

Baseboards
Baseboards are ¾" thick by 6" tall with a ¾" quarter-round shoe molding.

Walls and Ceiling
The walls and ceiling are clad in 1950s-era 4'-0" by 8'-0", ¼" thick plywood panels. A decorative groove separates each panel.

Crown and Picture Moldings
Typical 1920s-era style 2" tall crown molding and 1½" picture molding frame the room.

Doorways
The room has three doorways – One leading to Room 101, one leading to Room 104, and one exterior door on the north wall. The door to Room 101 is discussed in the Room 101 - Dining Room section. The door to Room 104 is discussed in the Room 104 - Mud Room section. The north wall of the ell has an exterior wood sash door with a single-light-over-three-horizontal-panels. Measuring 2'-10" wide by 6'-6" tall by 1⅜" thick and has three brass-plated, 4" tall five-knuckle hinges. All doorways have typical ⅞" thick by 4" wide lintel-cut casing.

Windows
The room has one north-facing window. It is six-over-six-light wood double-sash with typical 1920s-era ⅞" thick by 4" wide lintel-cut casing.

Finishes
The walls, ceiling, doors, and all trim are painted.

Mechanical System
Supply registers are set in the floor.

Electrical System
Modern plastic plate covers are installed on electric



Figure 222. Room 105, looking north.



Figure 223. Southeast oblique of Room 104.



Figure 224. Southwest Oblique of Room 105.

outlets and light switches. A modern flush-mount 16" globe ceiling light fixture is centered on the ceiling.

Plumbing System
A modern kitchen sink is located in front of the north-facing window.

Fireplace
On the east wall is a former flue opening, now concealed by the kitchen counter.

Built-In Cabinets
The room has modern kitchen cabinets, shelves, and counter have been added.

Room 201 – Northwest Bedroom
The footprint of Room 201 is very similar to that of an original 1823 room in the same approximate location. Its current shape was created in 1897 to extend the hall (Room 202) to connect with the new northeast bedroom (Room 204). This room measures about 12'-9" by 16'-1" and serves as a bedroom.

Flooring
The tongue-and-groove pine flooring measuring ¾" thick by 3" wide, probably dates to the 1897 expansion.

Baseboards
Baseboards are ¾" thick by 6" tall with a ¾" quarter-round shoe molding.

Walls
The walls are clad in alternating 2½" and 3½" tongue-and-groove board, probably dating to the 1897 expansion.

Ceiling
Modern 12" by 12" acoustical tile covers the ceiling.

Crown and Picture Moldings
Typical 1920s-era style 1½" tall crown molding and 2" picture molding frame the room.

Doorways
The room has two doorways both on the east wall. One leads to Room 202 and the other to a closet. Both doors are of the early four-panel design and measure 2'-6" wide by 6'-5 1/2" by 1 1/4" thick. Both doors have the typical early hardware, a description of which can be found in the *Common Design Elements* section above. Doors have the typical 1920s-era 7/8" thick by 4" wide lintel-cut casing.

Windows
The room has two windows, one facing west and one facing north. Both are six-over-six-light wood double-sash with the typical 7/8" thick by 4" wide lintel-cut casing.



Figure 225. Southeast oblique of Room 201.



Figure 226. Northwest oblique of Room 201.

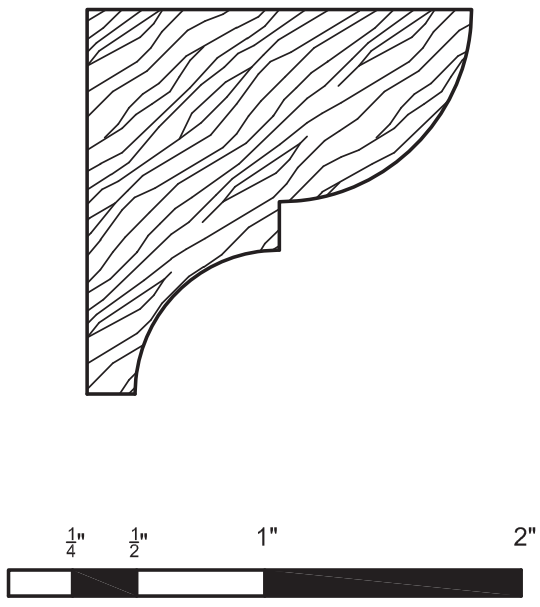


Figure 227. 1920's-era crown molding of the same design as that found on the first floor but of smaller dimensions is found throughout the Original Keeper's Quarters.

Finishes
The floor is varnished. The walls, doors, and all trim are painted.

Mechanical System
Supply and return registers are set in the ceiling.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern five-blade ceiling fan with a single globe light fixture is mounted in the center of the room.

Closet
A 3'-0" wide by 2'-0" deep closet is located to the north side of the east wall.

Room 202 – Hallway
The upstairs hallway was part of the 1823 floor plan, however it's footprint was enlarged when the second floor was expanded in 1897.

Flooring
The tongue-and-groove pine flooring measuring ¾" thick by 3" wide dates to the 1897 expansion.

Baseboards
Baseboards are ¾" thick by 6" tall with a ¾" quarter-round shoe molding.

Walls and Ceiling
The walls and ceiling are clad in 1950s-era 4'-0" by 8'-0", ¼" thick plywood panels. A decorative groove separates each panel.

Crown and Picture Moldings
Modern ¾" quarter-round serves as crown molding and 2" picture molding frames the room.

Doorways
The room has five doorways. Towards the north end of the hallway, a west-facing door leads to Room 201 and an east-facing door leads to room 204. These doors are identical and a description of them can be found in the section Room 201-Northwest Bedroom. Towards the south end of the hallway, south-facing doorways leads to Room 203A and Room 203B and a west-facing doorway leads to a closet. All three doorways have doors matching the one to Room 201 with the exception that these are all 6'-6" tall. All five doors are of the four panel design original to the house and have the typical early hardware, a description of which can be found in the *Common Design Elements*



Figure 228. Northeast oblique of Room 202.



Figure 229. Southwest oblique of Room 202.

section above. Doors have typical 1920's-era 7/8" thick by 4" wide lintel-cut casing.

Windows
The room has one window, facing east. It is a six-over-six-light wood double-sash with typical 7/8" thick by 4" wide lintel-cut casing.

Finishes
The floor is varnished. The walls, doors, and all trim are painted.

Mechanical System
Supply and return registers are set in the ceiling.

Electrical System
Plastic plate covers are installed on electric outlets and light switches. A flush-mount globe ceiling light fixture is centered on the ceiling.

Staircase
Parts of the original staircase may remain, however it was extensively rebuilt with a new handrail, balustrade, and newel posts in the 1950s. The new railing, supported by new 1" by 1" balusters spaced at 4" on center, leads from new newel posts 4½" by 4½" square with a pyramidal tops.

Room 203A – Southwest Bedroom
The footprint of Room 201 is largely part of an original 1823 room in this location. Its current shape was probably created in 1897. The room serves as a bedroom and measures about 14'-3" by 11'-11".

Flooring
The typical second-floor tongue-and-groove pine flooring measures ¾" thick by 3" wide.

Baseboards
Baseboards are ¾" thick by 6" tall with a ¾" quarter-round shoe molding.

Walls
The walls are clad in alternating 2½" and 3½" tongue-and-groove board probably dating to the 1897 expansion.

Ceiling
Modern 12" by 12" acoustical tile covers the ceiling.

Crown and Picture Moldings
Typical 1920s-era 1½" tall crown molding and 2" picture molding frame the room.



Figure 230. Southwest oblique of Room 203A.



Figure 231. Northwest oblique of Room 203A.

Doorways
The room has two doorways. One on the north wall leads to Room 202 and the other on the east wall to a closet. A description of the door to Room 202 can be found in the section Room 202 - Hallway. The closet door is a five-horizontal-panel wood door measuring 2'-6" wide by 6'-6" tall by $1^{3}/_{8}$" thick. Hardware includes 3" tall, five-knuckle brass-plated butt hinges. Both doorways have typical 1920's-era $^{7}/_{8}$" thick by 4" wide lintel-cut casing.

Windows
The room has a paired window, facing west. Both are six-over-six-light wood double-sash with 7/8" thick by 4" wide lintel-cut casing.

Finishes
The floor is varnished. The walls, doors, and all trim are painted.

Mechanical System
Supply and return registers are set in the ceiling.



Figure 232. Southeast oblique of Room 203B.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern five-blade ceiling fan with a single globe light fixture is mounted in the center of the room.

Closet
A closet is located to the north side of the east wall.

Room 203B – Bathroom
The bathroom was added in 1929, when the Assistant Keeper's Quarters was constructed. It measures about 14'-3" by 7'-0".

Flooring
Black and white 2½" by 2½" ceramic tile in an basket weave pattern covers the floor.

Lower Walls
The lower walls have a wainscoting of 4" by 4" white ceramic tile with a black 2" by 6" cap and a black 2½" by 6" base.

Upper Walls and Ceiling
The walls and ceiling are clad in 1950s-era 4'-0" by 8'-0", ¼" thick plywood panels. A decorative groove separates each panel.



Figure 233. Northeast oblique of Room 203B.



Figure 234. Southwest oblique of Room 203B.

Crown and Picture Moldings
The typical 1920s-era 1½" tall crown molding and 2" picture molding frame the room.

Doorways
The room has one doorway that leads to the Hallway and one doorway to a closet in the southwest corner. The door to the Hallway is described in the Section Room 202 - Hallway. The closet door is of plywood with a simple brass handle. Both doorways have typical 7/8" thick by 4" wide lintel-cut casing.

Windows
The room has one window, facing east. It is a six-over-six-light wood double-sash with typical 7/8" thick by 4" wide lintel-cut casing.

Finishes
The upper walls, doors, and all trim are painted.

Mechanical System
Supply and return registers are set in the ceiling.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern flush-mount globe ceiling light fixture is centered on the ceiling. Modern wall sconces flank the mirror above the lavatory.

Plumbing System
The full bathroom has a toilet, shower, tub, and lavatory. The room was installed in 1929, the toilet and sink are modern and likely date to the 1950s renovation.

Room 204 – Northeast Bedroom
Part of the 1897 expansion, the plan of this room closely matches its earliest design. Serving as a bedroom, this room measures about 13'-3" by 11'-5". The floor level of Room 204 is 1'-7" lower than Room 102 and is accessed by a single step with a 9½" riser.

Flooring
Typical Second-floor tongue-and-groove pine flooring measures ¾" thick by 3" wide.

Baseboards
Baseboards are ¾" thick by 6" tall with a ¾" quarter-round shoe molding.

Walls
The walls are clad in alternating 2½" and 3½" tongue-and-groove board probably dating to 1897.

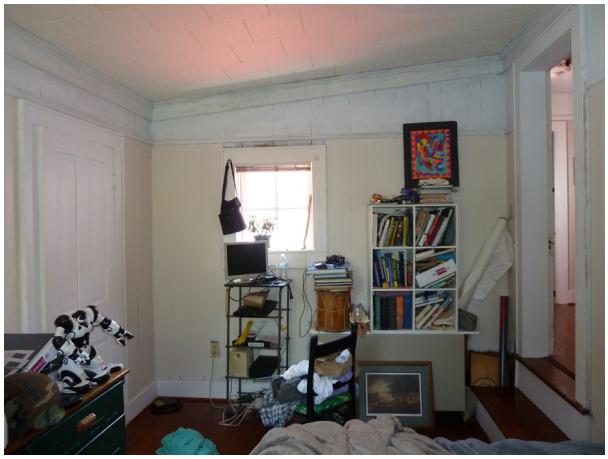


Figure 235. Southeast oblique of Room 204.



Figure 236. Northeast oblique of Room 104.

Ceiling
Modern 12” by 12” acoustical tile covers the ceiling.

Crown and Picture Moldings
Typical 1920s-era 1½” tall crown molding and 2” picture molding frame the room.

Doorways
The room has two doorways. One on the west wall leads to Room 202 and the other on the east wall to a closet. Both doors are of the same design, a description of which can be found in the section Room 202 - Hallway. Doors have typical 7/8” thick by 4” wide lintel-cut casing.

Windows
The room has two windows, one facing north and one facing south. The north-facing window is six-over-six-light double-hung wood sash. The south-facing window is a four-light single-sash wood window. Both have typical 7/8” thick by 4” wide lintel-cut casing.

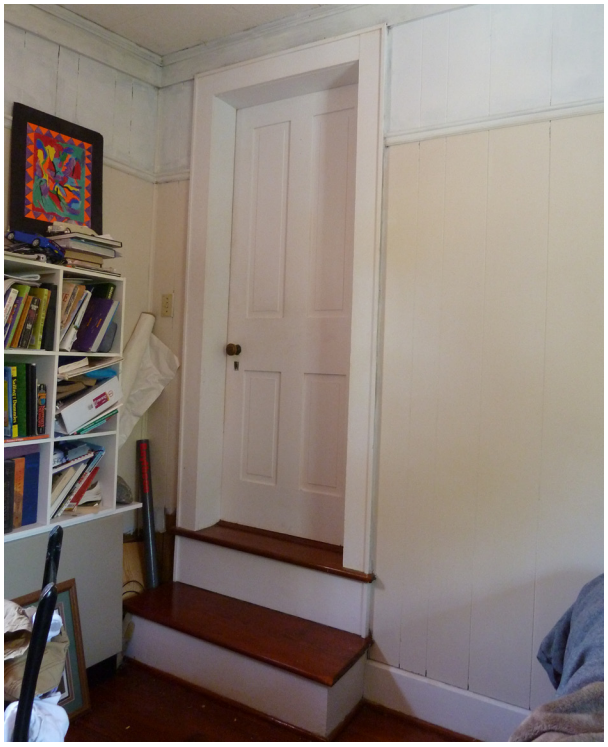


Figure 237. Door to Room 104 and two wood steps down to second-floor level of rear Ell.



Figure 238. Built-in shelf typical in second-floor closets.

Finishes
The floor is varnished. The walls, doors, and all trim are painted.

Mechanical System
Supply and return registers are set in the ceiling.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern flush-mount 16” globe ceiling light fixture is centered on the ceiling.

Closet
A closet is located to the south side of the east wall.

1929 South Addition – Assistant Keeper's Quarters

The Assistant Keeper's Quarters faces southeast. For the purposes of this report, the Assistant Keeper's Quarters is said to face south.

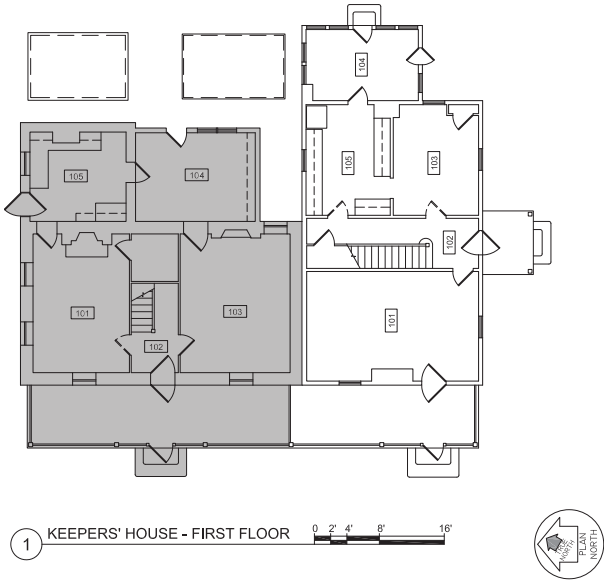


Figure 239. First floor plan of Assistant Keeper's Quarters.

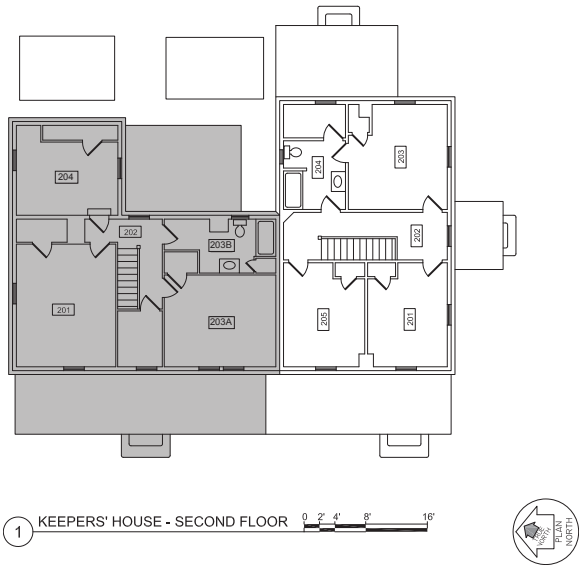


Figure 240. Second floor plan of Assistant Keeper's Quarters.

The Architecture

The 1929 Assistant Keeper's Quarters was built adjacent to the south wall of the Original Keeper's Quarters and is oriented perpendicular to it. The side-gabled two-story main block faces south and is the same height as the 1823 structure with its 1897 second floor. The south gable end of the Original Keeper's Quarters was extended as a cross gable to the Assistant Keeper's Quarters. The west-facing front porch of the Original Keeper's Quarters was extended the full length of the west façade of the Assistant Keeper's Quarters, unifying the two dwellings. A one-story east shed addition was added to the Assistant Keeper's Quarters during the 1940s.

The three-bay main block has a front door centered on the south wall, flanked by a single double-hung window in each adjacent bay. A small single-bay front porch is centered on the front door. Two bays were added to the west-facing porch to extend it the full length of the west façade. A screen door in the southernmost bay provides access to the porch, where a door in the southernmost of the two-bay west façade provides entry to the house. A door is centered on the three bay east shed addition, flanked by paired single-sash windows. An additional door provides entry from the south. On the second floor, one window is placed in each bay of the three-bay-wide-two-bay-deep main block, except where it connects to the older dwelling.

The Assistant Keeper's Quarters has a central hall plan, with a single room to the west at first floor level and two rooms to the east. The west room serves as the living room, while the southeast room serves as the dining room and the northeast room as the kitchen. The east shed addition, containing only a mud room, is accessed through the northeastern room of the main block. Upstairs, the central hall plan continues with two rooms to either side forming three bedrooms and a bathroom.

Construction Characteristics

Structural System

Foundations and Footings

The 1929 architectural drawings show the foundation walls of the main block to be of concrete 10" thick sitting on strip footings at a depth of 3'-0". The foundation wall and strip footing along the north wall sits directly on top of the strip footing of the south wall of the Original Keeper's Quarters. In 1987, work done to correct extensive termite damage to the foundation included the addition of ten new piers and two girders. The locations of these additions are unknown. Also part of the 1987 work was the addition of four stainless steel vents cut into the foundation walls of the main block, with an



Figure 241. Southwest oblique of the Assistant Keeper's Quarters. Lighthouse seen in background.



Figure 242. Southwest oblique of east shed addition.



Figure 243. Standing-seam metal roof, chimney, lightning rod, and quarter-circle attic level windows.

additional two vents in the shared wall between the two residences.

The continuation of the west porch of the Original Keeper's Quarters to the east and the small open front porch to the south are supported with 8" thick concrete foundation walls on strip footings. The east shed additions is supported by three evenly spaced 10" by 12" piers of cast concrete.

Exterior Walls
The 1929 construction drawings show the exterior walls of the additional residence to be balloon framed with 2" by" 4" vertical stud walls resting on a 4" by 6" sill plate. The east shed addition is wood framed.

Interior Walls
All interior partitions are 2" by 4" stud walls.

Flooring Systems
According to the 1929 drawings, 3" by 10" floor joists running north-south support the first and second story of the Assistant Keeper's Quarters. The dimensions of the floor joists of the east shed addition are unknown.

Roofing Systems
The roof of the main block is side-gabled, with a cross gable attaching the gable end of Original Keeper's Quarters to the new structure. The first-floor east shed addition, the south porch, and the west porch each have shed roofs. The 1929 drawing shows 2" by 6" rafters spaced 2'-0" on center with 2" by 6" collar ties located 2'-6" down from the roof peak and a 2" by 8" ridge board.

Porch Framing
The 1929 drawings indicate that 3" by 8" joists running north-south were attached to the south end of the existing porch framing. These joists rest on the concrete foundation walls beneath. The framing for the south porch is not shown, but is presumably similar in nature.

Utility Systems
Heating and Cooling Systems
The house was outfitted with a central forced air system sometime prior to the 1950s. The current HVAC system consists of two Armstrong heat pumps, presumably serving zoned floor levels, are located to the east of the house. The air handler for the first floor is located in the closet under the



Figure 244. Roof joists and ridge beam. Modern attic vent installed in masonry chimney.



Figure 245. Collar ties and modern air ducts.

stairs. The second air handler, serving the second floor, is located in the attic.

Electrical System
The dwelling was wired and electrified at the time of construction in 1929. Ceiling-mounted exterior light fixtures are located at the south and west porches.

Plumbing System
The dwelling was plumbed at the time of construction in 1929 and is fed by the municipal water source. The kitchen (Room 105) has a sink and the upstairs full bathroom (Room 204) has a toilet, shower, tub, and lavatory.

Exterior Features
Roof & Rainwater Collection/Dispersal
A metal standing-seam roof was installed at the time of construction in 1929 and was replaced with a roof of the same type in 1972. The current roof was installed in 2009. Galvanized gutters



Figure 246. Stuccoed, shingled, and board-and-batten-clad exterior walls.



Figure 247. Front (south) porch detail.

measuring 6” wide and 4 ½” deep run along the east and west sides, leading to 3” by 4” downspouts at the corners. Gutters and downspouts are white.

Chimneys

The Assistant Keeper’s Quarters has two chimneys, one centered on each gable end and set behind the exterior wall framing. The chimneys match the design of the Original Keeper’s Quarters.

Walls

The exterior of the Assistant Keeper’s Quarters was made to match the design of the Original Keeper’s Quarters. The first-floor level of the main block has an exterior stucco finish anchored to the wood framing with wire mesh. This blends into the painted masonry of the Original Keeper’s Quarters. The east shed addition has board-and-batten siding with plank boards measuring 1’-0” wide by ¾” thick and square-edge battens measuring 7/8”



Figure 248. East porch extension. Concrete entry steps.

by 1¾”. The second floor is clad in square-edge cypress shingles measuring 3” wide by 10” long, with a 6½” exposure. The junction of the first and second floors is delineated by the same cornice molding as the older residence. The plane of the second-story walls is offset to the exterior from the brick walls of the first floor by about 3”. All exterior siding is painted white.

Porches

The continuation of the west porch of the original structure matches the original portion in design. The porch is inset 10” from the south corner of the west wall of the main block, reflecting the 10” inset on the north end of the older portion of the porch. The point where the new and old portions meet is separated by a 2” wood frame with a screen similar to those that infill the spaces between the posts.

The single-bay front (south) porch measures 7’-10” wide and 6’-3” deep. Two chamfered posts measuring 5½” by 5½”, one at each corner of the south side of the porch support chamfered beams and rafters with decorative ends. ¾” thick 5” wide beaded board covers the ceiling and the enclosed sides of the shed roof. The ¾” thick 3¼” wide tongue-and-groove flooring runs north south. A



Figure 249. Front (south) wood sash door and modern aluminum screen door.



Figure 250. Typical modern brass entry door hardware.

¾" thick by 7⅜" skirt board finished the bottom edge and orthogonally oriented wood lattice fills the spaces between the piers.

Entry Steps

Two concrete steps with rounded vertical edges, matching the steps of the front porch of the Original Keeper's Quarters, provide access to the front and west porches and the east shed addition.

Doors

Centered on the south-facing front porch is a fifteen-light wood sash door measuring 3'-0" wide by 6'-11" tall by 1¼" thick. A modern aluminum screen door opens on the exterior face.

A screen door 2'-6" wide by 6'-7" tall is just south of center in the southernmost of the two-bay west porch extension. Beyond it, accessing the house is a five-horizontal-panel wood door measuring 2'-6" wide by 6'-5" tall by 1¼" thick. Door hardware is consistent on the south and west exterior doors and includes brass-plated, 3½" tall five-knuckle hinges and a modern brass-plated mortise lock with interior and exterior oval escutcheons and an exterior curved handle.

The five-horizontal-panel wood door accessing the enclosed east porch is centered on its east wall and measures 2'-6" wide by 6'-4" tall by 1¼" thick. Hardware includes two 4" tall ball-pin three-knuckle hinges and a reproduction rim lock. A modern aluminum screen door opens on the exterior face. A second exterior door is located on the south wall of the enclosed porch. Measuring 2'-6" wide by 6'-6" tall, the four-light-over-two-panel wood sash door has two brass-plated, 4" tall five-knuckle hinges and rectangular, brass beveled-edge escutcheons.

The south- and west-facing doors on the main block booth have 1" lintel-cut casing with a ½" bead and an angled sill. The two exterior doors on the east shed addition, have 5½" wide lintel-cut casing and angled sills.

Windows

With few exceptions, the windows are of the same six-over-six wood double-sash design as those found on first and second floors the main block of the Original Keeper's Quarters, measuring 2'-8" wide by 4'-6" tall. Windows on the main block of



Figure 251. Typical double-sash window.

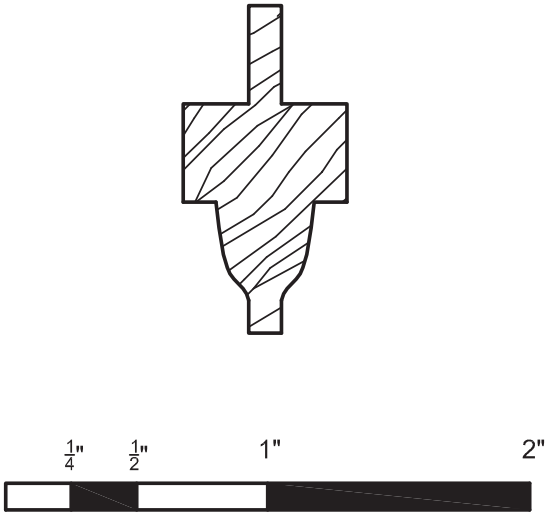


Figure 252. Typical window muntin design.

the Assistant Keeper's Quarters have 1" lintel-cut casing with a ½" bead, an angled sill, and aluminum single-sash storm windows. At the gable ends, a quarter-round two-light window is on either side of the chimney at the attic level. On the second-floor level of the north facade is a two-over-two-light wood casement window.

Windows of the east shed addition are paired one-light-over-one-light wood single-sash and

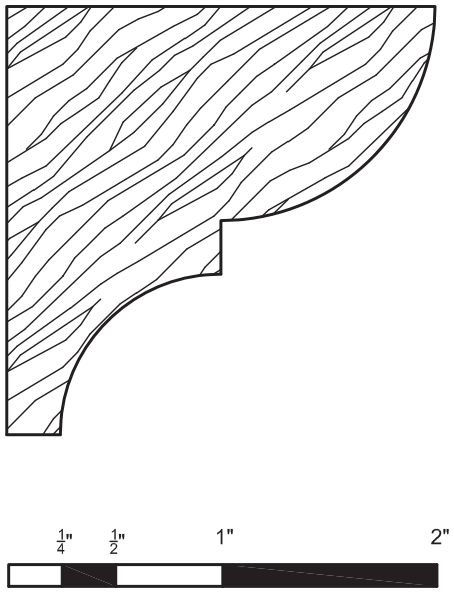


Figure 253. Crown molding detail.

measure 2'-4" wide by 2'-4" tall. The south wall has a single matching single window to the west of the door. From the inside, original framed openings for double-sash windows are visible. Windows on the east shed addition have 5½" wide lintel-cut casing, angled sills and aluminum single-sash storm windows.

Interior Features

Common Design Elements

Unlike the Original Keeper's Quarters, there is a high degree of consistency of materials and finishes in the Assistant Keeper's Quarters. Constructed over one hundred years later, the Assistant Keeper's Quarters has not been subject to as many additions over the years.

Walls and Ceilings

Walls and ceilings throughout the house are clad in gypsum board with ½" by 1¾" batten strips arranged in a decorative geometric pattern. All wall surfaces are painted.

Baseboards

Baseboards with a rounded top edge measuring ¾" by 7¼" with a ¾" quarter-round shoe molding are throughout.

Crown and Picture Molding

A 2" tall crown molding is found throughout the Assistant Keeper's Quarters. A 1¾" tall picture rail molding sits atop the window casing in each room.

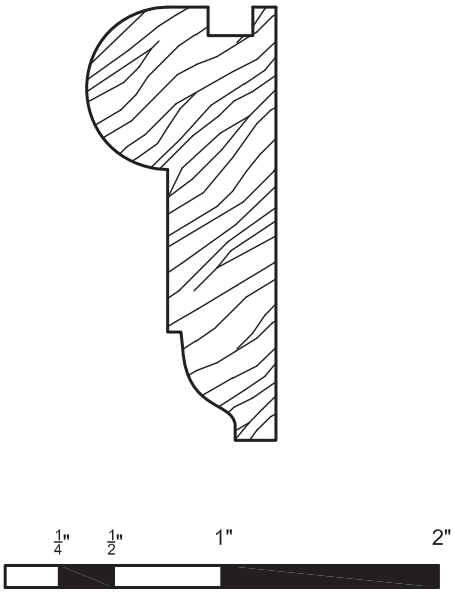


Figure 254. Picture Rail Molding detail.



Figure 255. Typical five-horizontal-panel wood door, door hardware, and trim.

Window and Door Casing
Windows have ¾" by 3⅝" lintel-cut casing. Lintels are topped with 1¼" crown molding and have ⅜" banding. Doors have matching trim with the addition of 1⅛" by 8" plinth with rounded edges.

Interior Doors
Five-horizontal-panel wood doors are consistently found throughout the house. Measuring 2'-6" wide by 6'-5" by 1¼" thick, the doors have 3½" tall, five-knuckle ball-pin butt hinges, brass knobs, and brass-plated, rectangular escutcheons with beveled edges.

Description by Room

Room 101 – Living Room
Room 101 retains its 1929 floor plan. Serving as the Living Room, Room 101 is rectilinear in plan and measures about 13'-6" by 21'-0".

Flooring
Original 1929 pine floorboards measures 2½" wide.

Baseboards
Baseboards measure ¾" by 7¼", with a rounded top edge and a ¾" quarter-round shoe molding.

Walls and Ceilings
Walls and ceilings are clad in gypsum board with ½" by 1¾" batten strips.

Crown and Picture Moldings
The typical 2" tall crown molding and 1¾" picture molding frame the room.

Doorways
The room has two doorways, one to the west leading to the west side porch and one to the east leading to the Central Hall (Room 102). The east-facing door is of the typical five-horizontal-panel design. The west-facing exterior door is a fifteen-light wood sash door described in the Exterior Features section. Both doors have typical hardware and trim work.

Windows
Two six-over-six-light wood double-sash windows provide daylight, one faces west and the other faces south. Both have typical trim work.

Finishes
The floor is varnished. The walls, ceiling, doors, mantel, and all trim are painted.

Mechanical System
A floor-mounted HVAC unit, a remnant of a system no longer in use, is in the northwest corner against the north wall. Supply registers are set in the floor.

Electrical System
Modern plastic plate covers are installed on electric



Figure 256. Northwest oblique of Room 101.



Figure 257. Southeast oblique of Room 101.



Figure 258. Modern five-globe brass chandelier.

outlets and light switches. A five-round-globe chandelier is mounted to the ceiling in the center of the room.

Fireplace
On the west wall is a now inoperable fireplace. The firebox has been sealed closed and covered with gypsum board. The footprint is 5'-1" wide by 1'-6" deep. The decorative wood mantel dates to initial construction in 1929.

Room 102 – Central Hall
Room 102 retains its 1929 rectangular floor plan, measuring about 6'-2" by 21'-0". This room still serves as the Central Hall.

Flooring
Original 1929 pine floorboards measures 2½" wide.

Baseboards
Baseboards measure ¾" by 7¼", with a rounded top edge and a ¾" quarter-round shoe molding.

Walls and Ceilings
Walls and ceilings are clad in gypsum board with ½" by 1¾" batten strips arranged in a decorative geometric pattern.

Crown and Picture Moldings
The typical 2" tall crown molding and 1¾" picture molding frame the room.

Doorways
The room has a total of four doorways. Two east-facing doorways lead to Rooms 103 and 105. These doorways have typical casing and are now devoid of doors. One doorway to the west leads to the Living Room (Room 101) and a west-facing door under the stairs provides access to a mechanical closet. Both doors are of the typical five-horizontal-panel design and have typical hardware and trim work.

Finishes
The floor, stair treads, and handrail are varnished. The walls, ceiling, doors, risers, balusters, newel post, and all trim are painted.

Mechanical System
Supply registers are set in the floor and a return register is set in the west wall adjacent to the mechanical closet.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. Two modern flush-mount globe ceiling light fixtures are centered on the ceiling, one at the north end and one at the south end of the hall.

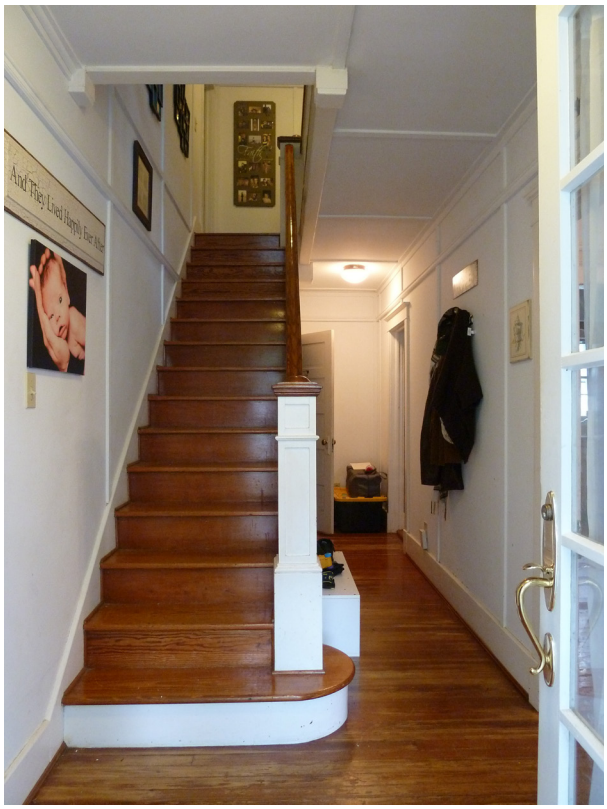


Figure 259. Room 102, looking north.



Figure 260. Original 1929 staircase, showing decorative newel post, handrail, and balustrade.

Closet
Located under the stairs is a mechanical closet containing the air handler for the first floor of the central HVAC system.



Figure 261. Typical registers found throughout the Assistant Keeper's Quarters.



Figure 262. Typical modern plastic receptacle cover plate.

Staircase
The original staircase remains intact at this level. A wood railing supported by 1" by 1" balusters spaced at 4" on center leads from an oak newel post 4½" by 4½" square with a pyramidal top. Fifteen 7½" risers with 10" treads lead to the second story. The staircase is 3'-0" wide.

Room 103 – Dining Room
Room 103 retains its 1929 footprint. Still serving as the Dining Room, Room 103 is rectilinear in plan and measures about 13'-7" by 10'-4".

Flooring
The original pine floorboards measures 2½" wide.



Figure 263. Southeast oblique of Room 103.



Figure 264. Northwest oblique of Room 103.

Baseboards
Baseboards measure ¾" by 7¼", with a rounded top edge and a ¾" quarter-round shoe molding.

Walls and Ceilings
Walls and ceilings are clad in gypsum board with ½" by 1¾" batten strips.

Crown and Picture Moldings
The typical 2" tall crown molding and 1¾" picture molding frame the room.

Doorways
The room has three doorways, one to the west leading to Central Hall (Room 102) one to the north leading to Room 105, and one to the east providing access to a closet. The west- and north-facing doorways no longer have doors present in them, while the east-facing doorway has a fifteen-light wood sash door matching the south exterior door described in the Exterior Features section. All doors have typical hardware and trim work.



Figure 265. Closet door in Room 103.



Figure 266. Six-arm brass chandelier in Room 103.

Windows
Two six-over-six-light wood double-sash windows provide daylight, one faces east and the other faces south. Both have typical trim work.

Finishes
The floor is varnished, while the walls, ceiling, doors, and all trim are painted.

Mechanical System
A formerly used floor-mounted HVAC unit is against the north wall. Supply registers are set in the floor.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A five-round-globe chandelier is mounted to the ceiling in the center of the room.

Closet
A closet with a wood sash door in the southeast corner provides decorative storage.

Room 104 – Mud Room
Room 104 is a 1940s addition. Functioning as a Mud Room, the room is rectilinear in plan and measures about 8'-8" by 13'-10".

Flooring
Sheet vinyl covers the floor.

Baseboards
Baseboards measure ¾" by 7¼", with a rounded top edge and a ¾" quarter-round shoe molding.

Walls and Ceilings
Walls and ceilings are clad in gypsum board with ½" by 1¾" batten strips arranged in a decorative geometric pattern, with the exception of the west wall which is the exposed exterior surface of the east wall of the main block.

Doorways
The room has three doorways, one to the west leading to the Kitchen (Room 105) and one east-facing and one south-facing exterior door. The west-facing doorway has a formerly exterior single-light-over-three-horizontal-panels wood sash door with typical exterior door hardware. The east-facing door is the typical five-horizontal-panel design with typical hardware. The south-facing four-light-over-two-panel wood sash door has two brass-plated, 4" tall five-knuckle hinges and rectangular, brass beveled-edge escutcheons. The west- and south-facing doors have 5½" wide lintel-cut casing.

Windows
Windows of the east shed addition are paired one-light-over-one-light wood single-sash. The south wall has a single matching single window to the west of the door. The original framed opening for double-hung windows are visible. All windows have 5½" wide lintel-cut casing.

Finishes
The walls, ceiling, doors, and all trim are painted.



Figure 267. Room 104, looking east.



Figure 268. Room 104, looking south.



Figure 269. Room 104, looking north.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern flush-mount globe ceiling light fixture is centered on the ceiling.

Room 105 – Kitchen
Room 105 retains its 1929 footprint and original function as a Kitchen. Rectilinear in plan, the room measures about 13'-6" by 10'-4".

Flooring
Sheet vinyl covers the floor.

Baseboards
Baseboards measure ¾" by 7¼", with a rounded top edge and a ¾" quarter-round shoe molding.

Walls and Ceilings
Walls and ceilings are clad in gypsum board with ½" by 1¾" batten strips arranged in a decorative geometric pattern.

Crown and Picture Moldings
The typical 2" tall crown molding and 1¾" picture molding frame the room.

Doorways
The room has three doorways, one to the south leading to the Dining Room (Room 103), one to the west leading to the Central Hall (Room 102), and one to the east leading to the Mud Room (Room 104). The west- and south-facing doorways are now devoid of doors, while the east-facing doorways has a formerly exterior single-light-over-three-horizontal-panels wood sash door with typical exterior door hardware. All doors have typical casing.

Windows
A single north-facing six-over-six-light wood double-sash window with typical casing provides daylight.

Finishes
The walls, ceiling, doors, and all trim are painted.

Mechanical System
Supply registers are set in the floor.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern flush-mount globe ceiling light fixture is centered on the ceiling.



Figure 270. Southeast oblique of Room 105.



Figure 271. Southwest oblique of Room 105.

Plumbing System
A sink is located in front of the window.

Built-In Cabinetry
Modern built-in cabinets and countertops line the walls.

Room 201 – Southwest Bedroom
Room 201 retains its 1929 floor plan and continues to serve as a bedroom. It is rectilinear in plan and measures about 13'-7" by 10'-3".



Figure 272. Northeast oblique of Room 201.



Figure 273. Northwest oblique of Room 201.

Flooring
Oatmeal-colored carpet covers the floor.

Baseboards
Baseboards measure ¾" by 7¼", with a rounded top edge and a ¾" quarter-round shoe molding.

Walls and Ceilings
Walls and ceilings are clad in gypsum board with ½" by 1¾" batten strips arranged in a decorative geometric pattern.

Crown and Picture Moldings
The typical 2" tall crown molding and 1¾" picture molding frame the room.

Doorways
The room has two east-facing doorways, one leading to Upstairs Hall (Room 202) and one providing access to a closet. Both doors are the typical five-horizontal-panel design and have typical hardware and trim work, with the exception of reproduction doorknobs.

Windows
Two six-over-six-light wood double-sash windows provide daylight, one faces west and the other faces south. Both have typical trim work.

Finishes
The floor is carpeted, while the walls, ceiling, doors, and all trim are painted.

Mechanical System
Supply registers are set in the ceiling.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern flush-mount 14" globe ceiling light fixture is centered on the ceiling.

Closet
A closet in the northeast corner provides storage.

Room 202 – Upstairs Hall
Room 102 retains its 1929 floor plan and serves as the Upstairs Hall. Rectilinear in plan, the Upstairs Hall measures about 6'-2" by 21'-0".

Flooring
Original pine floorboards measures 2½" wide.

Baseboards
Baseboards measure ¾" by 7¼", with a rounded top edge and a ¾" quarter-round shoe molding.

Walls and Ceilings
Walls and ceilings are clad in gypsum board with ½" by 1¾" batten strips arranged in a decorative geometric pattern.

Crown and Picture Moldings
The typical 2" tall crown molding and 1¾" picture molding frame the room.

Doorways
The room has a total of four doorways. Two east-facing doorways lead to Rooms 203 and 204 and two west-facing doorways lead to Rooms 201 and 205. All doors are of the typical five-horizontal-panel design and have typical hardware and trim work.

Windows
A single six-over-six-light wood double-sash south-facing window with typical casing provides daylight.

Finishes
The floor, stair treads, and handrail are varnished. The walls, ceiling, doors, risers, balusters, newel post, and all trim are painted.

Mechanical System
Supply registers are set in the ceiling.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A flush-mount globe ceiling light fixtures is centered on the ceiling.

Staircase
The original 1929 staircase remains intact at this level. A wood railing supported by 1" by 1" balusters spaced at 4" on center leads from an oak newel post 4½" by 4½" square with a pyramidal top.



Figure 274. Southeast oblique of Room 202.



Figure 275. Northeast oblique of Room 202.



Figure 276. Northeast oblique of Room 203.



Figure 277. Northwest oblique of Room 203.

Room 203 – Southeast Bedroom
Room 203 retains its 1929 floor plan and serves as a bedroom. It is rectilinear in plan and measures about 13'-7" by 12'-9".

Flooring
Oatmeal-colored carpet covers the floor.

Baseboards
Baseboards measure ¾" by 7¼", with a rounded top edge and a ¾" quarter-round shoe molding.

Walls and Ceilings
Walls and ceilings are clad in gypsum board with ½" by 1¾" batten strips arranged in a decorative geometric pattern.

Crown and Picture Moldings
The typical 2" tall crown molding and 1¾" picture molding frame the room.

Doorways
The room has three doorways, one facing west leading to Upstairs Hall (Room 202), one facing north leading to the Bathroom (Room 104), and one providing access to a closet. All doors are the typical five-horizontal-panel design and have typical hardware and trim work.

Windows
Two six-over-six-light wood double-sash windows provide daylight, one faces east and the other faces south. Both have typical trim work.

Finishes
The floor is carpeted. The walls, ceiling, doors, and all trim are painted.

Mechanical System
Supply registers are set in the ceiling.

Electrical System
Modern plastic covers are installed on electric outlets and light switches. A modern flush-mount 14" globe ceiling light fixture is centered on the ceiling.

Closet
A closet in the northeast corner provides storage.



Figure 278. Room 204, looking west.



Figure 279. Room 204, looking north.

Room 204 – Bathroom
Room 204 retains its 1929 floor plan and serves as a Bathroom. It is rectilinear in plan and measures about 8'-10" by 8'-8".

Flooring
Black and white 2½" by 2½" ceramic tile in an basket weave pattern covers the floor.

Lower Walls
The lower walls have a wainscoting of 4" by 4" white ceramic tile with a black 2" by 6" cap and a black 2½" by 6" base.

Upper Walls and Ceiling
The walls and ceiling are clad in gypsum board with ½" by 1¾" batten strips arranged in a decorative geometric pattern.

Doorways
The room has two doorways, one facing west leading to Upstairs Hall (Room 202) and one providing access to a closet. Both doors are the typical five-horizontal-panel design and have typical hardware and trim work.

Windows
A single six-over-six-light wood double-sash east-facing window with typical casing is located in the closet. A 1'-10" wide by 2'-4" tall hinged, four-light

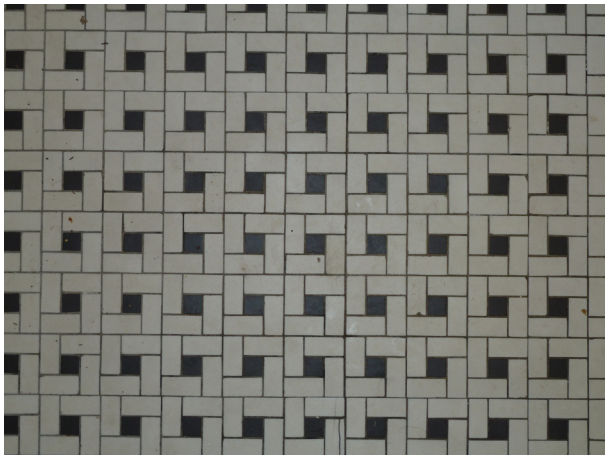


Figure 280. Tile floor of Room 204.



Figure 281. Wall sconces in Room 204.

casement window is located in the main room facing north. This window has typical casing.

Finishes
The upper walls, doors, and all trim are painted.

Mechanical System
Supply and return registers are set in the ceiling.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern flush-mount globe ceiling light fixture is centered on the ceiling. Two modern wall sconces flank the mirror above the sink.

Plumbing System
The full bathroom has a toilet, shower, tub, and lavatory. First installed in 1929, the toilet and sink are modern.

Closet
A large closet 4'-5" deep runs the full-width of the east wall.

Room 205 – Northwest Bedroom
Room 205 retains its 1929 footprint. Serving as a bedroom, Room 205 is rectilinear in plan and measures about 13'-7" by 10'-4".

Flooring
Oatmeal-colored carpet covers the floor.

Baseboards
Baseboards measure ¾" by 7¼", with a rounded top edge and a ¾" quarter-round shoe molding.

Walls and Ceilings
Walls and ceilings are clad in gypsum board with ½" by 1¾" batten strips arranged in a decorative geometric pattern.

Crown and Picture Moldings
The typical 2" tall crown molding and 1¾" picture molding frame the room.

Doorways
The room has two east-facing doorways, one leading to Upstairs Hall (Room 202) and one providing access to a closet. Both doors are the typical five-horizontal-panel design and have typical hardware and trim work.



Figure 282. Northeast oblique of Room 205.



Figure 283. Southwest oblique of Room 205.

Windows
A single six-over-six-light wood double-sash west-facing window with typical casing provides daylight.

Finishes
The floor is carpeted, while the walls, ceiling, doors, and all trim are painted.

Mechanical System
Supply registers are set in the ceiling.

Electrical System
Modern plastic plate covers are installed on electric outlets and light switches. A modern flush-mount 14" globe ceiling light fixture is centered on the ceiling.

Closet
A closet in the southeast corner provides storage.



Figure 284. Carpenter's shop, looking east.

Outbuildings and Other Ancillary Structures

Carpenter's Shop

Largest of the outbuildings, the end-gabled carpenter's shop measures 30'-4" wide by 10'-4" deep and encloses a single room of roughly 286 square feet. The exterior is clad in 11¾" wide wall boards with battens measuring ¾" by 2" and 7/8" by 1¾" The wood-framed building has a single point of entry on its west façade. Board-and-batten double doors each measure 2'-9" wide by 6'-1" tall and have a steel hook closure.

Two modern six-light thermal sash windows measuring 2'-2" wide by 2'-1" tall are fitted into historic openings on the north and west sides measuring 2'-6" wide by 2'-6" tall. Window casing is lintel-cut and measures ¾" by 5¾". Both windows have a square-cut sill.

Compound-cut exposed $1^{5}/_{8}$" by $3^{5}/_{8}$" rafters and ¾" by 5½": plank deck boards form the roof, which is clad is 18" long wood shingles with a 5" to 5½" exposure.

The wall framing is open to the interior. Horizontal bracing at alternating locations down the length of the structure provide lateral stability. Bare $5^{3}/_{8}$" plank floors run north-south. A seam in the floor about one-third of the way down the building from the north wall and changes in the framing at this location indicate that the north third of the building was a later addition. Workbenches line both long walls on the interior. Electric service is provided to the building.



Figure 285. Carpenter's shop, looking southwest.



Figure 286. Carpenter's shop interior, looking south.



Figure 287. Northern brick cistern.



Figure 288. Southern cast-in-place concrete cistern.

Cisterns

Two cisterns are east of the keepers' quarters, both designed in a similar manner. The walls and cap of each cistern are painted white to match the house. The caps slope to the east at about a 13% grade or about a 7.5° angle. Above grade, the brickwork of the northern cistern stands 3'-2" tall at its western edge and 2'-2" tall at its eastern edge. A 10" thick concrete cap with a 4" overhang covers the northern cistern. The southern cast in place concrete cistern has a 6" thick concrete cap with a 2" overhang and stands 4'-2" above grade at its western edge and 3'-0" above grade at its eastern edge. Though visually inaccessible, it is assumed that the sub-grade walls and base of each cistern is of the same respective construction.

Each cistern is rectilinear in plan. The northern cistern measures 7'-8" by 11'-8"; the southern cistern measures 7'-8" by 12'-4". A cistern would have been necessary for life at the Light Station and one would have been built with the Original Keeper's Quarters. While the construction dates of the two present cisterns are unknown, the northern brick cistern is the older of the two and may be the original cistern. It was reported that during the period of June-September, 1987, both cisterns were cleaned and pargeted on interior for waterproofing and their modern cistern filter boxes removed. Four modern Armstrong heat pumps on wood bases rest on the cap of the southern cistern.

Generator House

Facing south, the shed-roofed generator house measures 12'-2" wide by 10'-3" deep and encloses a single room of roughly 108 square feet. The building is wood framed and is clad on the exterior with board-and-batten siding. The plank boards measure approximately 11¼" wide by ¾" thick. The square-edge battens measure ¾" by 1¾".

A six-light modern wood sash window measuring 2'-4" wide by 1'-10" tall is just north of center on the west elevation. Gravity dampers measuring 2'-10" wide by 3'-0" tall are on the north and east façades. Centered on the south elevation is a modern false Dutch door measuring 3'-6" wide by 6'-8½" tall by 1½" wide constructed of vertical boards measuring 5" wide by ¾" thick with exterior battens match those of the siding and are spaced 11" on center. The door has four strap hinges 12" in length. To the left of the false Dutch door is a modern four-panel wood door measuring 2'-6" wide by 6'-8½" tall by 1¾" thick. The door has a chrome lever handle and three 4" tall, brass plated five-knuckle rounded butt hinges.

The steep-angled shed roof is sloped to the south and framed with 2" by 6" rafters spaced at 16" on center. 18" long wood shingles cover the roof, every other shingles having a gap. 7¼" wide by 1½" thick fascia with an applied ¾" by 2" trim piece runs the full perimeter of the roof edge.

The interior walls and ceiling are clad in 3/8" plywood. The concrete slab is exposed as the floor surface.

The building is fully equipped with electrical service. One 70-amp and one 100-amp electrical box providing 120/240 volt service. Rigid PVC conduit runs to outlet boxes, wall-mounted light switches, and two 2-bulb ceiling-mounted florescent light fixtures. Inside is an Onan Techstar 33 diesel generator set, an Onan Transfer Switch, and a diesel fuel tank.



Figure 289. Lighthouse, oil house, and generator house with boardwalk in foreground.



Figure 290. Oil house, southeast oblique view.



Figure 291. Generator house, southwest oblique view.

Oil House

The cast-in-place concrete oil house measures 10'-9" wide by 7'-6" deep and encloses a single room. The low-sloped shed roof slab, also of cast-in-place concrete, is 3" thick with a 6" overhang including a 2¼" wide drip edge 1" thicker than the slab on all sides.

A historic wood-framed window opening measuring 2'-4½" wide by 2'-0" tall is centered on the north, east, and west sides. In each opening is a modern thermal false six-light sash in a stapled frame. Centered on the west side is a 1/8" thick sheet-iron door measuring 2'-6½" wide by 6'-0" tall with 3" by ¼" perimeter and center reinforcing, and two horizontal 2" by ¼" straps, all riveted to the interior face. The door swings on two pintels with strap hinges 2" wide by 3/8" thick by 2'-3" long and is secured by a 3/8" by 1" latch. The door was repaired during the 2009-10 ighthouse work.

Four vent openings, one in each corner, are on both the north and south elevations. On the exterior, each wall vent is covered by a concrete



Figure 292. Oil house interior, southeast oblique.

baffle. On the interior, each opening is fitted with a steel vent cover measuring 1'-5" wide by 11" tall by ¾" thick with six vertical openings each measuring 1" by 6".

Interior walls are pargeted to just above the height of the door opening. A faux baseboard 5 ½" in height (the same height as the door threshold) is painted red. Interior window trim consists of 7/8" by 3½" casing and a rounded-edge sill.

The building is fully equipped with electrical service. One 70-amp and one 100-amp electrical box providing 120/240 volt service. Galvanized conduit runs to outlet boxes, wall-mounted light switches, and a ceiling-mounted incandescent light fixture with a 14" diameter metal canopy. An Onan Techstar 6.0 diesel generator set is mounted on a concrete pedestal measuring 2'-3" wide by 2'-0" deep by 1'-11" tall. A second concrete pedestal measuring 1'-10" wide by 2'-10" deep, by 6" tall is in the northeast corner, but the piece of equipment it supported is no longer in place. Also inside are an Onan Transfer Switch, a diesel fuel tank, and a wall-mounted Dayton electric unit heater.

Privy

The wood-framed privy is 5'-0" wide by 4'-0" deep and encloses a single room of roughly 15 square feet. This structure consists almost entirely of modern materials. The exterior is clad in ¾" by 7¼" boards with ¾" by 1¾" battens. A single, south-facing board-and-batten door measures 2'-6" wide by 6'-8" tall. The 1½" by 5½" flush roof deck boards support wood shingles with a 5½" exposure. The roof has a ¾" by 4" cornice and copper flashing.



Figure 293. Privy, southwest oblique view.

The ¾" by 7¼" floor decking is exposed on the interior, as is the wall framing. The installed double-privy seat is 1'-7" deep and spans the north wall. The original double privy seat is stored inside. It measures 1'-6" deep by 2" thick.

Store House/Pump House

Purportedly the oldest of the outbuildings, the front-gabled store house/pump house measures 16'-3" wide by 16'-0" deep. Located just to the northeast of the keepers' quarters, the wood-framed building encloses a single room of roughly 228 square feet. The exterior is of 1" by 12" boards with 1" by 2" battens. The building has two modern exterior aluminum six-panel doors measuring 2'-8" wide by 6'-5" tall by 1¾" thick, one centered on the west facade and one to the north side of the east façade. The exterior of the doorways has ¾" by 2" molded diagonal-cut casing, while the interior side has 1" by 3½" lintel-cut casing.

A total of five six-over-six-light double-sash windows measuring 2'-4" wide by 4'-0" tall provide the interior with natural light. One window is to either side of the west-facing door, one window is to the south side of the east-facing door, and one window is centered on the north and the south



Figure 294. Store house/pump house, looking northwest.



Figure 295. Store house/pump house, looking northeast.



Figure 296. Store house/pump house interior, northeast oblique.

facades. Rafters measuring 2½" by 6" and spaced at 28" on center support 12" wide deck boards spaced with 4" gaps. Wood shingles, 18" long with a 5½" exposure, cover the roof. Exterior window casing is 1" by 3½" plank and lintel-cut. Interior window casing is ¾" by 3" plank and is also lintel cut. All five windows have aluminum-framed single-sash storm windows.

The 2½" to 3" wide by ¾" thick tongue-and-groove floorboards run east-west. Interior walls are clad with 5" tongue-and-groove boards with a ¼" bead.

Character Defining Features

Important character defining features include:

Lighthouse (1823/1854)

- The historic design of the entry-level door.
- The original stone/brick entry step beneath the modern wood entrance ramp.
- The tapering conical brick shell wall of the lighthouse tower.
- The white paint color of the exterior walls.
- The historic design of the six-over-six-light wood double sash windows.
- The brick corbelling supporting the lantern deck balcony.
- The pargeted stone lantern deck balcony.
- The offset 1854 lantern.
- The ferrous-based framing and dome of the lantern.
- The black paint color of the lantern.
- The trapezoidal window design of the lantern.
- The vented finial crowning the lantern dome.
- The cemented patches where the original wood staircase attached to the exterior wall.
- The domed ceiling supporting the lantern room.
- The 1890s fourth-order Fresnel lens in the lantern room.
- The three brass vents in the masonry wall of the lantern room.
- The steel floor hatch providing entry into the lantern room.
- The cast-iron door providing entry to the lantern balcony.
- The design of the historic iron post-and-railing system of the lantern balcony.

Keeper's Quarters – Original (1823/1897/1929/1940/1950)

- The original brick walls of the first floor.
- The wood mantels in Rooms 101 and 103.
- The wood four-panel interior doors and remaining early door hardware.
- The wood-shingled second-story exterior walls.
- The board-and-batten interior walls.
- The historic design of the six-over-six-light wood double sash windows.
- The 3" wide pine flooring on the second floor.
- The southeast shed addition.
- The screened-in front (east) porch.
- The brick chimneys with corbelled caps.
- The wood staircase.
- The ceramic tiled second-floor bathroom.
- The $2^1/_4$" wide oak flooring of the first floor.

Assistant Keeper's Quarters (1929)

- The stuccoed first-story exterior walls.
- The wood-shingled second-story exterior walls.
- The cornice molding delineating the first and second stories.
- The historic design of the six-over-six-light wood double sash windows.
- The multi-light quarter-round attic-level windows on the gable ends.
- The gable roof.
- The brick chimneys with corbelled caps.
- The screened-in west porch.
- The original fifteen-light wood sash doors.
- The original five-horizontal panel wood doors.
- The original door hardware.
- The original $2^1/_2$" wide pine flooring.
- The ceramic tiled second-floor bathroom.

Outbuildings and Other Ancillary Structures

- The proximity of the outbuildings and ancillary structures to the Lighthouse and the keepers' quarters.

Cisterns

- The pargeted brick walls of the earlier northern cistern.
- The cast-in-place walls of the later southern cistern.
- The cast-concrete sloped lids of both cisterns.

Generator House

- The historic design and proportion of the exterior, based on an earlier outbuilding in the same location.
- The board-and-batten cladding.
- The wood shingled shed roof.
- The false dutch door.
- The fenestration and sash pattern.

Store House/Pump House

- The board-and-batten cladding.
- The wood shingled gable roof.
- The fenestration and sash pattern.



Figure 297. Ocracoke Light Station viewed from southwest.

- The open-stringer wood entrance steps.
- The 2$^{1}/_{2}$" to 3" wide tongue-and-groove floorboards.
- The interior beaded-board wall and ceiling cladding.

Carpenter's Shop

- The board-and-batten cladding.
- The shingled gable roof.
- The exposed framing of the interior.
- The fenestration and sash pattern.

Privy

- The historic design and proportion of the exterior, based on an earlier outbuilding in the same location.
- The board-and-batten cladding.
- The wood shingled shed roof.
- The historic design of the two-hole privy seat.

Oil House

- The poured-in-place concrete walls and roof.
- The original sheet-iron door.
- The original cast-iron wall vents.
- The fenestration and sash pattern.
- The pargeted interior walls and faux painted baseboard.

Summary of Physical Conditions

All buildings composing the Ocracoke Light Station complex are in fair-to-good condition, appear to be structurally sound, and appear to be well maintained.

Lighthouse

A number of condition issues arise primarily from repairs to the lighthouse conducted in the 1950s. These repairs include both inappropriate choices of building materials and components, and inappropriate finish techniques.

In the early 1950s the original wood staircase was replaced with modern steel staircase, the whitewashed interior of the brick shell wall was sandblasted, and the exterior of the brick shell wall was coated in shotcrete, also known by the trade name gunite.

The new staircase is smaller in dimension, with shorter risers than the original wood staircase. The spiral runs clockwise instead of the historic counterclockwise of the wood steps, giving an entirely different experience of ascending and descending the tower with little to no correlation to the existing windows. Mortar patches cover the points in the brick shell wall where each tread of the original staircase was anchored. The footprint of the modern staircase is offset from the brick wall by several inches and supported laterally by a series of metal brackets mortared into the shell wall. This required new holes to be made in the brick shell wall for the supporting brackets. It is important to note that the steel brackets provide the only lateral support of the steel staircase. As such, their condition needs to be closely monitored.

The original whitewashing on the interior surface of the brick shell wall would have served



Figure 298. Uneven pillowing around masonry openings caused by application of shotcrete.

to protect the brick from seasonal changes of humidity within the tower. The sandblasting not only damaged the protective harder surface of the brick, but left the soft interiors exposed to moisture.

While the exterior brick shell wall of the lighthouse was pargeted at some point early in its history, and may in fact have originally been so, the shotcrete coating applied in the early 1950s was an inappropriate material and an inappropriate application technique.

Parge coats are applied by hand trowel and as such, the cement or grout used does not form a complete bond with the brick substrate. The parge coats are removable and must be reapplied every few years to be maintained. Most importantly for this building, the original parge coats were likely lime-based mortar compatible with the lime-based mortar of the brick shell wall.

Photographic evidence shows that the existing parge coat was removed before the application of the shotcrete. The high-speed pneumatic delivery of cement or grout to the brick substrate in the shotcrete process formed a strong bond and is irreversible without causing damage to the underlying brick.

The shotcrete coating is a Portland cement-based mortar mixture, much harder than the lime-based mortar of the brick wall it coats. The shotcrete created a non-breathable, watertight surface on the brick, effective in keeping water out, but problematic in that it traps moisture inside the permeable masonry. Seasonal freeze-thaw cycles cause heaving and spalling of the masonry, accelerating the deterioration of the brick.

The shotcrete also changed the aesthetic character of the design of a brick tower and stone base. The 1892 construction drawing of the lighthouse indicates that the original cut-stone foundation was just visible above grade, meaning the juncture between the top of the stone foundation and the bottom of the brick shell wall was visible. The shotcrete as applied coats the tower all the way to grade, covering the once visible stone foundation.

In 1989, all six wood sash windows (thought to date to 1929) were removed, stored, and replaced with vinyl-clad thermal sash windows. Upon protest by local citizens, these windows were removed in 1990. Five of the early window sash were repaired and another seven reconstructed. Questions exist as to the condition of these windows and the quality of wood chosen for the repaired and reconstructed window sash.

The entrance ramp and boardwalk installed around 2010 raises several issues. Undoubtedly the purpose behind the construction of the ramp was to provide a handicapped accessible entrance to the entry-level of the lighthouse. Yet the ramp as constructed ends 5” lower than the threshold of the entrance doorway. The single entrance point and the long, narrow 400’ length of the boardwalk raise possible safety concerns for visitors to the site. Unfortunately, the addition of the ramp also meant that the original stone/brick entry steps had to be covered.

Currently in need of repair is the masonry of the interior shell wall. The lower third of the interior face of masonry of the shell wall was



Figure 299. Standing seam metal roof of Keepers' Quarters installed in 2008.

repointed around 2010. Portions of the upper shell wall exhibit mortar loss and deterioration. More concerning are extensive lateral and vertical cracking found near the masonry window openings on both the interior and exterior faces. In addition to the moisture erosion of mortar joints, there is also the presence of efflorescence, indicating moisture control issues.

Keepers' Quarters

Largely in good repair after concerted restoration efforts in the late 1980s and early 2000s, the keeper's quarters has issues of concern limited to inappropriate choices of building materials and components.

Interior work in the 1950s replaced most of the original wall cladding with plywood sheathing with decorative grooves in the Original Keeper's Quarters and gypsum board with decorative batten strips in the Assistant Keeper's Quarters. There were major changes in the character of the residences.

The south firebox on the first floor of the main mlock of the Original Keeper's House and the west firebox on the first floor of the Assistant Keeper's House have been sealed over. All flue openings on the second floor of both residences have been sealed.

With the 1929 addition of the Assistant Keeper's Quarters, wood shingle roof of the Original Keeper's Quarters was replaced with a standing seam metal roof. In 2008, the entire roof of the keepers' quarters was replaced with the current bright red modern metal roof. This was both an inappropriate design and poor color choice for the keepers' quarters. The large, clunky seams of the roof are out of scale. A very cost-effective and more historically accurate design would have been 5-V metal panels in an historic color.

The two residences exhibit a range of door hardware dating to the many phases of construction, however the modern (1990s or later) curved brass handles with oval escutcheons on exterior doors are of an inappropriate design.

Outbuildings and Other Ancillary Structures

With the exception of the store house/pump house, the window sash have been replaced with modern thermal sash windows even though the buildings are not climatized. The fate of the original window sash is unknown.

The cast-iron vents of the oil house are cracked and in need of repair.

The paint on the exterior cladding of the carpenter's shop exhibits extensive peeling.

II.A Ultimate Treatment and Use

The Ocracoke Island Lighthouse, constructed in 1823, is the oldest functioning lighthouse in North Carolina and the second oldest still in service in the United States. With a height of approximately 75 feet, it is also one of the shortest in the state; many others are at least twice as tall, ranging in height from about 162 feet (Currituck Beach and Cape Lookout) to 170 feet (Bodie Island), while the Cape Hatteras Lighthouse stands 193 feet above grade, the tallest in the country.

Though its original purpose of warning sailing ships of the dangerous offshore shoals has long passed, the Ocracoke Island Lighthouse continues to serve as a navigational aid, primarily to local craft and recreational boats.

Today the lighthouse is typically unoccupied, the need for twice-daily visits by keepers having ended long ago. Public access to the interior of the lighthouse is generally limited according to the season. Nevertheless, the light station grounds are, along with the beaches, the favorite tourist destinations on the island.

More importantly, the white-painted, shotcrete-coated brick building with black lantern is iconic. The lighthouse retains much of its original character. It is, sentimentally and historically, the most important building on the island. It did not function alone, but had a complement of buildings on the station grounds.

The original, one-and-a-half story, brick Keeper's Quarters was expanded over time, first with a larger second story, with additions to the rear, and eventually with a new quarters built to one side for the Assistant Keeper. The combined sections of the building, known together as the Keepers' Quarters, is significant both architecturally and historically. Both sections now house NPS staff and their families.



Figure 300. Lighthouse tower viewed from below.

Between the lighthouse at the north end of the fenced light station and the Keepers' Quarters to the south, are several outbuildings and two cisterns. All provide testimony to the evolution of the light station.

The General Management Plan (GMP) prepared for the Cape Hatteras National Seashore in 1984 states that the management strategy for the lighthouse and keepers' quarters is to "preserve and maintain." Without distinguishing between the two buildings, it acknowledges the uses as "residence/interpretation" and prescribes that the exteriors be "preserved" and the interiors be treated for "adaptive use."

The recommended treatments and uses remain valid for all buildings and structures of the station.

- ***The Recommended Ultimate Treatment for the exteriors of the Lighthouse and the Keepers' Quarters, as well as the outbuildings and cisterns, is Preservation.***
- ***The Recommended Ultimate Treatment for the interior of the Lighthouse is also Preservation.***
- ***The Recommended Ultimate Treatment for the Keepers' Quarters and outbuildings is Rehabilitation.***

- ***The Recommended Ultimate Use for the Lighthouse is interpretation for its historic role on the Outer Banks and the community of Ocracoke.***
- ***The Recommended Ultimate Use for the Keepers' Quarters is housing for NPS staff while its preserved exterior contributes to the interpretation of the historic light station.***
- ***For the outbuildings and structures, the Ultimate Uses are ancillary functions in support of the operation and maintenance of the site, while their preserved exteriors contribute to the interpretation of the historic light station.***

This management strategy continues the effective plan for use currently in place. It recognizes the importance of historical interpretation recommending preservation of all the buildings and structures of the Light Station and preservation of the interior of the principal building of the group, the Lighthouse. It also promotes sensible adaptive uses for the other buildings. In addition, these treatments are the most cost effective.

II.B Requirements for Treatment and Use

A number of laws, regulations, and functional requirements circumscribe treatment and use of the historic structures in our national parks. In addition to protecting cultural resources, these requirements also address issues of life safety, fire protection, energy conservation, abatement of hazardous materials, and handicapped accessibility. Some of these requirements may contradict or be at cross purposes with one another if rigidly interpreted. Any treatment must be carefully considered in order that the historic fabric of the structure be preserved.

National Historic Preservation Act

The National Historic Preservation Act of 1966 as amended (NHPA) mandates Federal protection of significant cultural resources, including buildings, landscapes, and archeological sites. In implementing the act, a number of laws and authorities have been established that are binding on the NPS.

Section 106

A routine step in the park's planning process for the treatment of cultural resources is compliance with Section 106 of NHPA. This requires that prior to any undertaking involving National Register or National Register-eligible historic properties, Federal agencies "take into account the effect" of the undertaking on the property and give the Advisory Council on Historic Preservation "a reasonable opportunity to comment with regard to such undertaking."

To satisfy the requirements of Section 106, regulations have been published (36 CFR Part 800, "Protection of Historic Properties") that require, among other things, consultation with local governments, State Historic Preservation Officers, and Indian tribal representatives. They also establish criteria under which the Advisory Council may comment, but as a practical matter, the vast majority of Federal undertakings do not involve review by the Advisory Council. The entire point of Section 106 review is to ensure that all interested parties have a voice in the preservation of our nation's cultural heritage.

To expedite the review process, a programmatic agreement between the Advisory Council for Historic Preservation, the National Council of State Historic Preservation Officers, and the NPS allows for a streamlined Section 106 review process. With certain conditions, routine repairs and maintenance that do not alter the appearance of the historic structure or involve widespread or total replacement of historic features or materials are not subject to review outside the NPS.

The Secretary's Standards

The Secretary of the Interior's Standards for the Treatment of Historic Properties are the Secretary's best advice to everyone on how to protect a wide range of historic properties. They provide a philosophical underpinning for historic preservation that is widely understood and almost universally accepted in the United States. They are intended to be applied to a wide variety of resource types, including buildings, sites, structures, objects, and districts. The Standards, revised in 1992, are codified as 36 CFR Part 68.

The Standards describe four broad approaches to the treatment and use of historic properties. These are, in hierarchical order:

- Preservation, which places a high premium on the retention of all historic fabric through conservation, maintenance and repair. It reflects a building's continuum over time, through successive occupancies, and the

respectful changes and alterations that are made.

- Rehabilitation, which emphasizes the retention and repair of historic materials, but provides more latitude for replacement because it is assumed the property is more deteriorated prior to work. (Both Preservation and Rehabilitation standards focus attention on the preservation of those materials, features, finishes, spaces, and spatial relationships that, together, give a property its historic character.)
- Restoration, which focuses on the retention of materials from the most significant time in a property's history, while permitting the removal of materials from other periods.
- Reconstruction, which establishes limited opportunities to re-create a non-surviving site, landscape, building, structure, or object in all new materials.

Regardless of treatment approach, the Standards put a high priority on preservation of existing historic materials and features and not just the architectural form and style. The Standards also require that any alterations, additions, or other modifications be reversible, i.e., be designed and constructed in such a way that they can be removed or reversed in the future without the loss of existing historic materials, features, or character.

Americans With Disabilities Act of 1990

The Americans With Disabilities Act of 1990 (ADA) establishes comprehensive civil rights protection for disabled Americans, both in employment and in their right to free, unaided access to public buildings. While people with restricted mobility have most frequently benefited from ADA, protection also extends to those with other disabilities, including those with impaired vision or hearing.

Requirements for full compliance with ADA regulations are extensive and easiest to apply to new construction. Full compliance for historic buildings is more difficult and sometimes would require significant alterations to the historic character of the property. Where that is the case, ADA authorizes a process for arriving at alternatives to full compliance that can preserve historic character while maximizing a disabled visitor's access to the historic building.

International Building Code

As a matter of policy, the NPS is guided by the International Building Code, which includes this statement regarding code compliance in historic buildings:

> 3406.1 Historic Buildings. The provisions of this code related to the construction, repair, alteration, addition, restoration and movement of structures, and change of occupancy shall not be mandatory for historic buildings where such buildings are judged by the building official to not constitute a distinct life safety hazard [emphasis added].

Threats to public health and safety should always be eliminated, but because this is an historic building, alternatives to full code compliance are always sought where compliance would needlessly compromise the integrity of the historic building.

NFPA Code 914

The National Fire Protection Association (NFPA) has promulgated codes for historic buildings, most notably NFPA 909, "Code for the Protection of Cultural Resources Properties - Museums, Libraries, and Places of Worship," and NFPA 914, "Code for Fire Protection of Historic Structures." As a matter of policy, NPS recommends installation of fire-suppression systems in every historic building.

NPS Management Policies

The NPS General Management Policies (2006) guide overall management of historic properties, especially Chapter 5 "Cultural Resource Management." Based upon the authority of some nineteen Acts of Congress and many more Executive orders and regulations, these policies require planning to ensure that management processes for making decisions and setting priorities integrate information about cultural resources, and provide for consultation and collaboration with outside entities. These policies also support good stewardship to ensure that cultural resources are preserved and protected, receive appropriate treatments (including maintenance), and are made available for public understanding and enjoyment.

Section 5.3.5, "Treatment of Cultural Resources"

This section of the management policies provides specific directives, including a directive that "the preservation of cultural resources in their existing states will always receive first consideration." The section also states that "treatments entailing greater intervention will not proceed without the consideration of interpretive alternatives.... Pending treatment decisions reached through the planning process, all resources will be protected and preserved in their existing states. Except for emergencies that threaten irreparable loss without immediate action, no treatment project will be undertaken unless supported by an approved planning document appropriate to the proposed action."[210] The present HSR is that approved planning document.

Park General Management Plan

The General Management Plan (GMP) for the Cape Hatteras National Seashore was prepared in 1984. That document, described in *Section II.A* of this report, acknowledges the importance of historical interpretation together with the continued residential use of the quarters, and recommends the preservation of exteriors and rehabilitation of interiors.

210. NPS General Management Polices (2006), p. 50.

II.C Alternatives for Treatment and Use

In addition to the Ultimate Treatment and Use discussed in *Section II.A* above and following NPS directives, an alternative treatment has been considered.

While not recommended under the present circumstances, this alternative approach nevertheless fulfills the basic park mandate to retain the historic character of the exterior and interior of the Lighthouse.

Alternative #1: Restore the exterior and interior of the Lighthouse to its original (pre-1950) design. Continue to preserve and maintain the exteriors of the Keepers' Quarters, the outbuildings and the cisterns while rehabilitating the interiors of these buildings for adaptive uses.

This approach would have the following advantages:

- Is consistent with the intent of the GMP to preserve and maintain the historic character of the lighthouse and other buildings and structures of the light station.
- Enhances interpretation of the Lighthouse by removing the modern metal staircase installed in 1950 and reconstructing a wood staircase based on the original design. Such a staircase was reconstructed for the Sapelo Island Lighthouse in Georgia in 1998.
- Enhances interpretation of the Lighthouse by removing the modern wooden window units and replacing them with wood windows of a more durable and historically accurate design.



Figure 301. Reconstructed wood steps of Sapelo Island Lighthouse in Georgia, which was constructed by Winslow Lewis in 1820. The original contract is identical to the Ocracoke contract. Steps were replaced as part of large-scale restoration undertaken in 1998 (lighthousefriends.com.)

- Improves the conservation of the brick building by applying a shelter coat of limewash to the interior masonry wall surfaces. The interior surfaces of the conical masonry wall were compromised by sandblasting and are deteriorating with each seasonal freeze-thaw cycle.
- Improves the long-term conservation of the brick building by removing the incompatible shotcrete coating of the exterior wall surfaces and replacing it with a more compatible parge coat to reduce harm to the structure.

This approach would have the following disadvantages:

- Requires testing to determine the appropriate means to remove the shotcrete. Given the relatively soft nature of the handmade bricks and the density and adhesion qualities of shotcrete, there is a significant chance that damage can occur to the masonry. In addition, the level of success of the removal options cannot be predetermined.
- Requires additional investigation, sampling and testing of materials to determine the original/early parge coat composition as well as the original/early bedding and pointing mortars before formulating conservation-conscious replacements.
- Prompts additional investigation, sampling and testing of materials to determine the original composition of original/early finish coatings, both interior and exterior, before formulating conservation-conscious replacements.
- Requires in-depth archival research, building archaeology and use of the comparative method to establish the appropriate historic designs for reconstructed features.
- The processes of determining original designs when no physical remnants remain always involve a level of speculation, however small.
- The process of testing the potential options for removing the exterior shotcrete coating can be time-consuming and costly.
- The process of investigating, sampling and testing the original/early building materials (including mortars, stuccoes, paints and limewashes) can be time-consuming and costly.
- The process of conducting in-depth archival research, building archaeology and analysis based on the comparative method to establish the appropriate historic designs for reconstructed features can be time-consuming and costly.
- For a successful and long-term cost-effective project, it is important that all aspects of pre-design research, investigation and testing be conducted.
- The accurate reconstruction of the missing historical features, such as the window units and spiral staircase, will be costly.

II.D Recommendations for Treatment and Use

The following recommendations for ultimate treatment and use for the buildings and structures of the Ocracoke Island Light Station echo the treatment and use strategy of the CAHA General Management Plan, which calls for the preservation and maintenance of the exteriors of all buildings and the interior of the lighthouse, and rehabilitation of the interiors of all other buildings for continued uses.

The recommended actions are intended to provide a conceptual plan for treatment in the harsh marine environment. They do not and are not intended to provide the specific guidance that architectural/engineering plans and specifications or other specialized professional documents would provide. Nor are A/E plans and specifications or other professional documents needed for many of the recommended actions. Some of the in-kind repairs and maintenance tasks can be performed by skilled craftsmen; however, other recommended actions will require the input of specialized persons and the creation of professional documents.

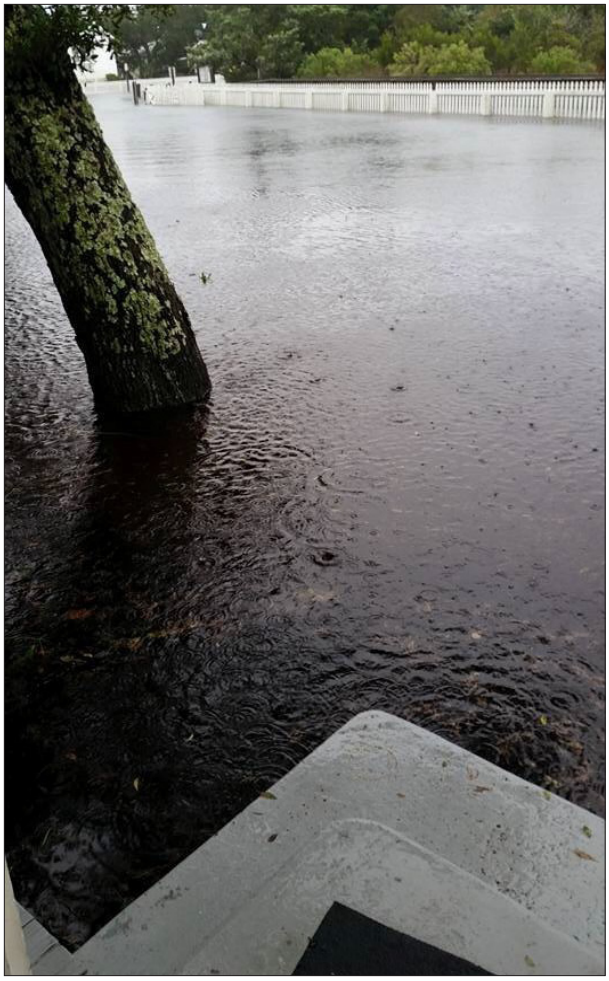


Figure 302. Flooded station after October 2015 storm, looking from porch door of Quarters towards visitors entrance. (CAHA)

Light Station - General

Barrier islands, such as Ocracoke, will be especially vulnerable to the effects of climate change and sea-level rise, which may negatively affect cultural resources on these islands.

Recommendations:

- Consult with Janet Cakir PhD, NPS SER Climate Change, Socioeconomics, and Adaptation Coordinator to guide management policies.
- Use results from the climate change study "Identify Cultural Resources Sites Affected by Sea-Level Rise at Cape Hatteras National Seashore" to guide management policies.
- Prepare or update Topographic Survey for the site.
- Prepare a Log of Flood Occurrences. Record at a minimum the dates of occurrences and approximate extent and severity (e.g. depth at specific locations). Correlate recordings with Topographic Survey. Maintain data so that they can be correlated with conditions such as tide, moon phase, etc.



Figure 303. Tower during shotcrete application, ca. 1952. (Mary Ruth Dickson Coll., Ocracoke Preservation Society)

- Evaluate site for flood avoidance potential including the introduction of dams and/or swales to divert or direct flooding waters.
- Evaluate each building, structure, and significant site feature for flood avoidance potential and/or enhancement potential for better withstanding the projected threatening events.
- Identify critical services (fresh water supply, waste disposal, energy sources, etc.), evaluate options, and develop a contingency plan for each.
- Strive to maintain for all buildings a sound structural system and a weather-tight exterior envelope, especially the roof.
- Use maintenance activities as opportunities to enhance the resistive capacities of the buildings and structures whenever feasible.

Grounds

The fenced site of the Light Station is not open to the public. Access by the public to the lighthouse is accomplished by way of a recently-installed long ramp/walkway of plank "Hardy boards" that begins at the parking lot on the south end of the site. The ramp/walkway runs between the west perimeter picket fence and a marsh to the west, gradually rising on wood piers until it reaches the base of the lighthouse and the entrance doorway. The height of the ramp/walkway landing hides the stone step at the base of the lighthouse, but is not high enough to avoid the entrance door threshold with a 5" rise to enter the lighthouse. The condition is a deterrent to access by persons with various handicapped impairments.

Recommendations for the Site:

As an immediate but temporary measure to promote access into the Lighthouse by handicapped persons, provide a small movable ramp that can be kept nearby (perhaps in the lighthouse) and installed when needed.

- Plan now for a more suitable and permanent design solution for access.
- Secure clearance from an archaeologist before commencing work that might require ground disturbance.
- Observe drainage patterns of the site during periods of significant rainfall and flooding; determine the feasibility of creating shallow swales to promote drainage away from the buildings.

Lighthouse

This is the most significant building of the site, and a building of considerable interest to Ocracoke, the Outer Banks, and well beyond. While it retains much of its historic character, some repairs of the last half century or so have unintentionally harmed rather than enhanced the lighthouse both visually and physically. Because the changes are causing continued damage, they bear monitoring, evaluation for eventual correction, and perhaps a measure of intervention during the interim.

Chief among the harmful changes is the application of the shotcrete to the exterior wall surfaces and the sandblasting of the interior wall surfaces. Coupled together, these changes have seriously affected the shell wall of the lighthouse.

The capacity of the original construction system to perform as intended has been compromised by the rigidly impervious shotcrete coating.



Figure 304. View of Light Station taken from rear of Keepers' Quarters looking north.

The original parge coat, like the mortar beds of the masonry, was intended to be sacrificial. The hand-applied coating was removable, repairable, and importantly, allowed for moisture in the masonry to move to the exposed surfaces for evaporation while allowing for movement and differential settlement. As cracking occurred, it could have easily been repaired. In contrast, the pneumatic adhesion of the shotcrete makes repairs difficult to impossible without full reapplication of the exterior coating. The rigidity of the surface worsens cracking from settlement and dramatically reduces evaporation, trapping moisture in the walls which causes damage during freeze-thaw cycles. The severity of the damage can be expected to increase with time.

The structural integrity of brick units that comprise the interior surfaces of the walls have been damaged by the sandblasting. The original whitewashing on the interior surface of the brick shell wall would have served to protect the brick from seasonal changes of humidity within the tower. The sandblasting not only damaged the protective harder surface of the brick, but left the soft interiors exposed.

Another unfortunate repair, though far less serious, is the replacement of the early wood windows. The new windows, while approximating the historic configuration, are constructed of far less durable material and are not detailed for longevity. The windows, while not causing harm, cannot be expected to provide weather-tight enclosures for very long.

Recommendations for the Masonry Walls:

- Make annual visual inspections to monitor the walls for new signs of distress.
- Make a base record drawing set and plot the hairline cracks that are visible on both the exterior and the interior faces, primarily along the north and south portions, and periodically spot check. Install crack monitors at the most egregious crack locations.
- Locate and archive the samples of original lime-based fulcrum mortars, the 1850s natural cement lantern mortars, the exterior parging and the 1950s shotcrete which were gathered by Blain Cliver in 1989 for the 1990 Historic Structure Report. If samples cannot be located, take new samples and archive.
- Take coring samples of the fulcrum in select locations to identify the nature and condition of the interior wythes. Ensure samples are archived.

- Consider compiling a series of thermographic images to document moisture patterns in the masonry walls. Repeat periodically. Correlate with core samples.
- Test, with strict control parameters, potential methods for removing the shotcrete.
- Sample and test the composition of the remnants of applied finish on the interior wall surfaces. Evaluate potential value of reapplication as a protective shelter coat against seasonal freeze-thaw cycles.

Recommendations for Wood Windows

- Make annual visual inspections to monitor for signs of damage and deterioration.
- Plot the areas of damages on a set of elevation drawings and periodically spot check.
- Maintain a protective paint finish on both the exterior and interior surfaces.

Recommendations for Lantern:

- Make annual visual inspections to monitor for signs of damage and deterioration, with special attention given to features at exterior locations.
- Plot the areas of damages on a set of elevation and plan drawings and periodically spot check for status.
- Maintain a protective paint finish on all ferrous metal features.

Keepers' Quarters

The other large building of the complex, the Keeper's Quarters, is architecturally and historically significant. The preserved exterior contributes to the public understanding of the historic evolution of the site. The two private quarters provide valuable living space for staff. The building is generally well cared for.

The recently installed roof is an unfortunate modification. The modern design of tall tightly-spaced seams and bright red factory-applied finish are jarring and incongruous with the historic character of the place. When it is time for replacement, a more historically accurate design such as a 5-V galvanized panel roofing system with a historically-appropriate color is recommended.

The gutter system has been problematic in recent years, filling with leaves and pulling loose from the wood trim. The maintenance of a protective exterior paint layer on exterior wood and ferrous metal elements is difficult but critical in the harsh marine climate. Termites have historically been a problem.

Recommendations:

- Make regularly scheduled inspections, at least on an annual basis, to monitor for signs of damage, deterioration, and wear, both inside and out.
- Plot the areas of concern on a set of plan drawings; periodically spot check and update notations.
- Locate, sample, and test the composition of original/early bedding and pointing mortars to inform repairs of masonry features.
- Locate, sample, and record the serialization of the original/early paint and other historic finishes, both exterior and interior.
- Periodically inspect brick perimeter walls and porch piers for condition and stability. Make in-kind repairs as needed using pre-established mortar mixes. The proper mortar avoids future damage to the brick. Maintain termite shields at porch posts.
- Periodically inspect the building envelope (siding, doors, windows, trim, porches and roofs) for deterioration and potential for water intrusion. Promptly make in-kind repairs or when an element, such as the roofing, is out of character, replace with a more appropriate design.
- Maintain a protective paint finish on all exterior finished wood and ferrous metal elements.
- When adapting the interior for modern uses, strive to maintain the major components of the early floor plans.
- While accommodating changes in lifestyle, strive to retain early interior features and the character defining qualities.
- Strive to locate modern utilities where the installation, operation, and process of repairs cause the least damage to significant historic features.

Outbuildings & Cisterns

The outbuildings and cisterns are testimony to the operation of the lighthouse and the evolution of the historic site. The buildings also provide valuable enclosed space for a variety of uses.

They most serious deterioration of building elements is found at the cast iron door and vents of the Oil House. All four vents are cracked and rusted. The protective paint finish on the cast-iron door is failing and the metal is beginning to corrode.

Maintenance of exterior wood and ferrous elements is a continuous challenge.
Recommendations:

- Repair the four deteriorated cast-iron vents of the oil house.
- Make regularly scheduled inspections, at least on an annual basis, to monitor for signs of damage and deterioration.
- Plot the areas of damages on a set of elevation and plan drawings; periodically spot check and update notations.
- Periodically inspect foundation posts and piers for condition and stability. Make in-kind repairs as needed.
- Throughout the year keep plant material from the base of all buildings and structures.
- Maintain termite shields in good condition.
- Periodically inspect building envelope (siding, doors, windows, trim, and roof) for deterioration and potential for water intrusion. Promptly make in-kind repairs where compromised.
- Maintain a protective paint finish on all ferrous metal features and all exterior finished wood elements.

Bibliography

Annual Report of the Commissioner of Lighthouses to the Secretary of Commerce and Labor for the Fiscal Year Ended June 1911. Washington: U. S. Government Printing Office, 1911.

Austin, Wesley. Lightkeeper's Logbook, 1912-1929.

Bachman, Karen. "Shipping and Settlement into the 1770s," in *The Insiders' Guide to North Carolina's Outer Banks*, 26th edition. http://www.insiders.com/outerbanks/main-history.htm#tod.

"Beacons in the Night: A Light House Keeper's Life." Clarke Historical Library, Central Michigan University. http://clarke.cmich.edu/lighthouses/lhkeep1.htm.

Carlin, Liz Austin. "The Austins of Hatteras Bank, North Carolina: Wesley Leon Austin." www.afaoa.org.db_files/Hatteras_Austins_NC/Individuals/1667.html.

Cipra, David L. *Lighthouses, Lightships, and the Gulf of Mexico*. Alexandria, Virginia: Cypress Communications, 1997.

Clifford, Candance. National Register Nomination for Bodie Island Light Station. Raleigh: North Carolina Department of Cultural Resources, 2003.

Completion Reports.

Ocracoke Lighthouse, Phase I and II, Lighthouse Grant Project, July 1990.

Ocracoke Lighthouse, Phase III Project, 1991.

Ocracoke Lighthouse, Window and Door Replacement Project, 1990.

Ocracoke Light Station Keeper's [*sic*] Quarters, Preservation Project Phase I, National Park Service, 1987.

Ocracoke Light Station Keeper's [*sic*] Quarters, Preservation Project Phase II. Ocracoke, NC: Cape Hatteras National Seashore, 1988.

Crompton, Samuel Willard, and Michael J. Rhein. *The Ultimate Book of Lighthouses*. San Diego: Thunder Bay Press, 2003.

"Evolving Coast Guard, An." *In Doctrine for the U. S. Coast Guard*. Coast Guard Publication 1, U. S. Coast Guard, February 2014.

Garber, Pat. "The Last Keeper of the Ocracoke Light." *The Island Breeze*. Hatteras, NC: June 1999.

Gaskill, John. *John Gaskill Remembers*. n.p.: La Porte City Printing & Design, Inc., 2007.

Harrison, Molly Perkins. *It Happened on the Outer Banks*. Guilford, CT: The Globe Pequot Press, 2005.

Hauser, Eric. "Graveyard of the Atlantic." http://www.coastalguide.com/packet/Shipwrecks 01.htm.

Heynen, William J., Elizabeth K. Lockwood, and Margo Szabunia. *Lighthouse Plans in the National Archives; A Special List of Lighthouse-Related Drawings in Record Group 26. National Archives and Records Administration (NARA)* Special List 57, Revised 1999.

Holland, Francis Ross, Jr. *America's Lighthouses: An Illustrated History*. New York: Dover Press, 1988.

Howard, Phillip. "Ocracoke Lighthouse." *Ocracoke Newsletter*, August 1, 2004. http://www.villagecraftsmen.com/news080104.htm.

Impact Assessment, Inc. *Ethnohistorical Description of the Eight Villages adjoining Cape Hatteras National Seashore and Interpretive Themes of History and Heritage*. Final Technical Report, Vol. 2. Atlanta: National Park Service Southeast Regional Office, 2005.

Jones, Ray, Bruce Roberts, Cheryl Shelton-Roberts. *American Lighthouses: A Comprehensive Guide to Exploring our National Coastal Treasures*. Guilford, CT: Globe Pequot Press, 2012.

Jones, Ray. *The Lighthouse Encyclopedia: The Definitive Reference*. Guilford, CT: The Globe Pequot Press, 2004.

Lighthouse Digest. April 2006.

Lighthouse Friends, "Ocracoke, NC." http://www.lighthousefriends.com/light.asp?ID=355

"Lighthouse Keeper's Duty, A." http://ponceinlet.org/images/content/keepers_duties.pdf.

Little, M. Ruth, et. al., National Register nomination for Ocracoke Historic District. Raleigh: North Carolina Department of Cultural Resources, 1990.

Mallison, Fred M. *The Civil War on the Outer Banks: A History of the Late Rebellion Along the Coast of North Carolina from Carteret to Currituck, with Comments on Prewar Conditions and an Account of Postwar Recovery*. Jefferson, NC: McFarland and Company, 1998.

Maritime Digital Archive, United States Lighthouse Service. www.ibiblio.org/maritime/photolibrary/index.php?cat=1554.

Michigan Lighthouse Conservancy. "Lighthouses: A Brief Administrative History." http://www.michiganlights.com/fresnel.htm.

_____. "USLHE Traveling Library." http://www.michiganlights.com/lhlibrary.htm.

Mills, Robert. *The American Pharos, Or Light-house Guide: Founded on Official Reports Received at the Treasury Department; Also, a General View of the Coast, from the St. Lawrence to the Sabine*. Thompson & Homans, 1832.

National Park Service. Files relating to Ocracoke Light Station, including drawings, plat maps, photographs, correspondence, contracts, reports, administrative files, guides' notebook, and other documents dating from 1823 to 2013. Held at the NPS Museum Resource Center, Manteo, NC.

_____. "Ocracoke Light Station." http://www.nps.gov/caha/planyourvisit/ols.htm.

Noble, Dennis L. *Lighthouses and Keepers: The U.S. Lighthouse Service and Its Legacy*. Annapolis: Naval Institute Press, 2004

Ocracoke Island Journal.
December 15, 2009.
January 11, 2012.

Ocracoke Lighthouse, Cape Hatteras National Seashore, North Carolina, Historic Structures Report. National Park Service, 1990.

Oppermann, Joseph K. *Cape Hatteras National Seashore, Bodie Island Light Station Double Keepers' Quarters Historic Structure Report*. Atlanta: National Park Service Cultural Resources Division, Southeast Region, 2009.

_____. *Cape Lookout Lighthouse, Cape Lookout National Seashore, North Carolina, Historic Structure Report*. Atlanta: National Park Service Cultural Resources Division, Southeast Region, December 2008.

Outer Banks Lighthouse Society. "Lighthouses of North Carolina." www.outerbankslighthousesociety.org.

Pilkey, Orrin H. et al. *The North Carolina Shore and Its Barrier Islands, Restless Ribbons of Sand*. Durham: Duke University Press, 1998.

Putnam, George Rockwell. *Lighthouses and Lightships of the United States*. Houghton Miffllin, 1917.

Rowlett, Russ. "Old Style Brick Lighthouses, 1820-1849." http://www.unc.edu/~rowlett/lighthouse/types/oldstylebrick.html.

Shelton-Roberts, Cheryl and Bruce Roberts. *North Carolina Lighthouses: Stories of History and Hope*. Globe Pequot, 2011.

Smithsonian Institution Archives. Joseph Henry Papers. www.siarchives.si.edu/history/jhp.

Stick, David. *Graveyard of the Atlantic: Shipwrecks of the North Carolina Coast*. Chapel Hill: The University of North Carolina Press, 1989.

_____. *North Carolina's Lighthouses*. Raleigh: Division of Archives and History, North Carolina Department of Cultural Resources, 1980.

_____. *Outer Banks of North Carolina, 1584-1958, The*. Chapel Hill: The University of North Carolina Press, 1958.

Strobridge, Truman R. "Chronology of Aids to Navigation and the United States Lighthouse Service 1716-1939." http://www.uscg.mil/history/articles/h_USLHSchron.asp.

"Under Sea Graveyard along the Outer Banks Holds the USS Monitor." July 19, 2005. www.kittyhawkfreepress.com/atlanticgraveyard.html.

United States Bureau of Light-Houses, *Compilation of public documents and extracts from reports and papers relating to light-houses, light-vessels, and illuminating apparatus and to beacons, buoys and fog signals. 1789-1871*.

United States Coast Guard. "Historic Light Station Information and Photography: North Carolina." http://www.uscg.mil/history/weblighthouses/LHNC.asp.

United States Coast Guard Historian's Office. www.uscg.mil/history.

United States Department of the Treasury. *Annual Report of the Secretary of the Treasury on the State of the Finances*. 1863.

United States Government Printing Office, Congressional Serial Set. 1892).

United States Light-House Board, *Instructions to Light-Keepers*. Washington: U.S. Government Printing Office, 1902.

United States Lighthouse Society, http://uslhs.org.

Warfield, Ronald G. National Register nomination for Ocracoke Light Station. National Park Service: 1977.

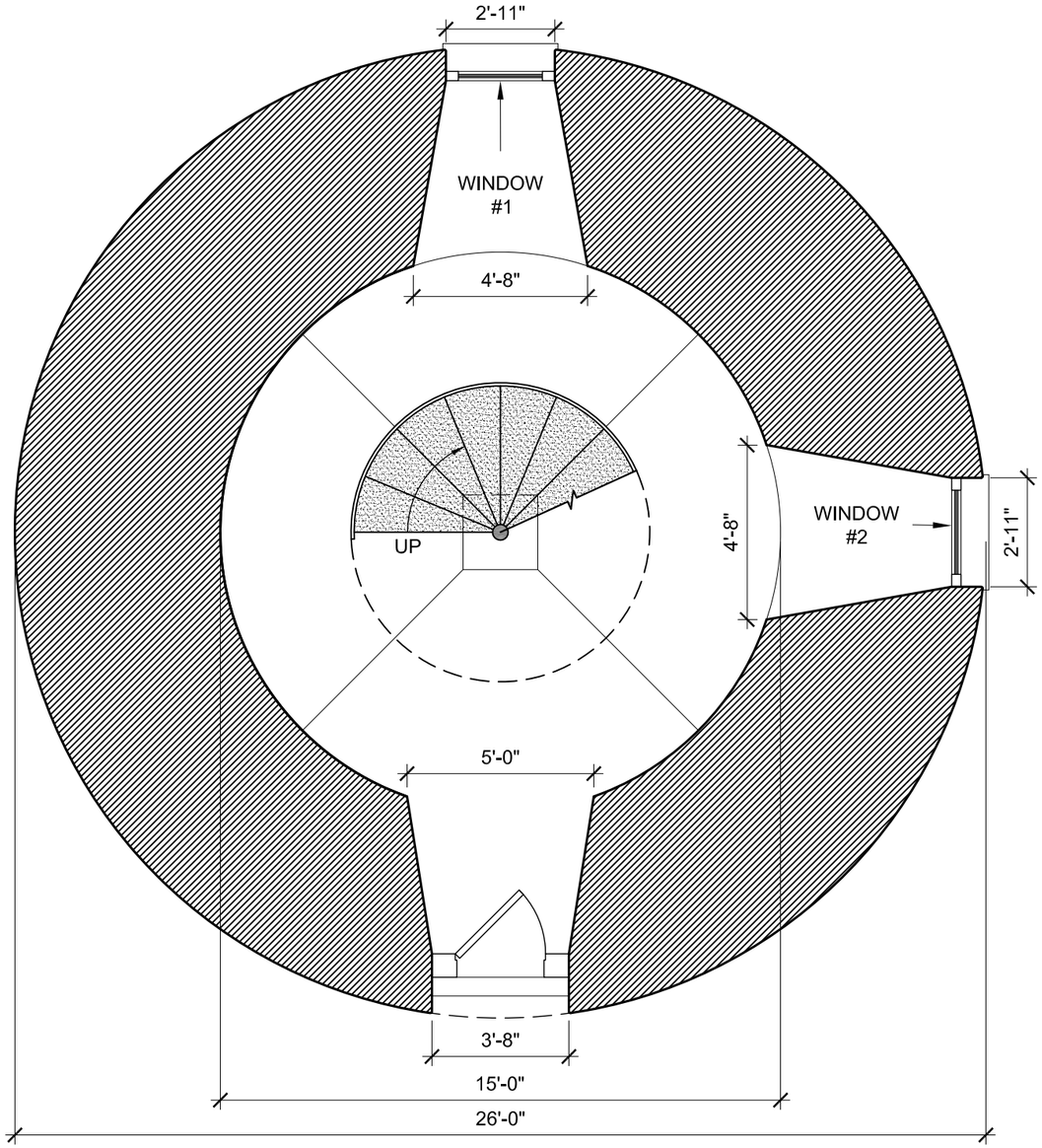
Wiss, Janney, Elstner Associates, Inc. and John Milner Associates, *Portsmouth Village, Cultural Landscape Report, Cape Lookout National Seashore*. Atlanta: National Park Service Southeast Regional Office, 2007.

Appendix A: Documentation Drawings

Lighthouse
Sheet 1: Entry Level Floor Plan
Sheet 2: Section at 3rd Window
Sheet 3: Section at 4th Window
Sheet 4: Section at 5th Window
Sheet 5: Section at 6th Window
Sheet 6: Lantern Room Floor Plan

Keepers' Quarters
Sheet 7: First Floor Plan
Sheet 8: Second Floor Plan
Sheet 9: Details

Outbuildings & Other Ancillary Structures
Sheet 10: Oil House, Generator Building, & Carpenter's Shop
Sheet 11: Privy & Store House/Pump House



1 LIGHTHOUSE ENTRY LEVEL FLOOR PLAN

SCALE: 1/4" = 1'-0"

0 1' 2' 4' 8'

TRUE NORTH

PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

OCRACOKE LIGHT STATION

HYDE COUNTY, NC

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE - SOUTHEAST REGION
CAPE HATTERAS NATIONAL SEASHORE

RECORDATION DATE:
03.01.2013

RECORDED BY:
JKO
RLM, CMW

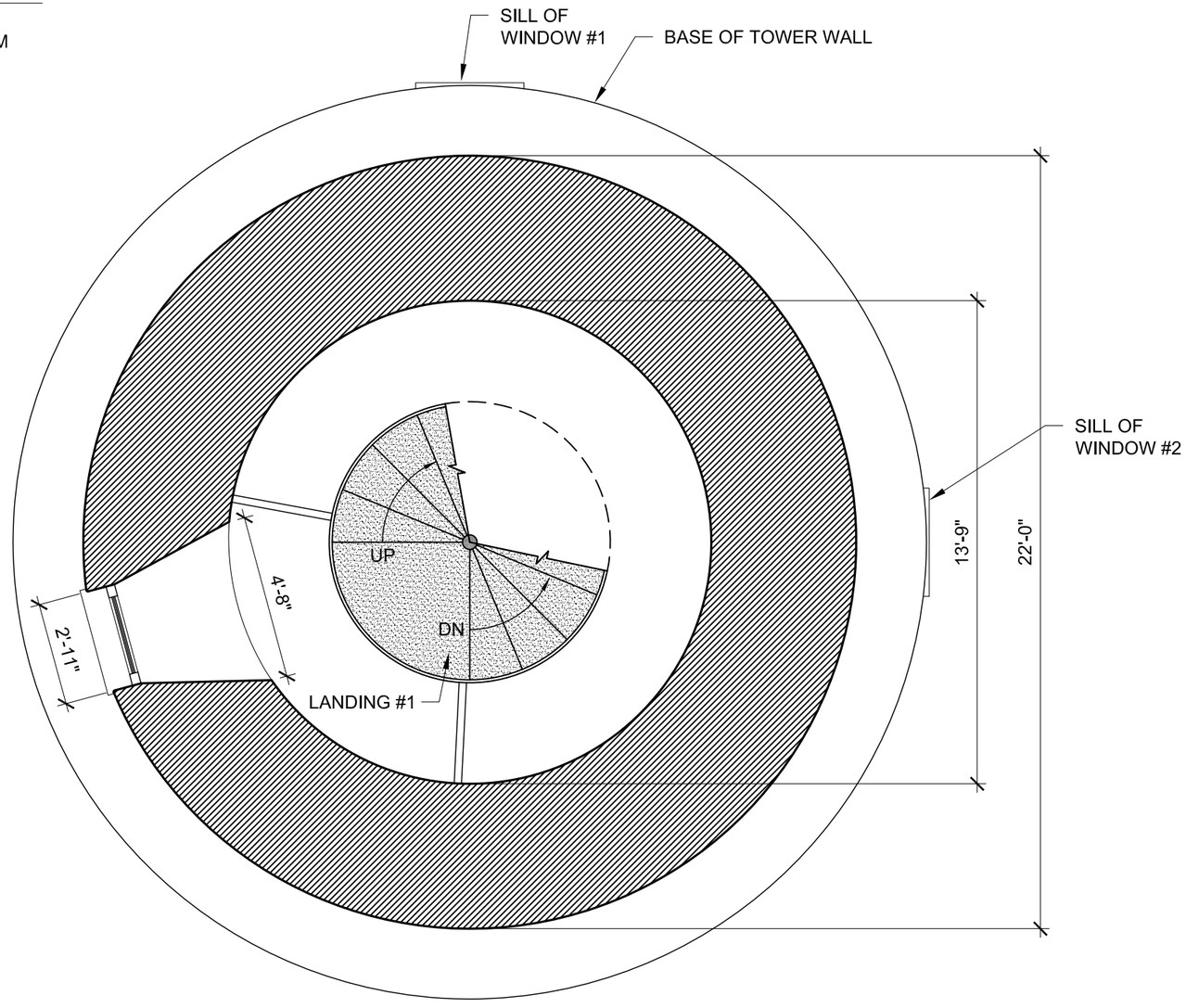
SCALE:
1/4"=1'-0"

HSR APPENDIX A: SHEET

1

NOTE:

THE WALL THICKNESS OF THE TOWER WALL AT THIS SECTION IS APPROXIMATE AND EXTRAPOLATED FROM THE 1892 SECTIONAL DRAWINGS (SEE APPENDIX B - SHEET 1)



1 LIGHTHOUSE SECTION AT 3RD WINDOW

SCALE: 1/4" = 1'-0"

0 1' 2' 4' 8'

TRUE NORTH
PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

OCRACOKE LIGHT STATION

HYDE COUNTY, NC

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE - SOUTHEAST REGION
CAPE HATTERAS NATIONAL SEASHORE

RECORDATION DATE:
03.01.2013

RECORDED BY:
JKO
RLM, CMW

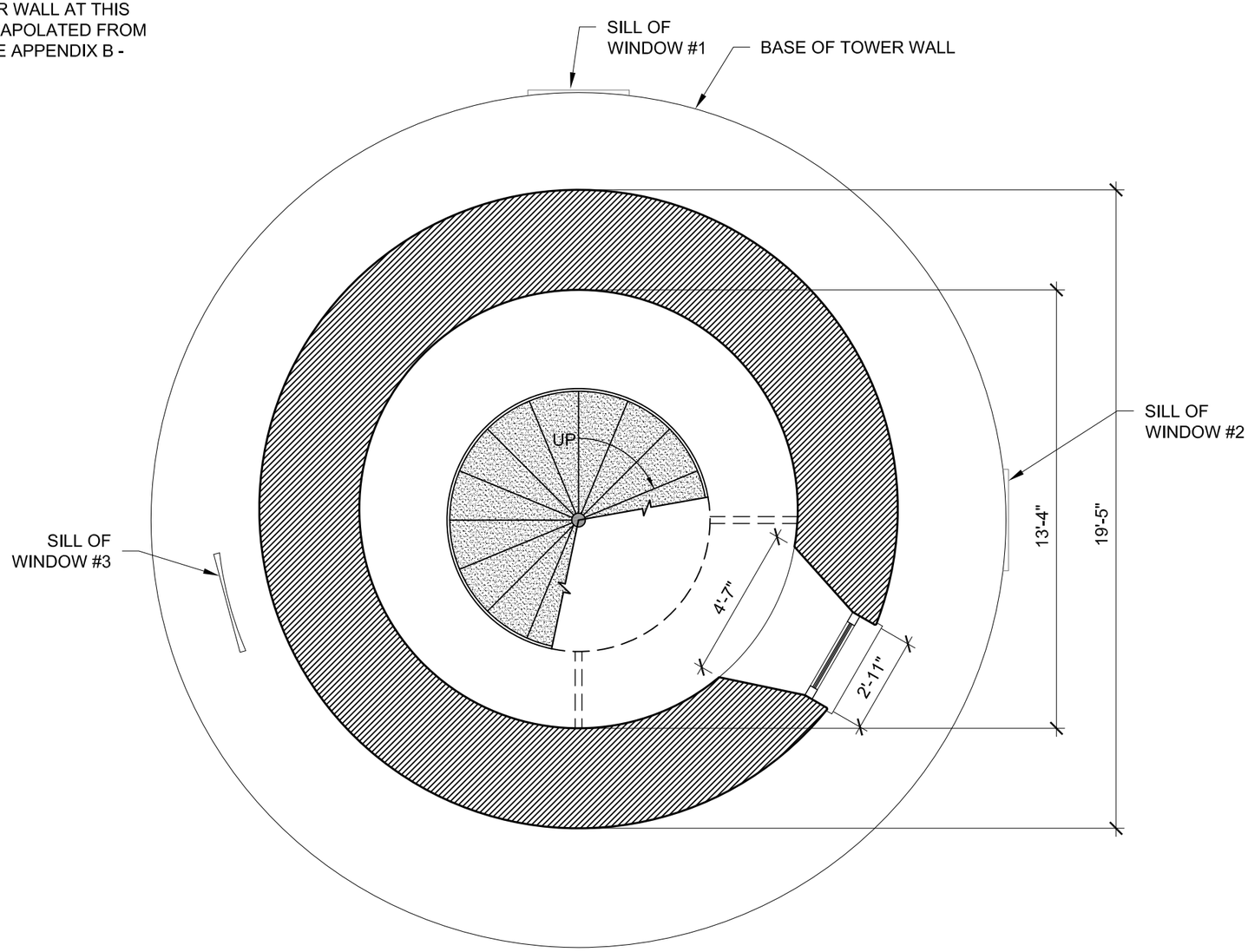
SCALE:
1/4"=1'-0"

HSR APPENDIX A: SHEET

2

NOTE:

THE WALL THICKNESS OF THE TOWER WALL AT THIS SECTION IS APPROXIMATE AND EXTRAPOLATED FROM THE 1892 SECTIONAL DRAWINGS (SEE APPENDIX B - SHEET 1)



1 LIGHTHOUSE SECTION AT 4TH WINDOW

SCALE: 1/4" = 1'-0"

0 1' 2' 4' 8'

TRUE NORTH

PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

OCRACOKE LIGHT STATION

HYDE COUNTY, NC

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE - SOUTHEAST REGION
CAPE HATTERAS NATIONAL SEASHORE

RECORDATION DATE:
03.01.2013

RECORDED BY:
JKO
RLM, CMW

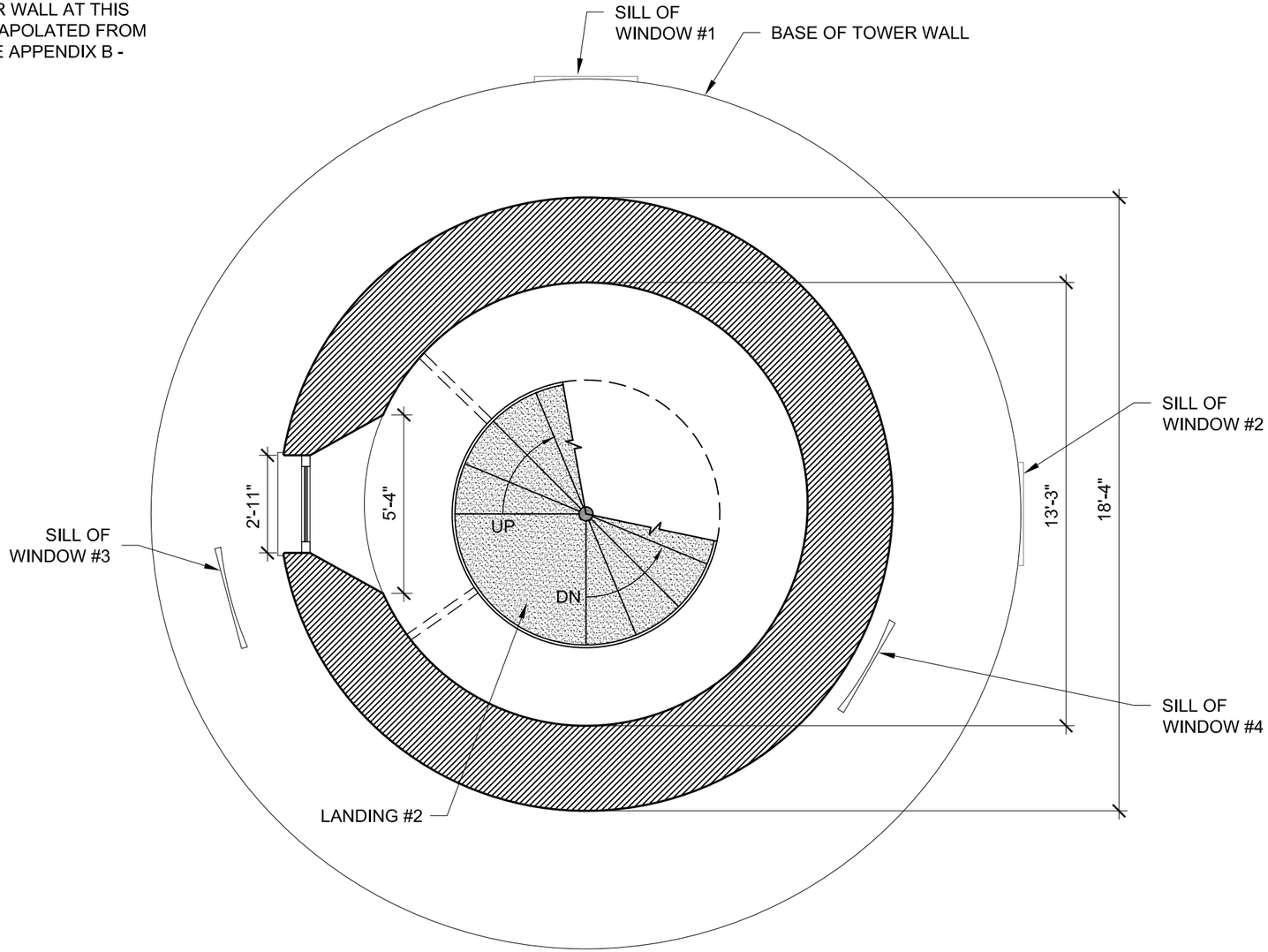
SCALE:
1/4"=1'-0"

HSR
APPENDIX A:
SHEET

3

NOTE:

THE WALL THICKNESS OF THE TOWER WALL AT THIS SECTION IS APPROXIMATE AND EXTRAPOLATED FROM THE 1892 SECTIONAL DRAWINGS (SEE APPENDIX B - SHEET 1)



1 LIGHTHOUSE SECTION AT 5TH WINDOW

SCALE: 1/4" = 1'-0"

0 1' 2' 4' 8'

TRUE NORTH
PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

OCRACOKE LIGHT STATION

HYDE COUNTY, NC
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE - SOUTHEAST REGION
CAPE HATTERAS NATIONAL SEASHORE

RECORDATION DATE:
03.01.2013

RECORDED BY:
JKO
RLM, CMW

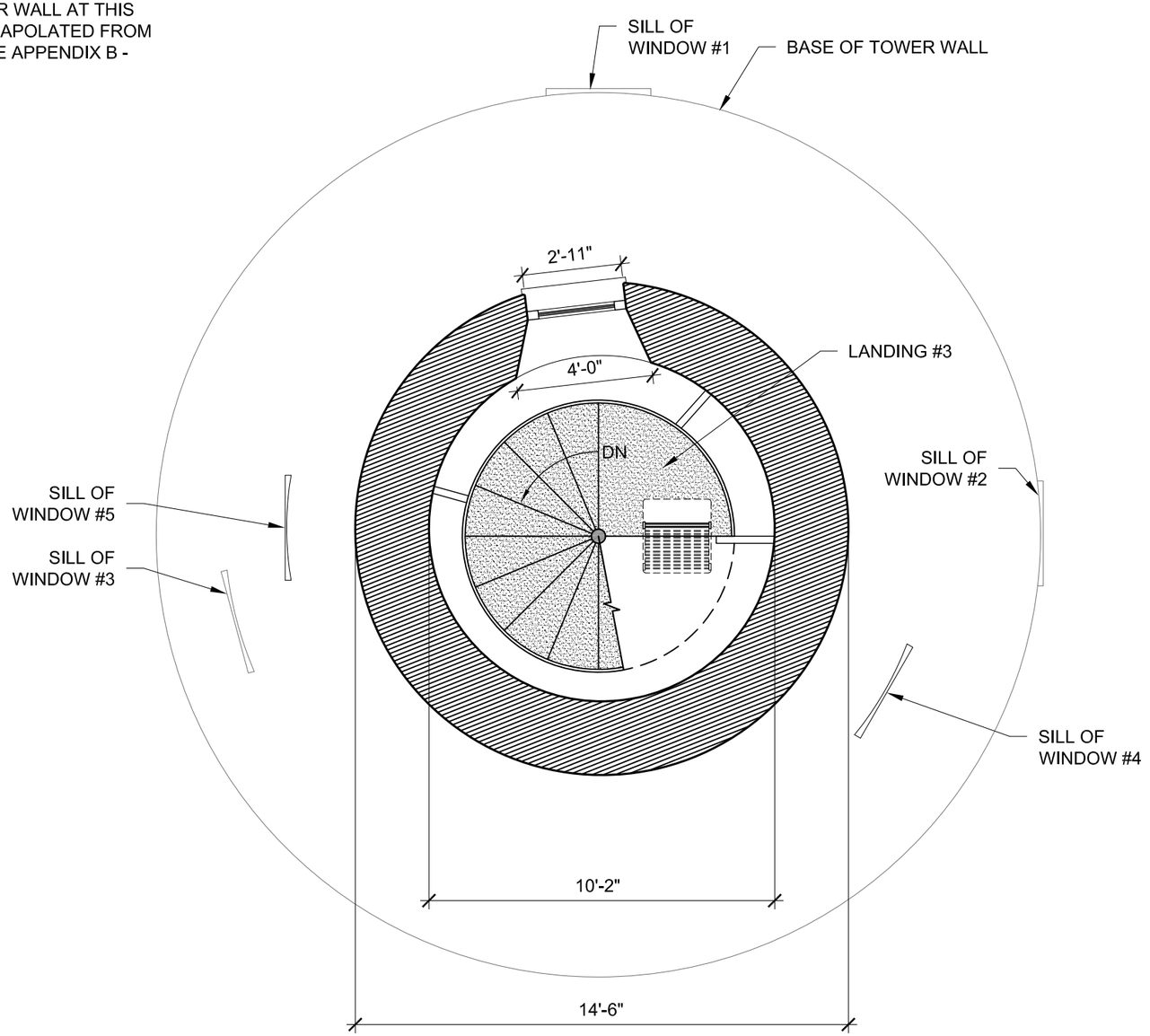
SCALE:
1/4"=1'-0"

HSR APPENDIX A: SHEET

4

NOTE:

THE WALL THICKNESS OF THE TOWER WALL AT THIS SECTION IS APPROXIMATE AND EXTRAPOLATED FROM THE 1892 SECTIONAL DRAWINGS (SEE APPENDIX B - SHEET 1)



1 LIGHTHOUSE SECTION AT 6TH WINDOW

SCALE: 1/4" = 1'-0"

0 1' 2' 4' 8'

TRUE NORTH
PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

OCRACOKE LIGHT STATION
HYDE COUNTY, NC
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE - SOUTHEAST REGION
CAPE HATTERAS NATIONAL SEASHORE

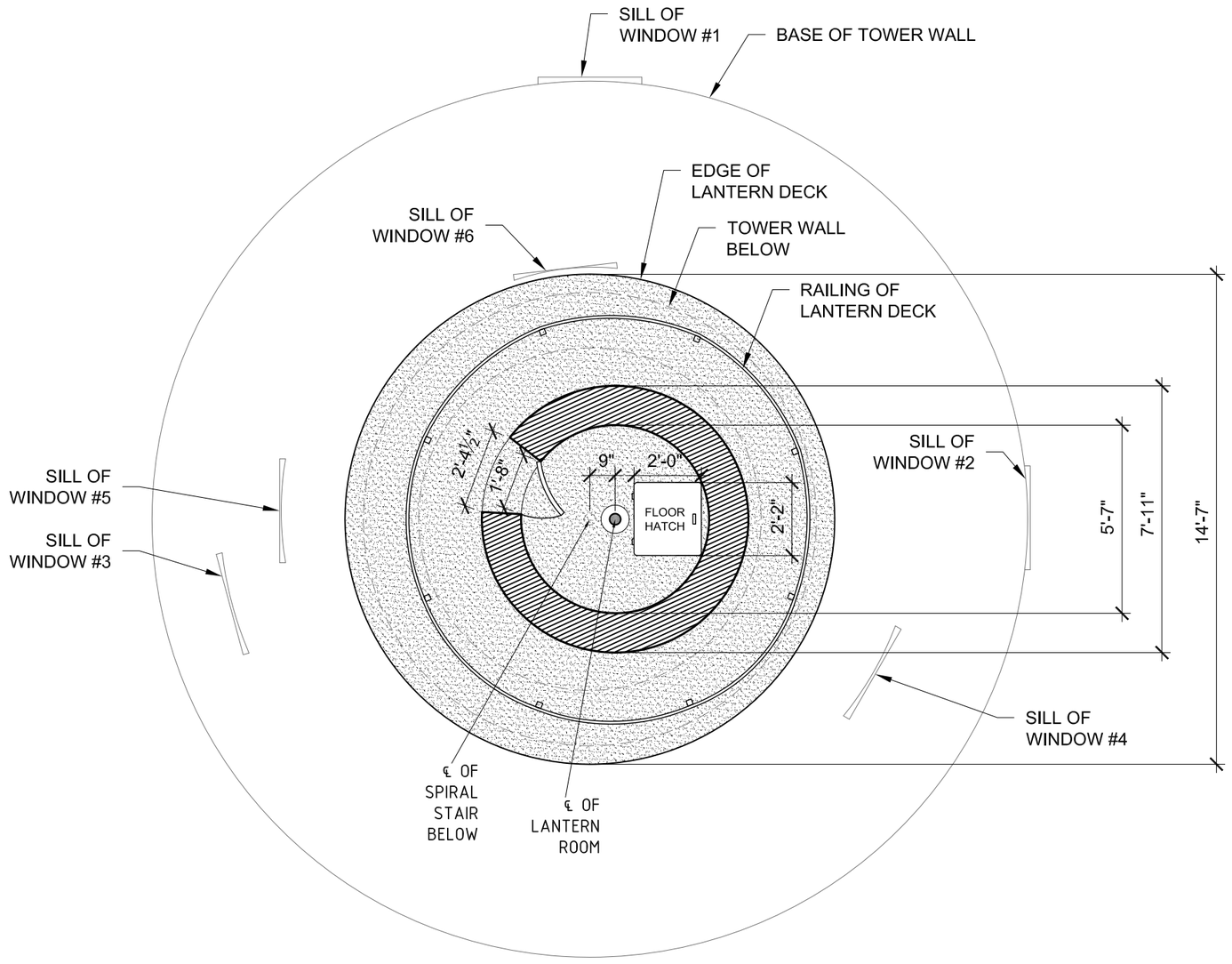
RECORDATION DATE:
03.01.2013

RECORDED BY:
JKO
RLM, CMW

SCALE:
1/4"=1'-0"

HSR APPENDIX A: SHEET

5



1 LIGHTHOUSE LANTERN ROOM FLOOR PLAN

SCALE: 1/4" = 1'-0"

0 1' 2' 4' 8'

TRUE NORTH
PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

OCRACOKE LIGHT STATION

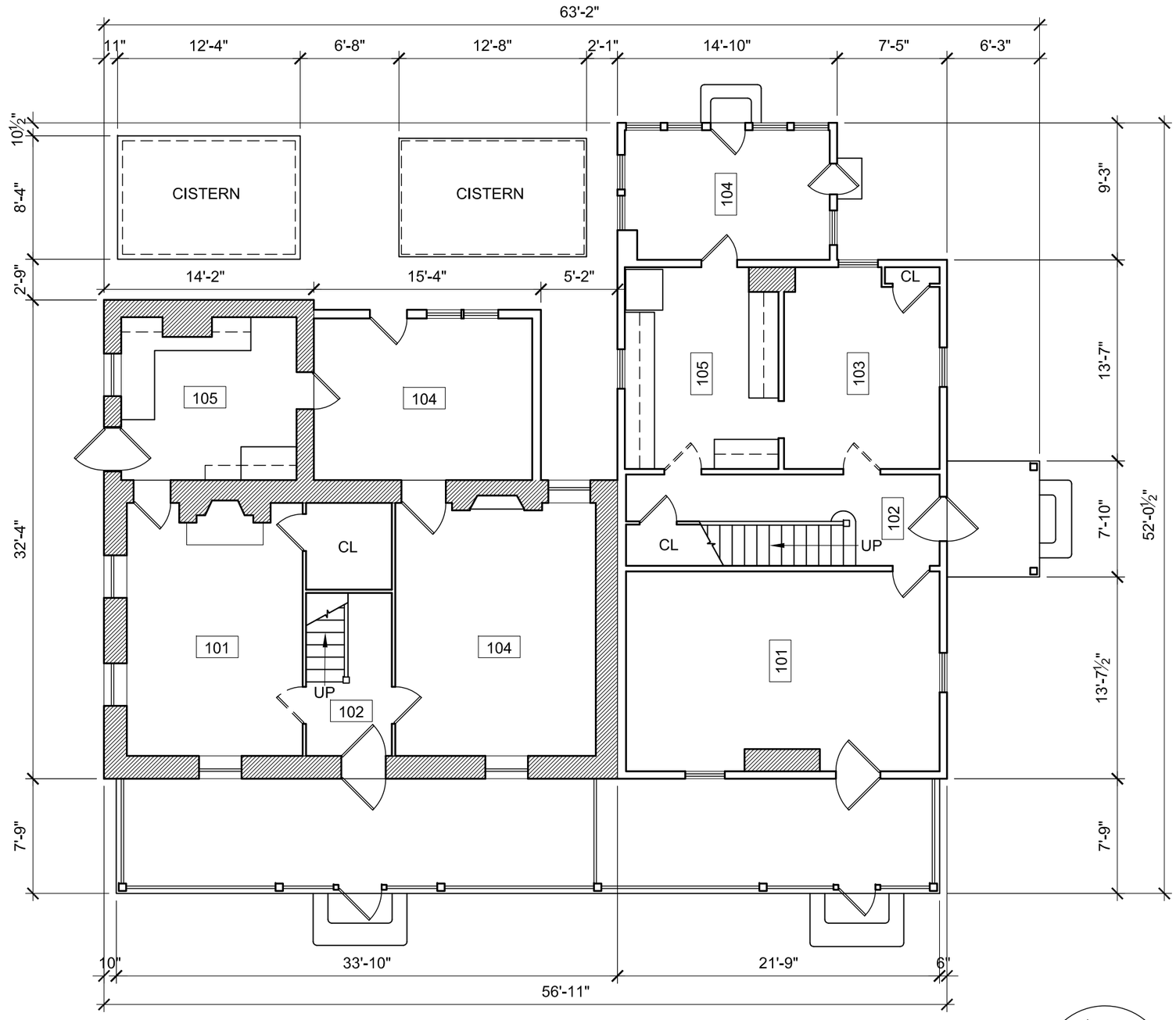
HYDE COUNTY, NC
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE - SOUTHEAST REGION
CAPE HATTERAS NATIONAL SEASHORE

RECORDATION DATE:
03.01.2013

RECORDED BY:
JKO
RLM, CMW

SCALE:
1/4"=1'-0"

HSR APPENDIX A: SHEET
6



1 KEEPERS' HOUSE - FIRST FLOOR

SCALE: 1/8" = 1'-0"

0 2' 4' 8' 16'

TRUE NORTH

PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

OCRACOKE LIGHT STATION

HYDE COUNTY, NC

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE - SOUTHEAST REGION
CAPE HATTERAS NATIONAL SEASHORE

RECORDATION DATE:
03.01.2013

RECORDED BY:
JKO
RLM, CMW

SCALE:
1/8"=1'-0"

HSR APPENDIX A:
SHEET
7



1 KEEPERS' HOUSE - SECOND FLOOR

SCALE: 1/8" = 1'-0"

0 2' 4' 8' 16'

TRUE NORTH

PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

OCRACOKE LIGHT STATION

HYDE COUNTY, NC
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE - SOUTHEAST REGION
CAPE HATTERAS NATIONAL SEASHORE

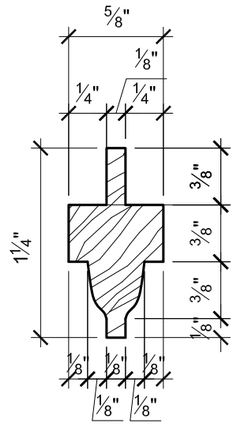
RECORDATION DATE:
03.01.2013

RECORDED BY:
JKO
RLM, CMW

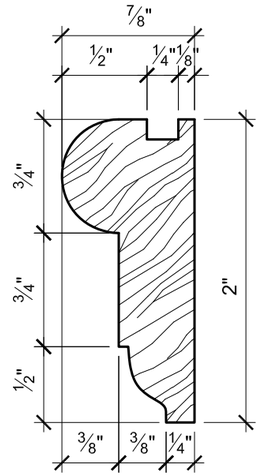
SCALE:
1/8"=1'-0"

HSR
APPENDIX A:
SHEET

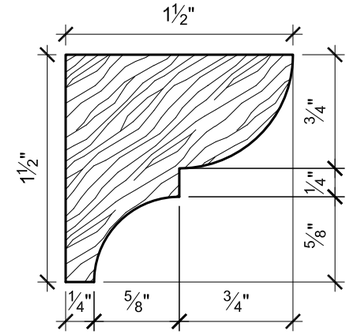
8



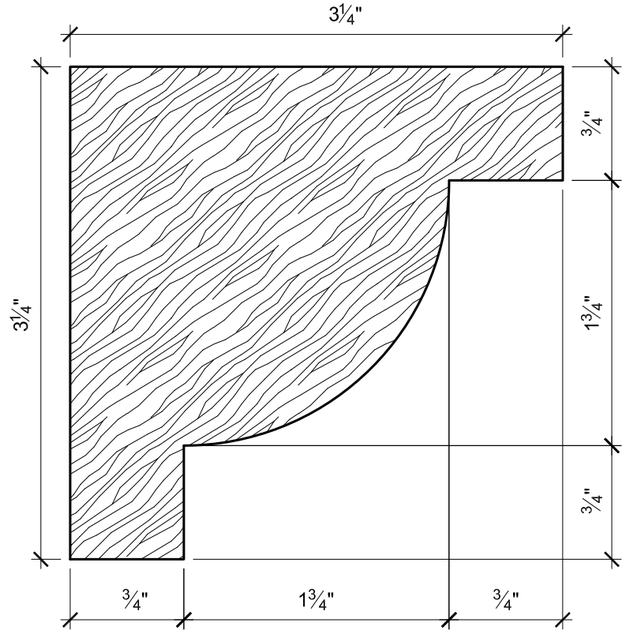
1 TYP. WINDOW MUNTIN
SCALE: FULL SCALE



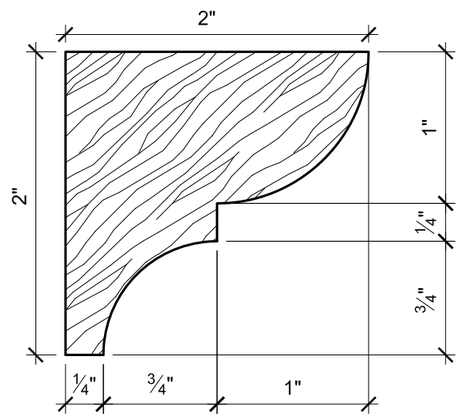
2 TYP. PICTURE RAIL
SCALE: FULL SCALE



3 TYP. CROWN MOLDING
ORIGINAL KEEPER'S QUARTERS
SCALE: FULL SCALE



4 EXTERIOR WALL CORNICE
SCALE: FULL SCALE



5 TYP. CROWN MOLDING
ASSISTANT KEEPER'S QUARTERS
SCALE: FULL SCALE

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

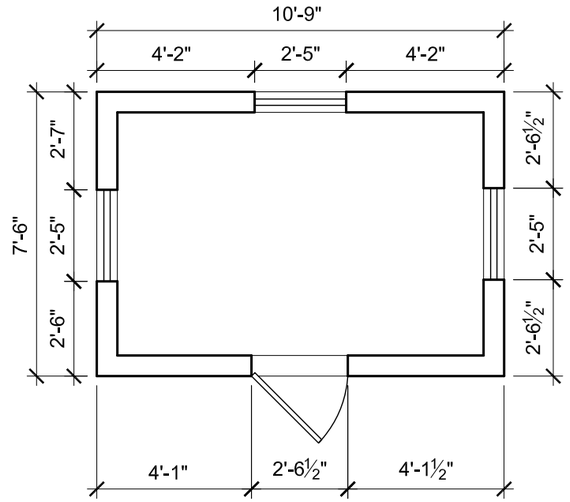
OCRACOKE LIGHT STATION
HYDE COUNTY, NC
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE - SOUTHEAST REGION
CAPE HATTERAS NATIONAL SEASHORE

RECORDATION DATE:
03.01.2013

RECORDED BY:
JKO
RLM, CMW

SCALE:
FULL SCALE

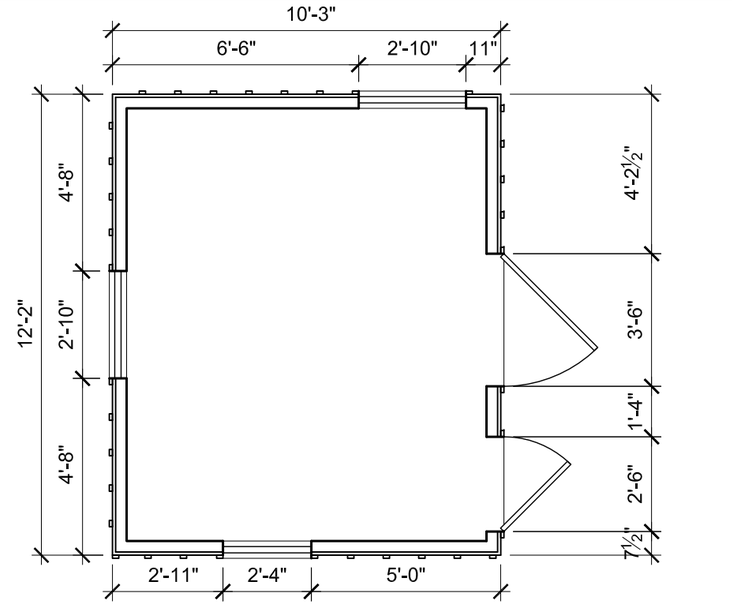
HSR
APPENDIX A:
SHEET
9



1 OIL HOUSE

SCALE: 1/4" = 1'-0"

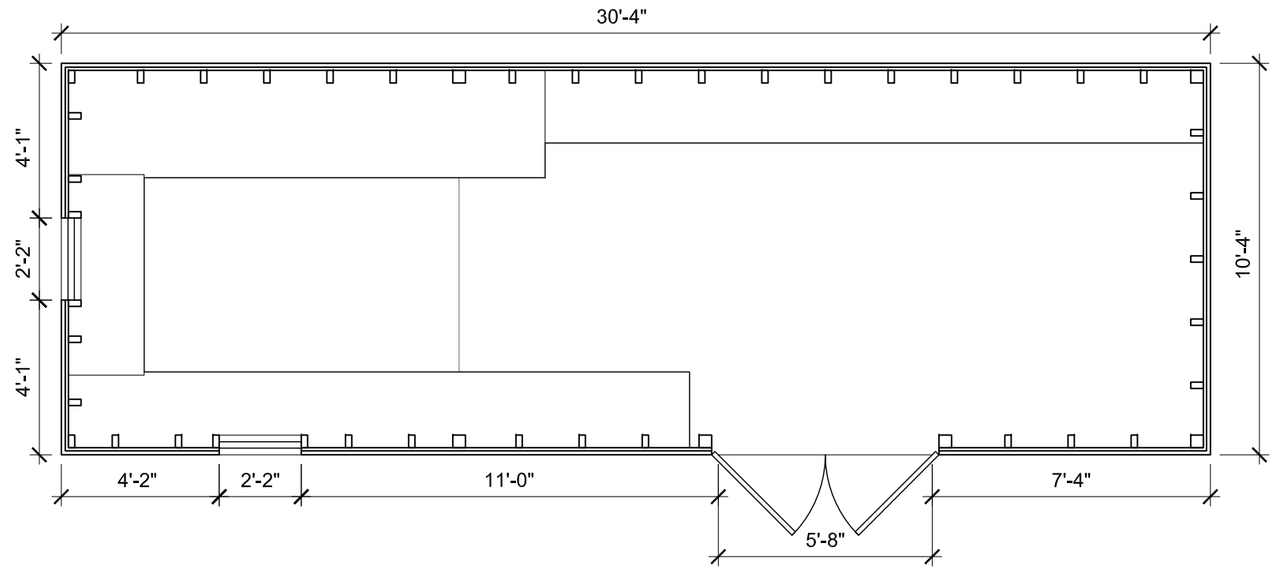
0 1' 2' 4' 8'



2 GENERATOR BUILDING

SCALE: 1/4" = 1'-0"

0 1' 2' 4' 8'



3 CARPENTER'S SHOP

SCALE: 1/4" = 1'-0"

0 1' 2' 4' 8'

TRUE NORTH

PLAN NORTH

JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

OCRACOKE LIGHT STATION

HYDE COUNTY, NC
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE - SOUTHEAST REGION
CAPE HATTERAS NATIONAL SEASHORE

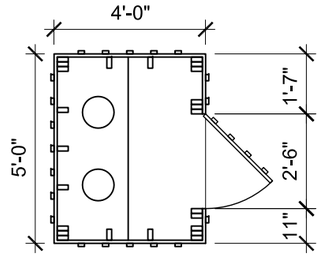
RECORDATION DATE:
03.01.2013

RECORDED BY:
JKO
RLM, CMW

SCALE:
1/4"=1'-0"

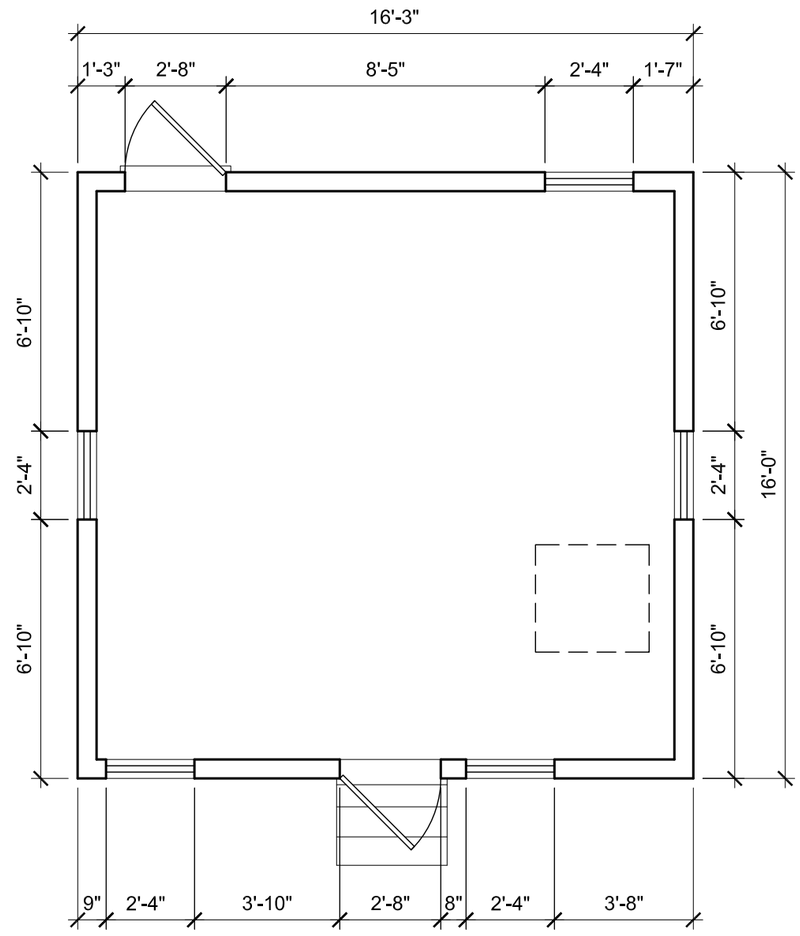
HSR APPENDIX A: SHEET

10



1 PRIVY
SCALE: 1/4" = 1'-0"

0 1' 2' 4' 8'



2 PUMP HOUSE/ STORE HOUSE
SCALE: 1/4" = 1'-0"

0 1' 2' 4' 8'



JOSEPH K. OPPERMANN - ARCHITECT, P.A.
WINSTON-SALEM, NORTH CAROLINA

OCRACOKE LIGHT STATION

HYDE COUNTY, NC
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE - SOUTHEAST REGION
CAPE HATTERAS NATIONAL SEASHORE

RECORDATION DATE:
03.01.2013

RECORDED BY:
JKO
RLM, CMW

SCALE:
1/4"=1'-0"

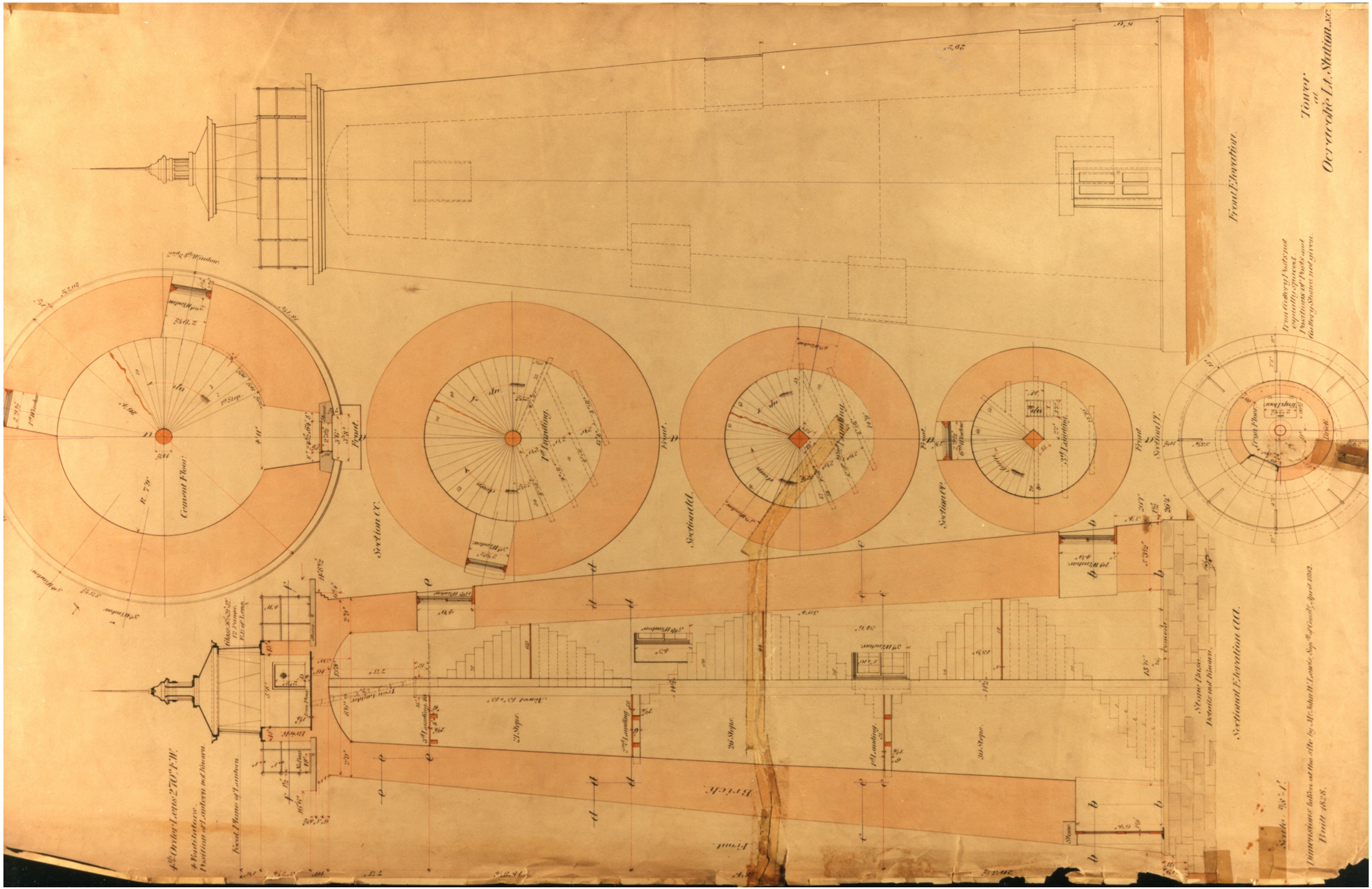
HSR
APPENDIX A:
SHEET
11

Appendix B: Historic Drawings

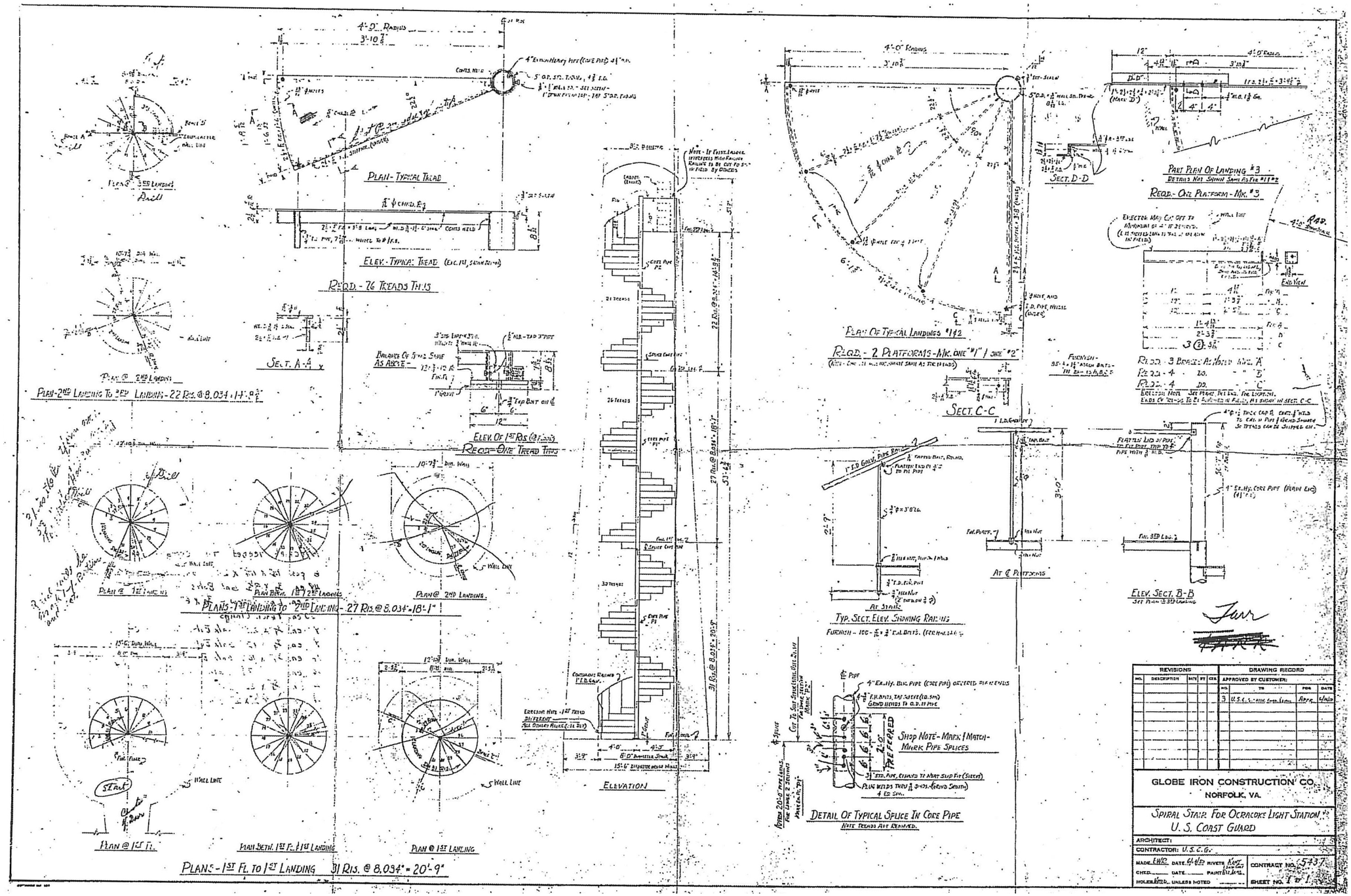
Sheet 1: Drawing sheet, Tower at Ocracoke Light Station, 1892.
Sheet 2: Spiral Stair for Ocracoke Light Station. Shop drawing by Globe Iron Construction Company of Norfolk Virginia, dated June 14, 1953.
Sheet 3: Front Elevation, Keeper's Dwelling, Ocracoke Light Station, 1889.
Sheet 4: Section and East Side Elevation, Keeper's Dwelling, Ocracoke Light Station, 1889.
Sheet 5: First- and Second-Story Plans, Keeper's Dwelling, Ocracoke Light Station, 1889.
Sheet 6: Preliminary plans, elevations and section for "Alteration of Keepers Dwelling at Ocracoke Lt. Sta. N.C.," dated October 28, 1896.
Sheet 7: Plans, elevations and section for "Alteration of Keepers Dwelling at Ocracoke Lt. Sta. N.C.," completed March 1897, dated May 12, 1897.
Sheet 8: Elevations and section, Ocracoke Light Station Keepers' Dwelling, 1929.
Sheet 9: Plans, Ocracoke Light Station Keepers' Dwelling, 1929.
Sheet 10: U.S. Coast Guard Civil Engineering floor plan, date obscured. Date between 1938 shed addition and before December 1955 handwritten notation.
Sheet 11: Electrical Plan, Keepers' Quarters, May 1987.
Sheet 12: Ocracoke Light Station Keepers [sic] Quarters As Built Sketches Floor Support System dated September 28, 1987.

Sheet 13: Plat of Ocracoke Light Station, 1892.
Sheet 14: Plat of Ocracoke Light Station showing well. Based on 1893 survey by Herbert H. Bamber. Office of the Light-House Board, 1905.
Sheet 15: Plat of Ocracoke Light Station, 1897 base drawing updated to 1929.
Sheet 16: Plot plan, Ocracoke Light Station, May 1958.

Drawing sheet, Tower at Ocracoke Light Station, 1892.
(*CAHA Coll.*)

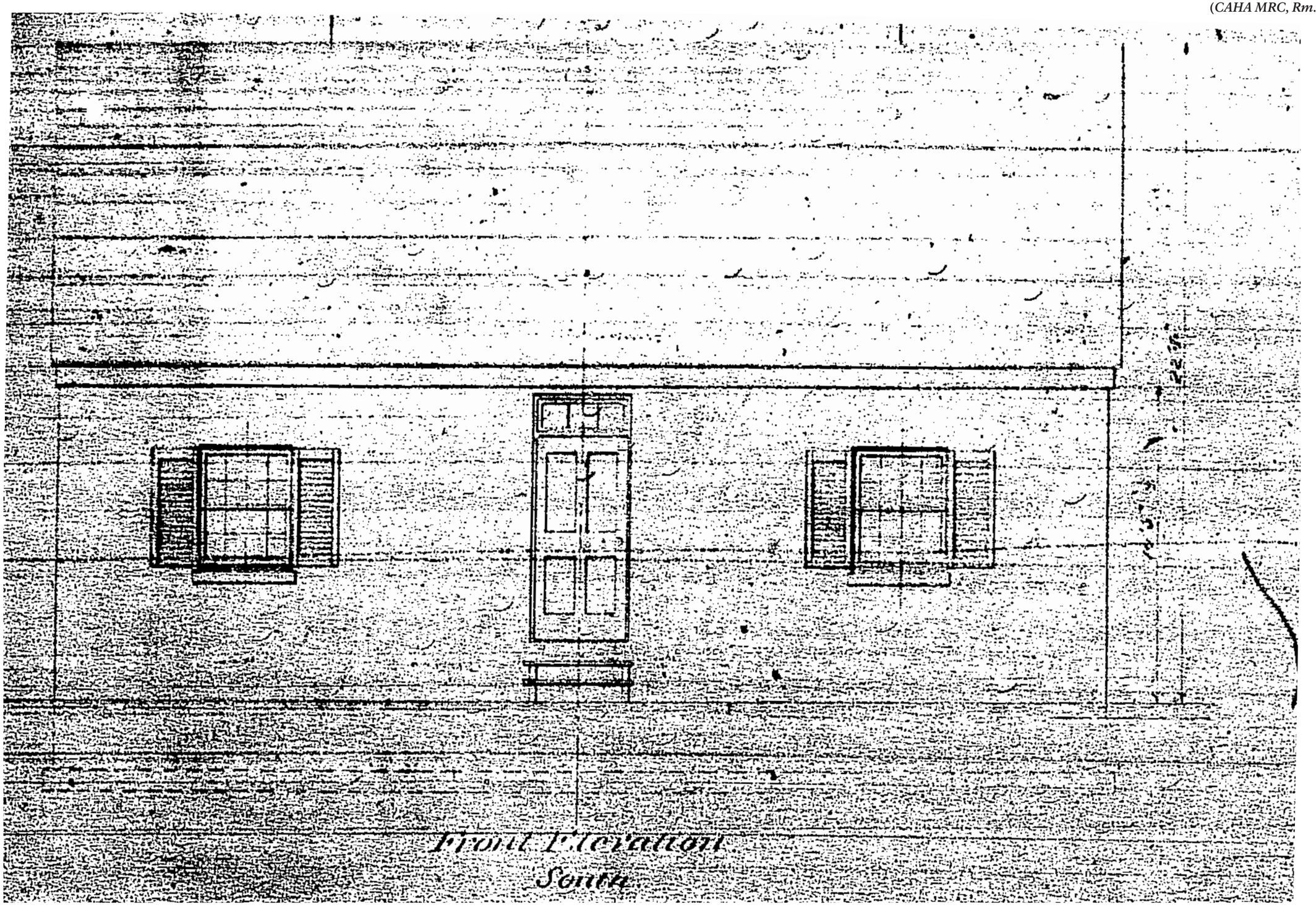


Spiral Stair for Ocracoke Light Station. Shop drawing by Globe Iron Construction Company of Norfolk Virginia, dated June 14, 1953.
(*CAHA MRC, Rm. 1, Map Case 4, Dwr. R*)



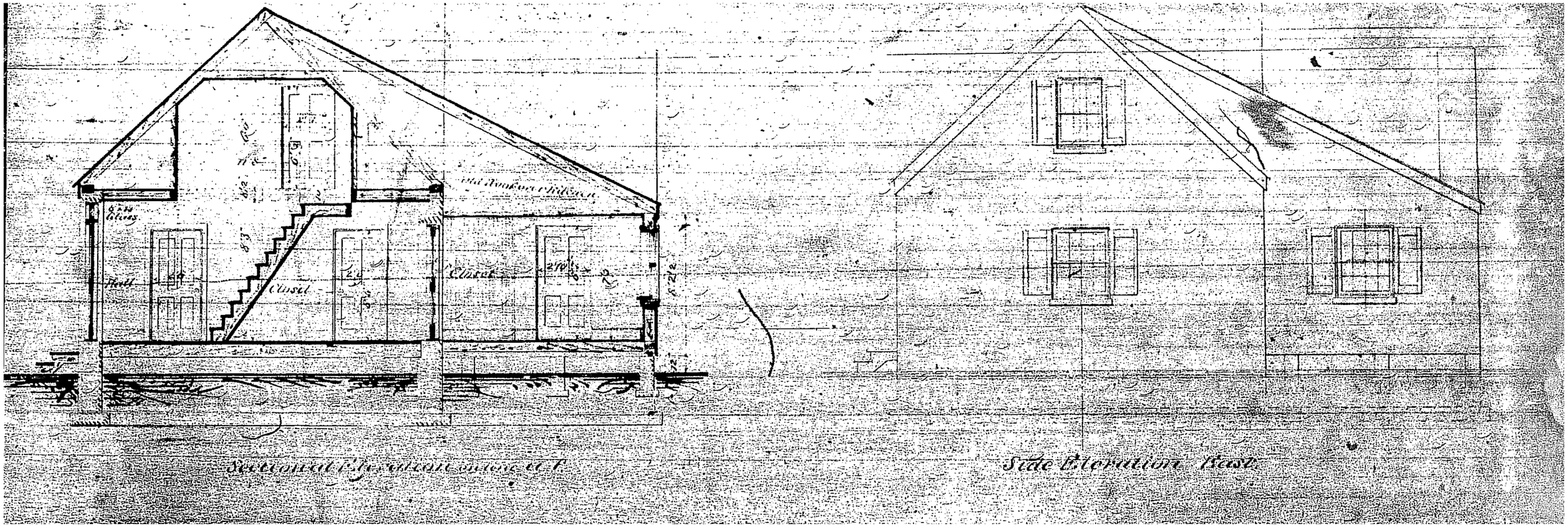
Sheet 2

Front Elevation, Keeper's Dwelling, Ocracoke Light Station, 1889.
(*CAHA MRC, Rm. 1, Map Case 4, Dwr. R*)



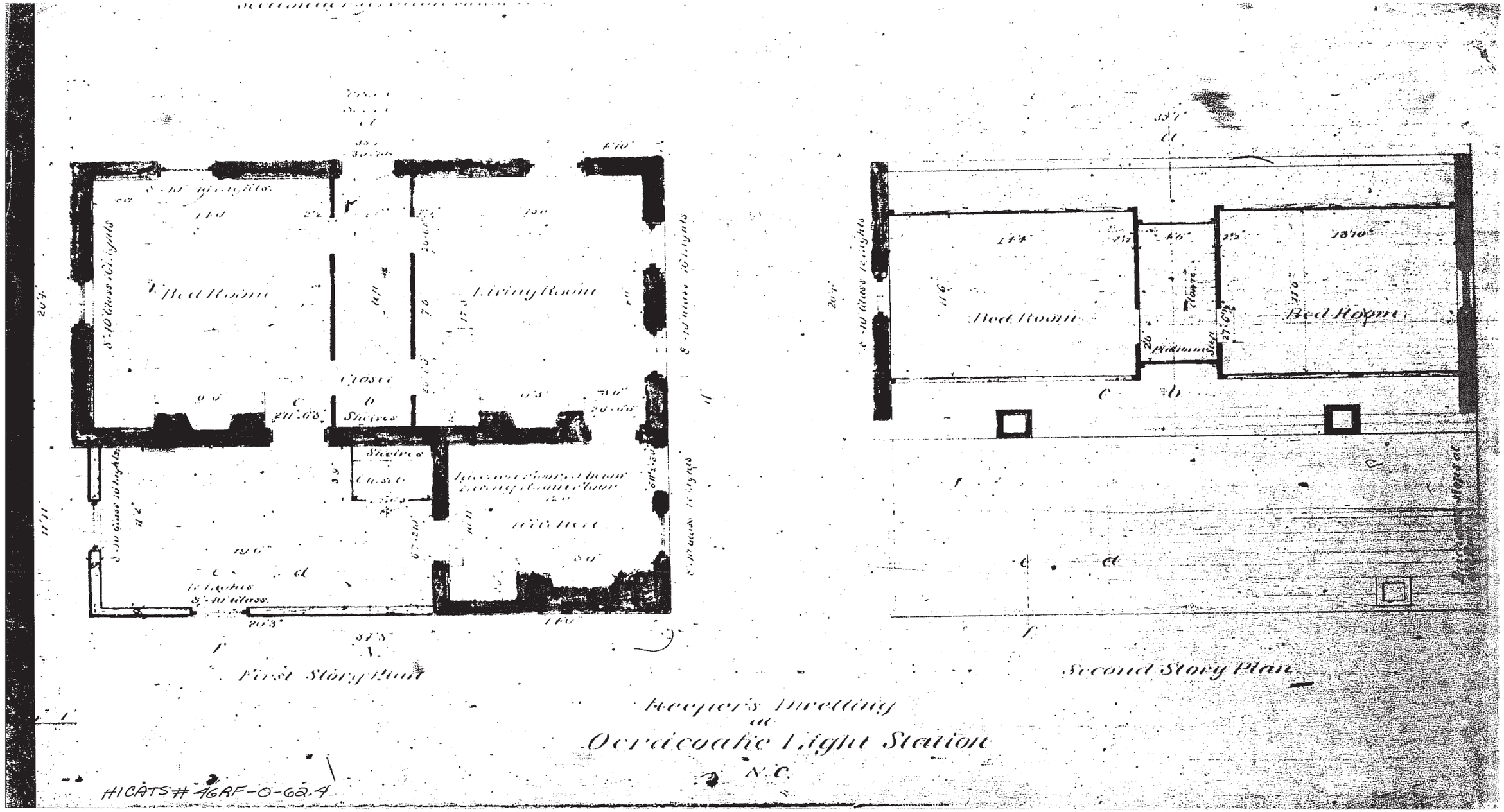
Sheet 3

Section and East Side Elevation, Keeper's Dwelling, Ocracoke Light Station, 1889.
(*CAHA MRC, Rm. 1, Map Case 4, Dwr. R*)



Sheet 4

First- and Second-Story Plans, Keeper's Dwelling, Ocracoke Light Station, 1889.
(*CAHA MRC, Rm. 1, Map Case 4, Dwr. R*)



Sheet 5

Preliminary plans, elevations and section for "Alteration of Keepers Dwelling at Ocracoke Lt. Sta. N.C.," dated October 28, 1896.
(CAHA MRC, Rm. 1, Map Case 4, Dwr. R)

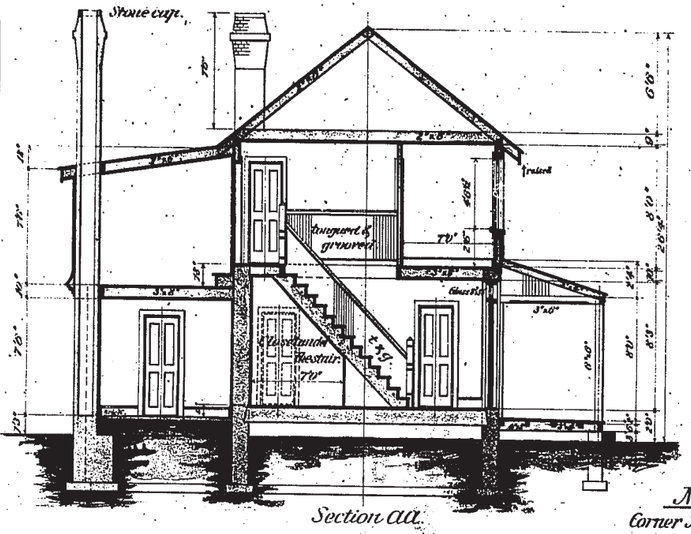


Sheet 6

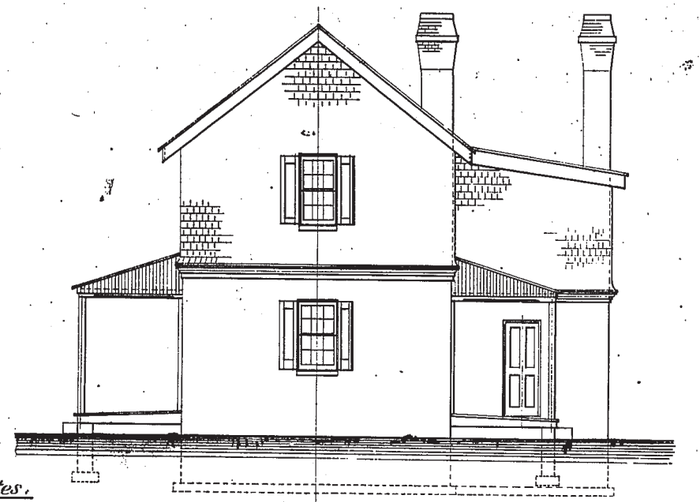
Plans, elevations and section for "Alteration of Keepers Dwelling at Ocracoke Lt. Sta. N.C.," completed March 1897, dated May 12, 1897.
(CAHA MRC, Rm. 1, Map Case 4, Dwr. R)



Front Elevation.

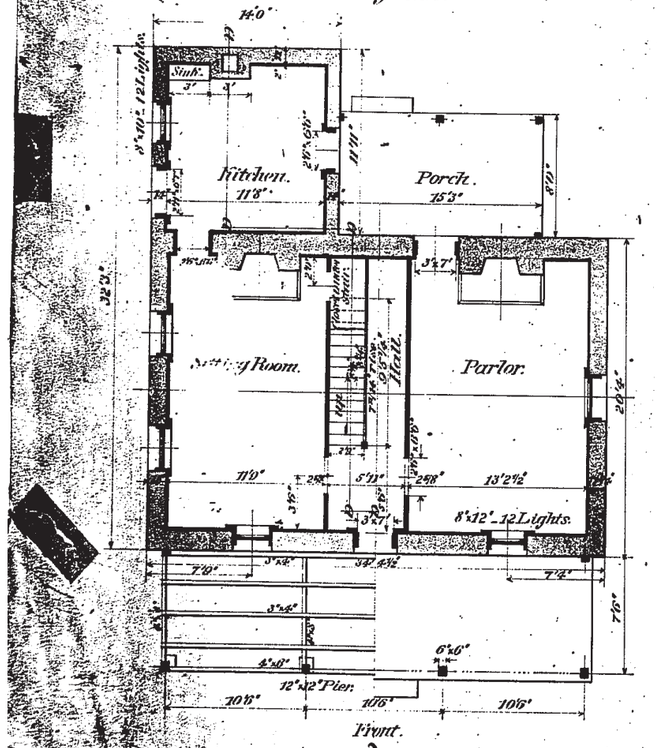


Section aa.

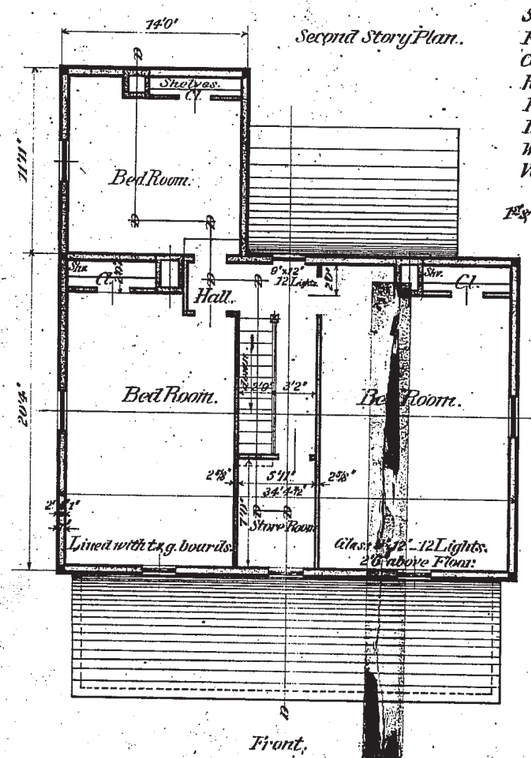


Side Elevation.

First Story Plan.



Second Story Plan.



Notes.

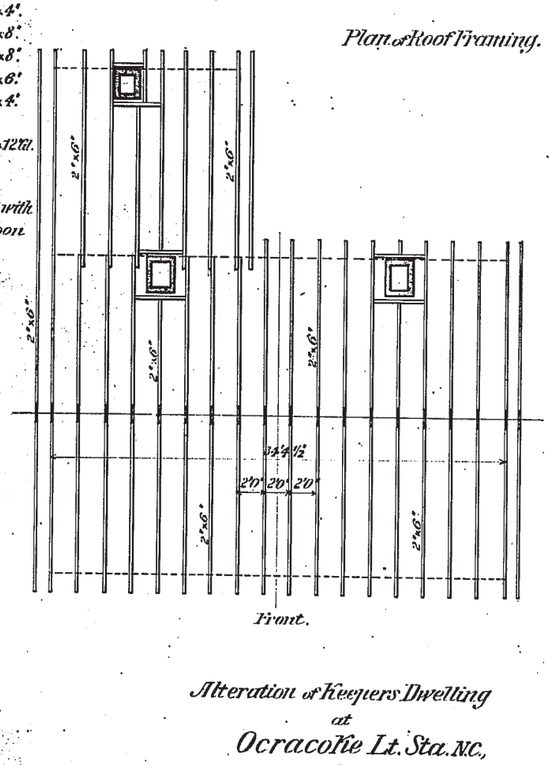
Corner Stud	4"x4".
Interm^te . 16" apart	2"x4".
Sills & Plates.	4"x4".
Floor Joists, 16" apart	3"x8".
Ceiling . , 24" .	2"x8".
Roof Rafter, 24" .	2"x6".
Porch . 24" .	2"x4".
Doors	1⅜"x2'6"x6'6".
Windows, 12 Lights.	9"x12"d.

Venetian Blinds.

1st & 2nd Story to be lined with Virginia Pine - Baloon Framing.

Scale. ¼"=1'.

Plan of Roof Framing.

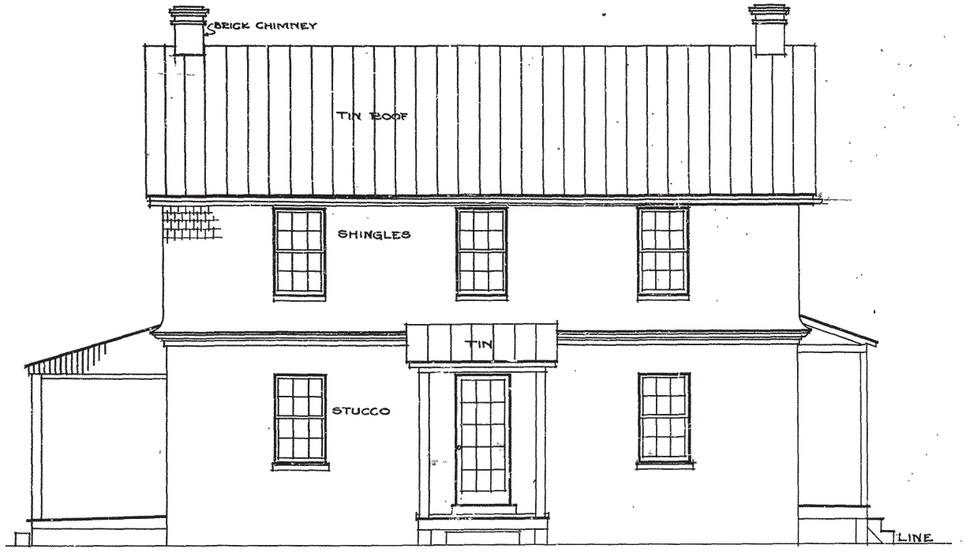


Dimensions given by Mr. John W. Lewis, Superintd.
See also former Drawings.

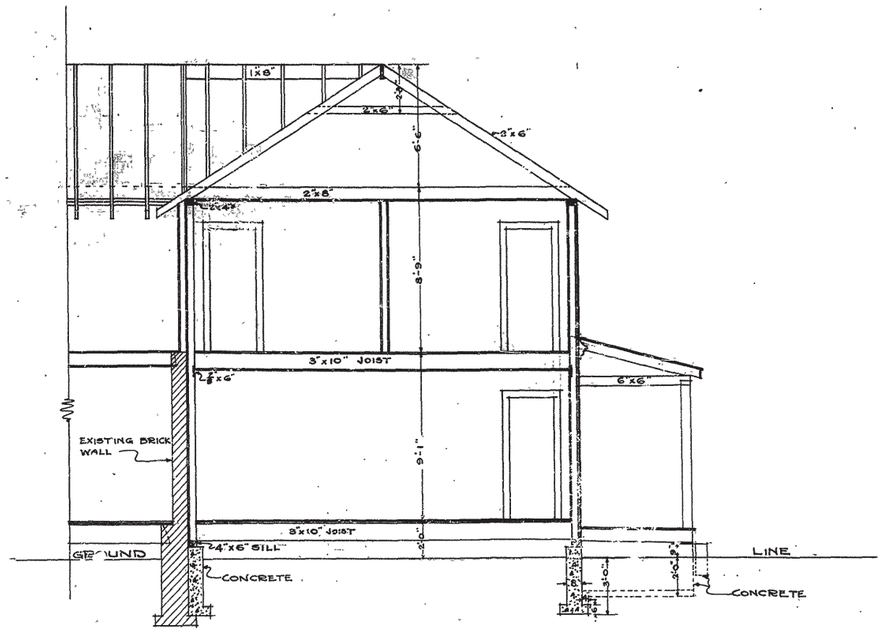
Baltimore, Md. May 12th 1897.

Alteration of Keepers Dwelling at Ocracoke Lt. Sta. NC, made March 1897.

Elevations and section, Ocracoke Light Station Keepers' Dwelling, 1929.
(*CAHA MRC, Rm. 1, Map Case 4, Dwr. R*)



FRONT ELEVATION OF NEW DWELLING



SECTION A-A ON PLAN



FRONT ELEV. OF OLD DWELLING.

OFFICE OF THE LIGHTHOUSE SUPERINTENDENT
FIFTH DISTRICT - BALTIMORE, MD.

OCRACOKE LIGHT STATION, N.C.
KEEPERS' DWELLING

SCALE: 1/4"=1'-0" APPROVED 4-4-29

D.B. Johnson
ENGINEER

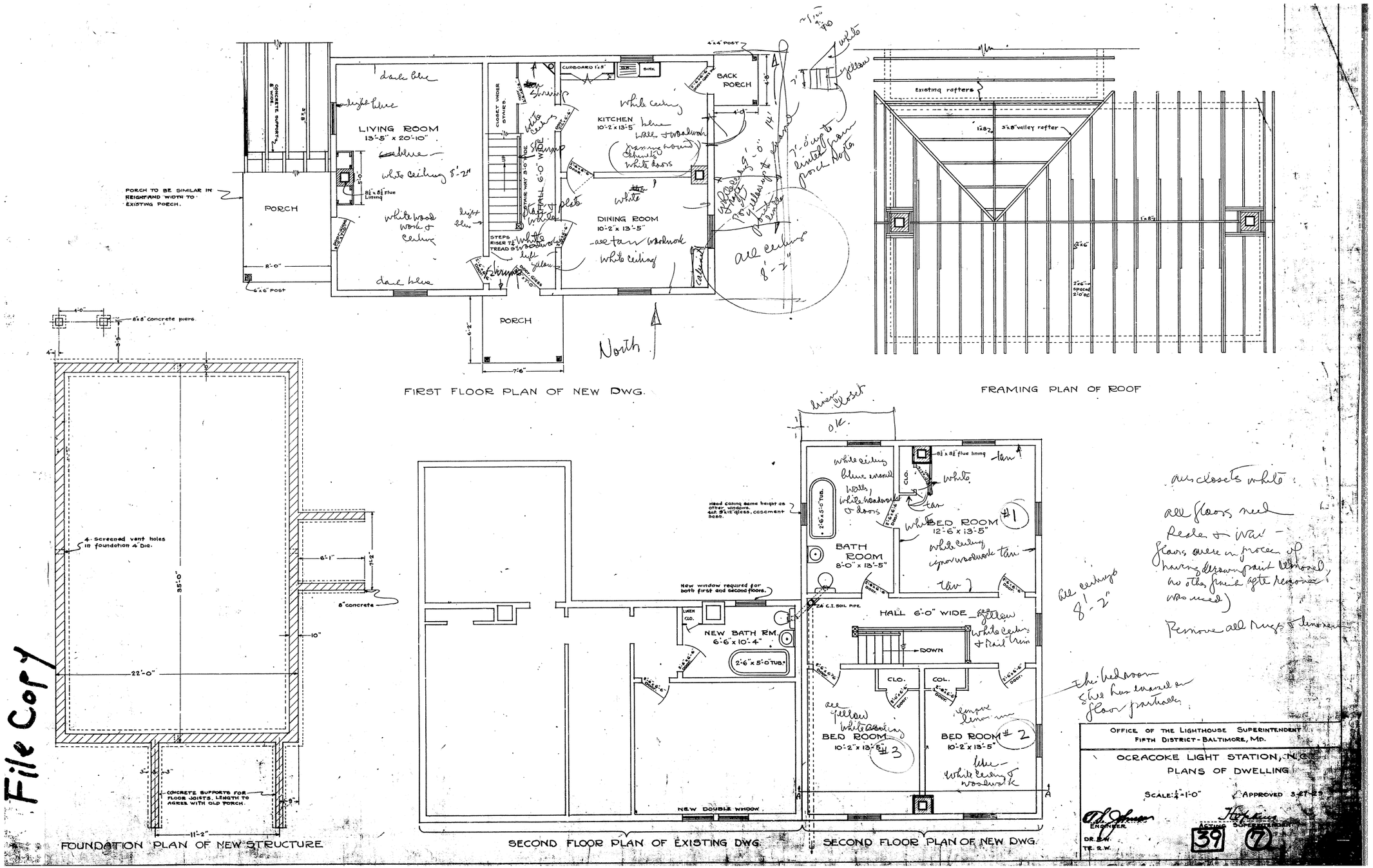
Hopkins
ACTING SUPERINTENDENT

DR. E.W.
TR. E.W.

396

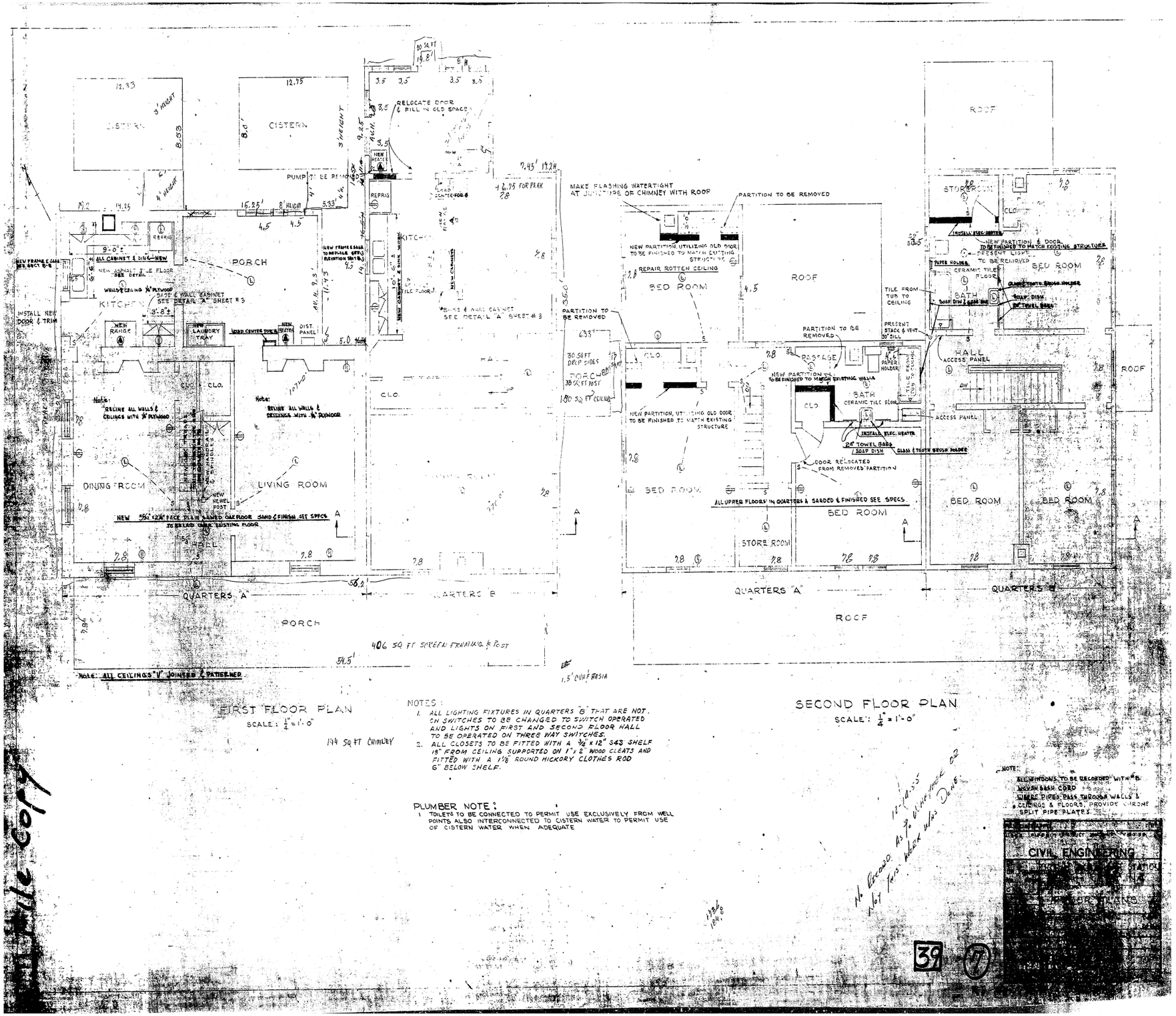
Sheet 8

Plans, Ocracoke Light Station Keepers' Dwelling, 1929.
(*CAHA MRC, Rm. 1, Map Case 4, Dwr. R*)



Sheet 9

U.S. Coast Guard Civil Engineering floor plan, date obscured. Date between 1938 shed addition and before December 1955 handwritten notation.
(*CAHA Coll., 603-9024*)



FIRST FLOOR PLAN
SCALE: 1/4" = 1'-0"

SECOND FLOOR PLAN
SCALE: 1/4" = 1'-0"

NOTES:
1. ALL LIGHTING FIXTURES IN QUARTERS "B" THAT ARE NOT ON SWITCHES TO BE CHANGED TO SWITCH OPERATED AND LIGHTS ON FIRST AND SECOND FLOOR HALL TO BE OPERATED ON THREE WAY SWITCHES.
2. ALL CLOSETS TO BE FITTED WITH A 3/4" X 12" S4S SHELF 18" FROM CEILING SUPPORTED ON 1" X 2" WOOD CLEATS AND FITTED WITH A 1 1/8" ROUND HICKORY CLOTHES ROD 6" BELOW SHELF.

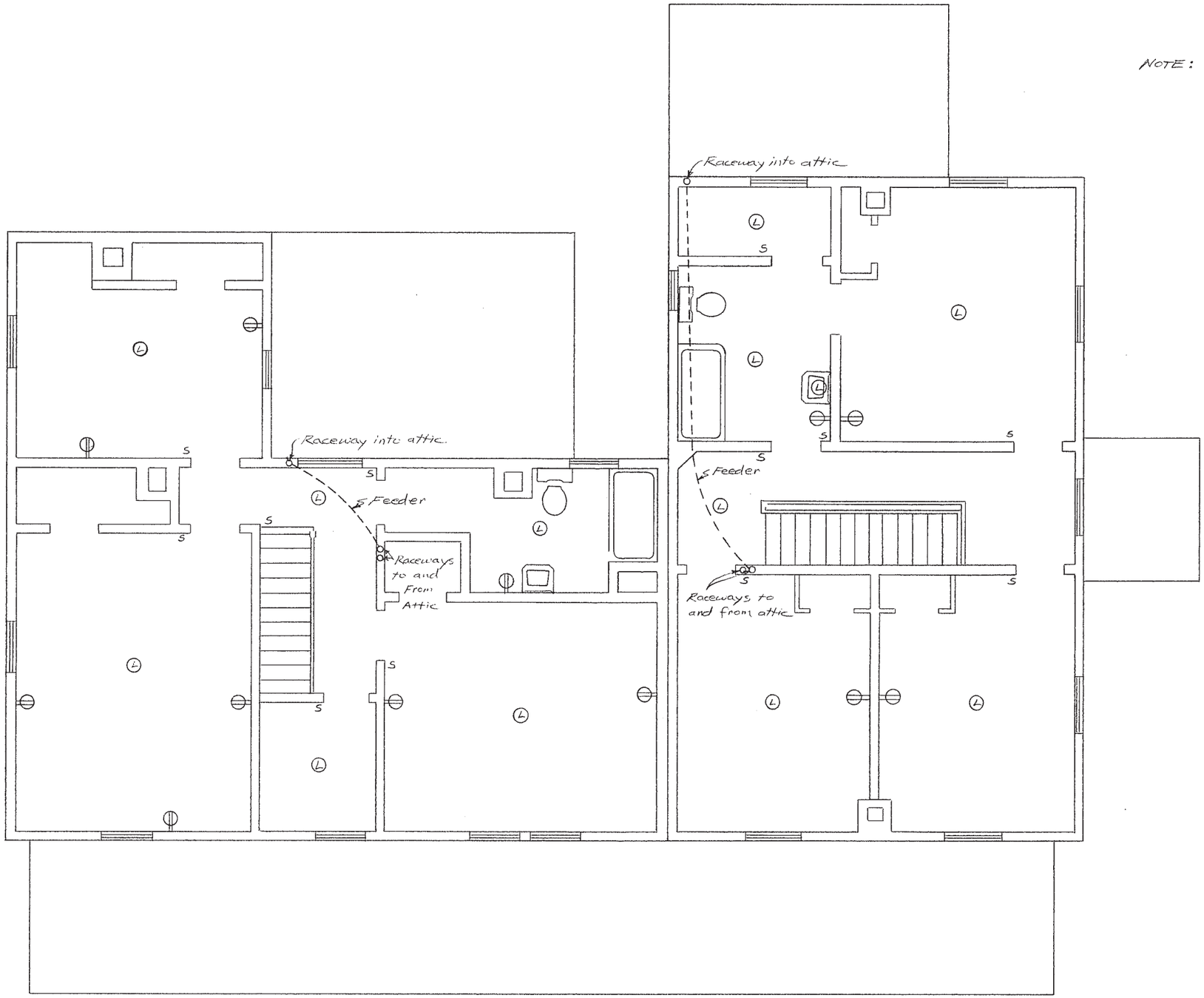
PLUMBER NOTE:
1 TOILETS TO BE CONNECTED TO PERMIT USE EXCLUSIVELY FROM WELL POINTS ALSO INTERCONNECTED TO CISTERN WATER TO PERMIT USE OF CISTERN WATER WHEN ADEQUATE

NOTE: ALL WINDOWS TO BE EQUIPPED WITH 8 MOVEN BRAID CORD WHERE PIPES PASS THROUGH WALLS & CEILINGS & FLOORS, PROVIDE CHROME SPLIT PIPE PLATES.

CIVIL ENGINEERING

Sheet 10

Electrical Plan, Keepers' Quarters, May 1987.
(CAHA MRC, Rm. 1, Map Case 4, Dwr. R)



Sheet 11

Ocracoke Light Station Keepers [*sic*] Quarters As Built Sketches Floor Support System dated September 28, 1987.
(*Completion Report, "Ocracoke Light Station Keeper's [sic] Quarters Preservation Project Phase I," 603-D143*)

CAHA 9-28-87

OCRACOKE LIGHT STATION

KEEPERS QUARTERS AS BUILT SKETCHES FLOOR SUPPORT SYSTEM

▬ = new material

otes Apt. A:

① orig. Floor joists = 3" x 7" 26" O.C.

② supplemental Floor joists = 1½" x 6¾" 26" O.C.

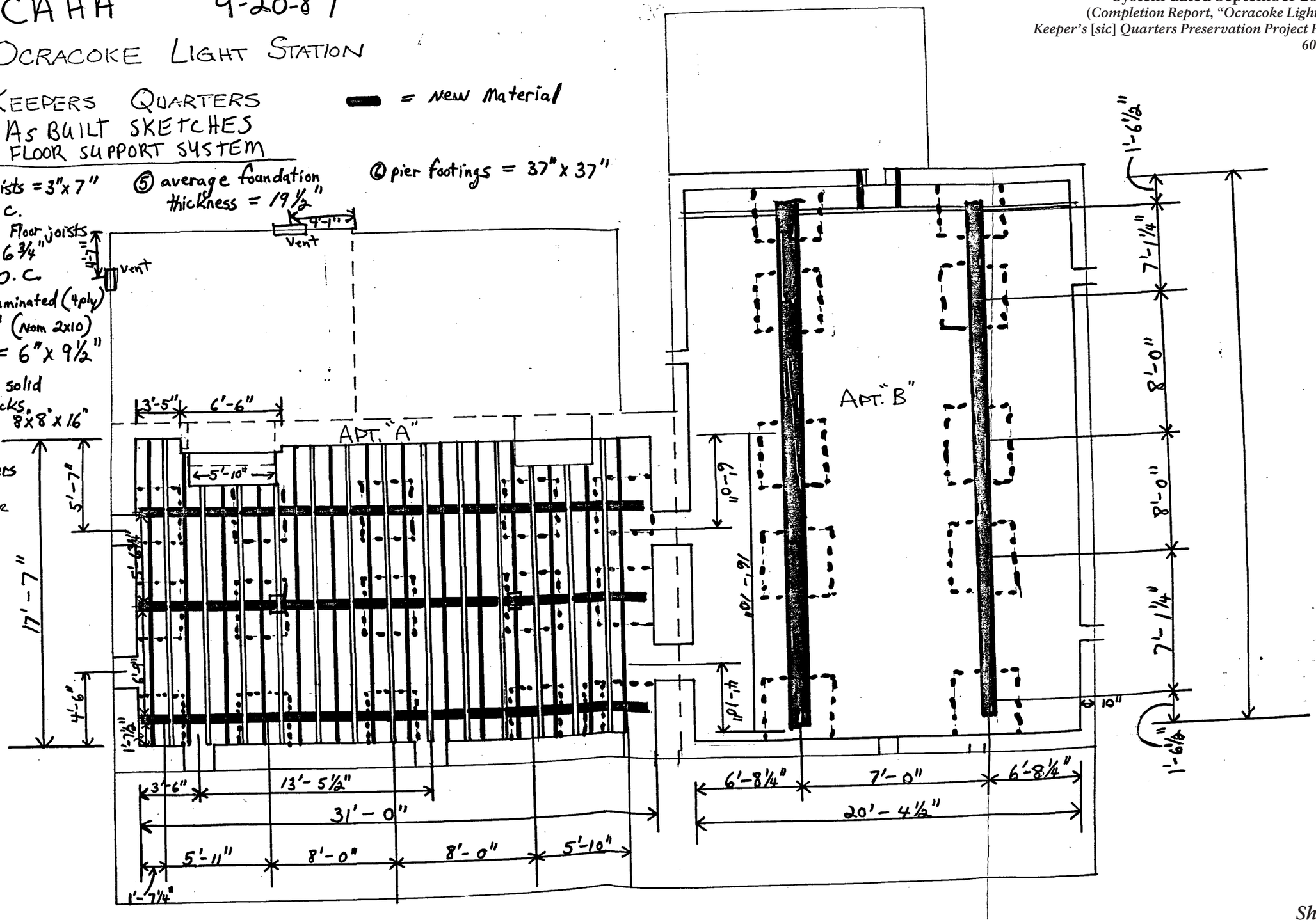
③ girders = laminated (4ply) 1½" x 9½" (Nom 2x10) overall dim. = 6" x 9½"

④ piers = 2 solid masonary blocks, nominal size 8"x8"x16"

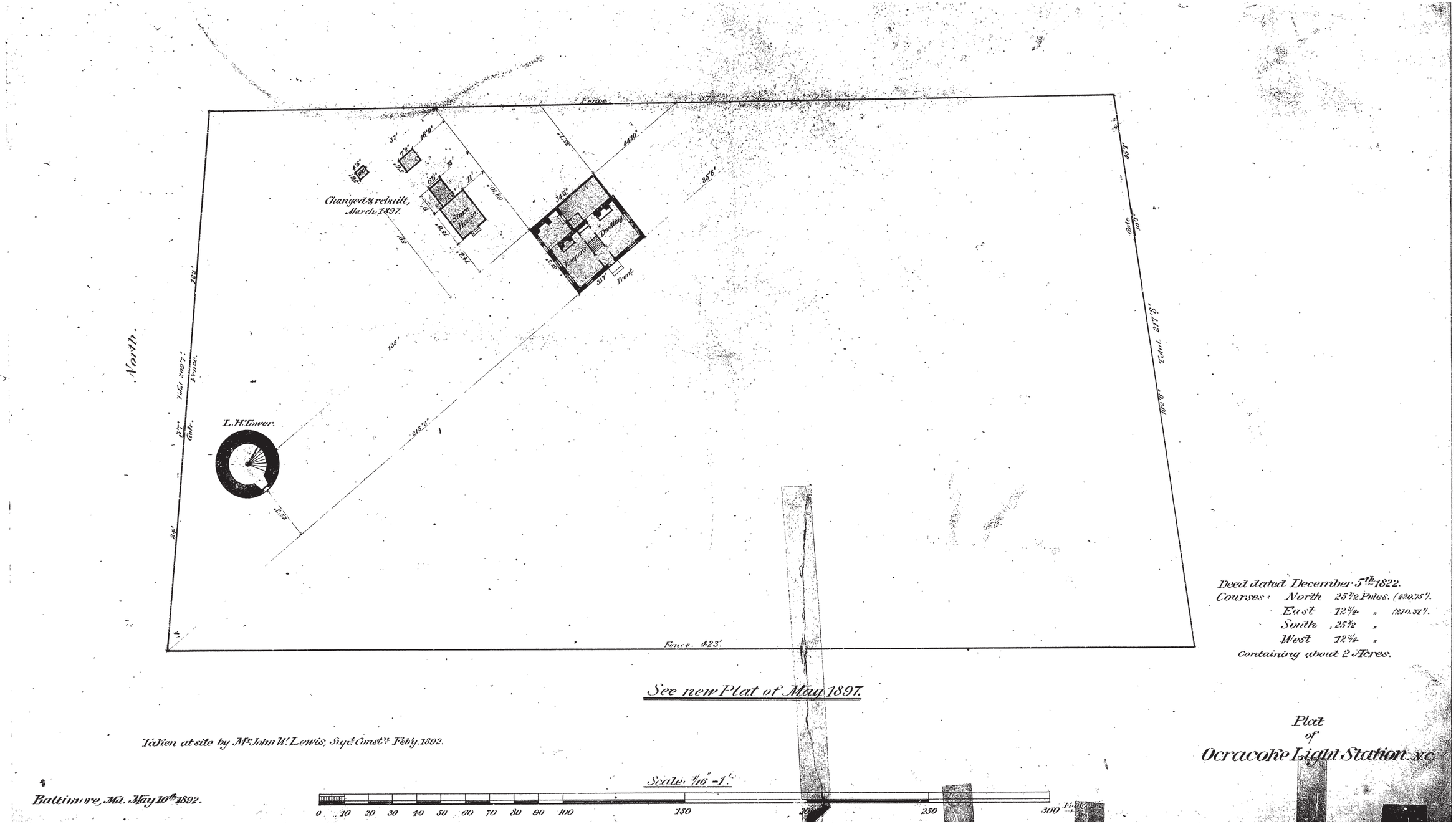
] = orig. brick piers UNDER APT. A CENTER GIRDER

⑤ average foundation thickness = 19½"

⑥ pier footings = 37" x 37"



Plat of Ocracoke Light Station, 1892.
(*USCG, cf2800161*)

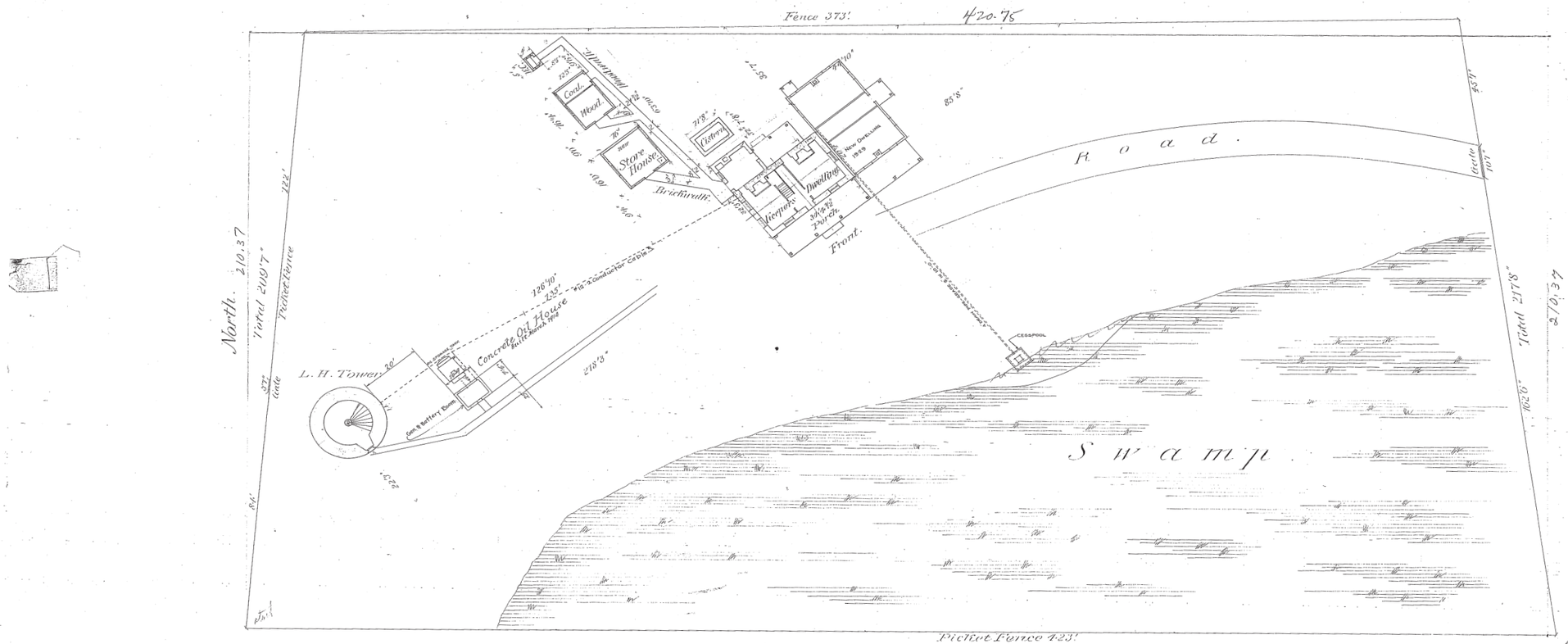




Plat of Ocracoke Light Station showing well. Based on 1893 survey by Herbert H. Bamber. Office of the Light-House Board, 1905. (*USCG, cf2800164*)

Sheet 14

Plat of Ocracoke Light Station,
1897 base drawing updated to 1929.
(*USCG, cf2800162*)



Deed dated December 5th 1822.
Courses: North 25½ Poles, (420.75').
East 12¾ " (210.37').
South 25½ "
West 12¾ "
Containing about 2 Acres.

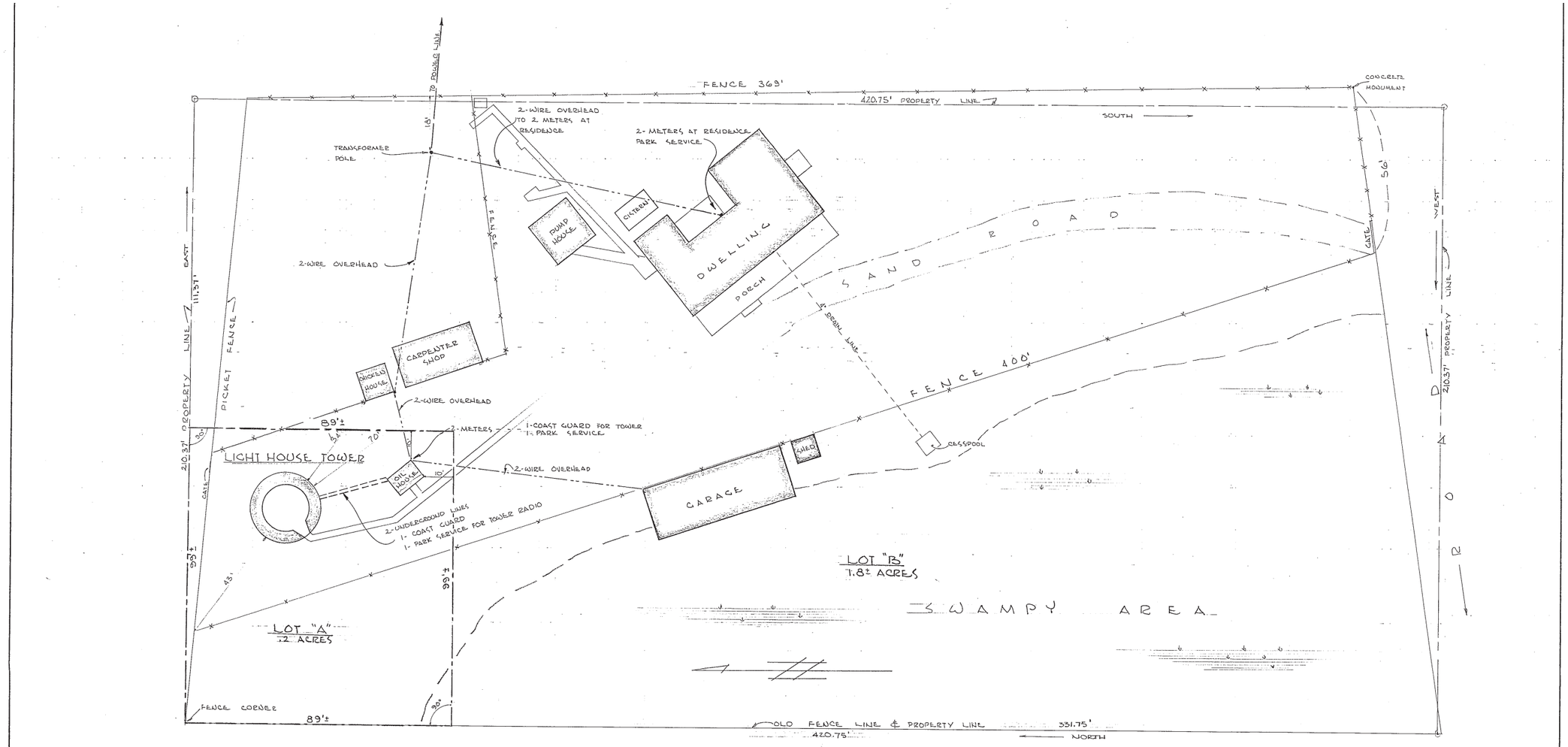
Taken at the site by Mr. John W. Lewis, Supt. Feby 1892 & March 1897.

Scale 1/16 = 1'.

0 10 20 30 40 50 100 150 200 250 300 ft.

Plat
of
Ocracoke Light Station, N.C.
1897.

Plot plan, Ocracoke Light Station, May 1958.
(*USCG, cfnd203301*)



PLOT PLAN
SCALE 1/16"=1'0"

NOTE: LAND PLOT IS COPY OF DRAWING - PLAN OF OCRACOKE LIGHT STATION, N.C. OF MAY 1897, WHICH SUPERSEDES THAT OF MAY 10, 1892

REVISION	DATE	APPD.		BY

U. S. COAST GUARD FIFTH DISTRICT NORFOLK, VA.

CIVIL ENGINEERING

DESIGNED - THOMAS
DRAWN - THOMPSON
TRACED -
CHECKED -

OCRACOKE LIGHT STATION

PLOT PLAN

(TAPE SURVEY OF 7 MAY 1958)

CHIEF OF SECTION

APPROVED: U.S.C.G. CHIEF OF DIVISION

DATE: MAY 14, 1958

C. G. DRAWING NO.
ND-2033

SCALE 1/16"=1'0" SHEET 1 OF 1

Appendix C: 1989 Field Report and Mortar Analysis

Historical Architect and Chief of Historic Preservation for the North Atlantic Regional Office of NPS, E. Blaine Cliver, conducted a field investigation of the lighthouse in April of 1989. His work included a condition assessment, recommendations, and analysis of mortar and paint samples.

This appendix contains Cliver's 1989 field report and an abridged version of his mortar analysis report.

United States Department of the Interior
NATIONAL PARK SERVICE
North Atlantic Region
15 State Street
Boston, Massachusetts 02109-3572

IN REPLY REFER TO:

H30(NAR-PHP)

May 11, 1989

Memorandum

To: Regional Historical Architect, Southeast Regional Office

From: Chief, Historic Preservation, North Atlantic Regional Office

Subject: Trip Report; Ocracoke Lighthouse

On April 25-26, I visited the Ocracoke Lighthouse, in North Carolina, as requested by your Regional Director. When I arrived at the Norfolk airport I met Rene Cote (SERO) and proceeded by rental car to the lighthouse. At the site I met with Bernie Weisgerber (WPTC), Barry Caldwell (SERO), Mac Weaver (park), and Billy Bean (SHPO).

The Ocracoke Light, one of the oldest lighthouses on the South Atlantic Coast, was constructed in 1823. A fourth-order lens was added in 1854. Presumably, the lantern dates from this time, or, possibly from 1864 when the lens was reinstalled (historical information can be found in America's Lighthouses by F. Ross Holland Jr.). However, this type of lantern appears on a lighthouse built later, after the turn of the century, in Hawaii, but, does show on a 1856 structure at Santa Barbara. Archival drawings for standard fourth-order lanterns may indicate a date for this type of lantern and should be pursued for the HSR research.

The lantern is made of cast iron elements and has had the glass replaced with plexiglas. In a conversation with Ross Holland he indicated that the lanterns were changed at the time the Fresnel lens systems were added because the new lens was too large for the old lanterns. Visually, the upper 15 brick courses appear slightly different and indicated that the lighthouse possibly was raised about three feet. Analysis of mortar samples taken from the top 10 interior brick courses (sample # CAHA 1A m02) and from the interior of the dome (sample # CAHA 1A m03) when compared with the general interior brick mortar (sample # CAHA 1A M04) indicate that the mortar of the upper 15 courses and the dome are the same mix as in the main body of the lighthouse, leaving little doubt that the structure was not raised. All three mortars are a basic 2 parts of sand to 1 part of lime. The sand appears to be beach sand as might be expected. Mortar taken from the vent(?) patching (sample # CAHA 1A m01) is of a different mix, 4.5 parts of sand to 1 part of lime, indicating this work was done at a different time period. A sample not taken which might indicate a mix for the time of the lantern installation is from the lantern drum. If a sample can be taken from the lantern drum mortar, I would be happy to analyze it and compare it with the other samples.

The main body of the lighthouse is constructed of brick, judging from the interior, and now is coated on the exterior with a cement parging, probably Gunite or a similar process. Evidence remains in the interior brick of the original wooden(?) stair with landings which is stated to have been replaced in 1950 by the existing steel stair. This evidence of the earlier stair consists of pockets in the brick, now fill with a cement mortar. Under some of this cement mortar which was spread on the brick face can be found traces of numerous coats of white wash which once coated the interior brick surface. This coating was removed by sand blasting after the steel stair had been installed since the patches over the pockets from the original stair have evidence of sand blasting as well. Since the windows and woodwork have been replaced recently through a Coast Guard contract, it was not possible to sample the interior woodwork for paint chronologies before c.1950. Paint samples taken from a piece of wood facia found under the floor of the old tool house show a cream followed by greys, grey-greens, red and black. Since the context of the facia is unknown, the sample is of little value. However, it should be pointed out that because of the length of the facia it was most likely from a door and because of the sand found imbedded in the paint layers, it probably came from an exterior door frame. Also, it should be noted that there is evidence of earlier cement patches around some of the original stair pockets; probably the result of repairs.

On the exterior, the cement parging appears to be in good condition with little evidence of cracking or delaminating. However, on the interior cracks can be seen over the window and door lintals. The nature of these cracks indicate that the lintals have settled or crushed at the bearing ends as the result of decay and termite action. It should be possible to replace these in-kind or to do epoxy repairs or both. The main problem on the interior, the growth of algae on the upper half of the brick surface, is the result of poor ventilation. At the time the present stair was installed (1950), a new steel hatch and concrete floor were installed at the lantern level. This effectively closed off the previous openings for ventilating the interior of the lighthouse body and allowed moisture to rise and condense on the brick surface. If this was the result of moisture penetrating the wall, the algae would be found on the lower interior brick surface. It is strongly recommended that the Coast Guard keep the hatch in the lantern floor open, and, or, open the upper-most window, installing louvers, so that better ventilation is provided.

Although not in a bad state of deterioration the lantern has sufferred most from weather and salt. Rust jacking has caused the cast iron dome roof to lift on one side more than the other and the resulting gap has been patched over the years with a cement mortar. Judging from rust streaking, this joint continues to leak. Several of the lantern mullions show deterioration from rust, though this is limited. These mullions are composed of two elements which sandwiched the glass between them and were fastened to each other with a tongue and groove joint, both sections being anchored in place by cast iron wedge pins through the joint. It is recommended that the rusted sections and pitting on the cast iron be repaired with epoxy auto body filler. This is a material well suited for this purpose and well tested in the field. Prior to doing these repairs all of the metal of the lantern should be sand blasted to clean off all

paint and rust. Obviously, this process may have to move in sections because of the tendency for the metal to begin rusting rapidly in the coastal environment. When the cleaning of the metal is done, it is recommended that the cast iron dome be lifted with jacks around the perimeter and the cement fill cleaned out. A piece of neoprene can be inserted where the dome rests on the cast iron ring, to seal this joint, before resetting the dome. Prior to installing the glass, the metal should painted with a three-coat system. The following is recommended for these coatings:

1. First Coat - a zinc rich epoxy paint.

2. Second Coat - a marine epoxy primer.

3. Third Coat - a marine epoxy boat finish (black).

When needed the exterior of the masonry portion of the lighthouse can be painted with a good quality latex paint system.

The Ocracoke Light is an interesting site and it is hoped that this visit will help contribute to improved maintenance and care for the structure. To accomplish this the Coast Guard will have to be made more aware of the conditions and the implications of the lack of ventilation. Much of the information contained in this memorandum was put on video tape and should be available to you. Please contact me if you have any questions.

E. Blaine Cliver

cc. C. Clapper
B. Weisgerber
Regional Director, SERO

APPENDIX B

MORTAR ANALYSIS

Mortar analysis was performed under the direction of Blaine Cliver, Chief, Historic Preservation, North Atlantic Regional Office. The following summaries and excerpts are from his report to the Southeast Region's Historic Architecture Division.

Tower Interior

Sample #'s:

CAHA 1A m01- Mortar taken from vertical brick patches (possibly vents) found in the upper 16 brick courses. (See photo #18)
CAHA 1A m02- Mortar taken from the top ten courses of brick.
CAHA 1A m03- Mortar taken from dome ceiling
CAHA 1A m04- Mortar from general interior of tower

The visual appearance of the brick coursing in the top sixteen courses of the tower is markedly different from the rest of the tower. Analysis of the mortar samples taken from the top 10 interior brick courses and from the interior of the dome when compared with the general interior brick mortar indicate that the same mix was used. All three mortars are a basic 2 parts of sand to 1 part of lime. The sand appears to be beach sand as might be expected.

"Mortar taken from the vertical brick patches is of a different mix, 4.5 parts of sand to 1 part lime indicating that this work was done at a different time period."

Lantern Drum Interior

CAHA 1A m005- Mortar from interior of lantern drum- South elevation
CAHA 1A m006- Parging on the interior of drum

"...samples from the lantern drum, as compared to those previously analyzed from the tower, might indicate whether the existing lantern was of the same or later date as the tower. Analysis of the lantern samples shows the lantern to be of a later date than the tower (1823)."

"Certainly, the lantern as described in the specifications [for the construction of the lighthouse at Ocracoke] is not the lantern presently in place at Ocracoke, since it calls for seven 21 pane sash set in an octagonal form; the eighth side being the door. This information would lead to the conclusion that the present lantern is not the original."

"The mortar of the tower is composed of lime and sand in a 2 to 1 mix. Both the mortar and parging from the interior of the lantern drum are composed of a mix using a natural cement. It is unlikely that natural cement would have been employed in 1823, especially if used in the drum and not in the tower body. More likely, the lantern drum was rebuilt when the Fresnel lens was installed at mid-century as the use of natural cement was common at this time in shore facilities such as fortifications. Therefore, it can be said that the lantern and drum date from the installation of the first Fresnel lens; it is not certain that the existing lens is the first."

Tower Exterior

CAHA 1A m007- Gunite on west exterior at base

The Gunite mix consists of 2 parts Portland cement, 5 parts sand and 1 part lime.

DATA

Sample #: CAHA 1A m01

Sample Location: Vent fill mortar

	INPUT
1. Sample Character: SOFT	2
2. Wt. of Beaker(grams)= 183.3	183.3
3. Wt. of Sample(grams)= 20	20
4. Barometric Pressure(mm)= 750	750
5. Temperature(C)= 24	24
6. CO2 Released(Liters)= .68	.68
7. Filtrate Color-AMBER	1
8. Fines Color-TAN	1
9. Hair or Fiber is not present	2
10. Wt. of Filter Paper & Sand(after drying)= 3.25	3.25
11. Wt. of Filter Paper(after drying)= 3	3
12. Wt. of Sand & Beaker(after drying)= 200	200
13. cc of Sand= 10.5	10.5
14. Wt. of Graduated Cylinder with Sand= 56.11	56.11
15. Wt. of Graduated Cylinder= 40.45	40.45
16. There is not SHELL in the Sand	2

SOLUBLE FRACTION ANALYSIS OF SAMPLE #:CAHA 1A m01

CO2 Gain = 86 %
(CO2 in mix/amount needed to convert all Ca(OH) to CaCO2)
Fines = 9 %
(Wt. of FINES/Wt. of LIME)

Wt. of FINES = .25 grams
Wt. of SAND = 16.69 grams
Wt. of Ca(OH)2 = 2.33 grams

% FINES by wt. = 1 %
% SAND by wt. = 86 %
% Ca(OH)2 by wt. = 12 %

SAND is assumed to contain 1 % Fine Material

Parts/volume of SAND = 58
Parts/volume of LIME = 13

DATA

Sample #: caha 1a m02

Sample Location: Mortar-interior top 10 courses

	INPUT
1. Sample Character: SOFT	2
2. Wt. of Beaker(grams)= 189.87	189.87
3. Wt. of Sample(grams)= 20	20
4. Barometric Pressure(mm)= 750	750
5. Temperature(C)= 24	24
6. CO2 Released(Liters)= .81	.81
7. Filtrate Color-AMBER	1
8. Fines Color-TAN	1
9. Hair or Fiber is not present	2
10. Wt. of Filter Paper & Sand(after drying)= 3.33	3.33
11. Wt. of Filter Paper(after drying)= 3.01	3.01
12. Wt. of Sand & Beaker(after drying)= 204.65	204.65
13. cc of Sand= 10	10
14. Wt. of Graduated Cylinder with Sand= 55.18	55.18
15. Wt. of Graduated Cylinder= 40.45	40.45
16. There is not SHELL in the Sand	2

SOLUBLE FRACTION ANALYSIS OF SAMPLE #:caha 1a m02

CO2 Gain = 59 %
(CO2 in mix/amount needed to convert all Ca(OH) to CaCO2)
Fines = 7 %
(Wt. of FINES/Wt. of LIME)

Wt. of FINES = .31 grams
Wt. of SAND = 14.77 grams
Wt. of Ca(OH)2 = 4.04 grams

% FINES by wt. = 1 %
% SAND by wt. = 77 %
% Ca(OH)2 by wt. = 21 %.

SAND is assumed to contain 1 % Fine Material

Parts/volume of SAND = 53
Parts/volume of LIME = 24

DATA

Sample #: CAHA 1A m03

Sample Location: Dome mortar

	INPUT
1. Sample Character: HARD	1
2. Wt. of Beaker(grams)= 195.24	195.24
3. Wt. of Sample(grams)= 20	20
4. Barometric Pressure(mm)= 750	750
5. Temperature(C)= 23	23
6. CO2 Released(Liters)= 1.45	1.45
7. Filtrate Color-AMBER	1
8. Fines Color-TAN	1
9. Hair or Fiber is not present	2
10. Wt. of Filter Paper & Sand(after drying)= 4.18	4.18
11. Wt. of Filter Paper(after drying)= 3.8	3.8
12. Wt. of Sand & Beaker(after drying)= 208.94	208.94
13. cc of Sand= 9.399999	9.399999
14. Wt. of Graduated Cylinder with Sand= 54.02	54.02
15. Wt. of Graduated Cylinder= 40.45	40.45
16. There is not SHELL in the Sand	2

SOLUBLE FRACTION ANALYSIS OF SAMPLE #:CAHA 1A m03

CO2 Gain = 98 %
(CO2 in mix/amount needed to convert all Ca(OH) to CaCO2)

Fines = 7 %
(Wt. of FINES/Wt. of LIME)

Wt. of FINES = .37 grams
Wt. of SAND = 13.69 grams
Wt. of Ca(OH)2 = 4.39 grams

% FINES by wt. = 2 %
% SAND by wt. = 74 %
% Ca(OH)2 by wt. = 23 %

SAND is assumed to contain 1 % Fine Material

Parts/volume of SAND = 52
Parts/volume of LIME = 27

DATA

Sample #: CAHA 1A m04

Sample Location: Interior brick mortar

	INPUT
1. Sample Character: SOFT	2
2. Wt. of Beaker(grams)= 224.5	224.5
3. Wt. of Sample(grams)= 20	20
4. Barometric Pressure(mm)= 612	612
5. Temperature(C)= 24	24
6. CO2 Released(Liters)= .7	.7
7. Filtrate Color-AMBER	1
8. Fines Color-TAN	1
9. Hair or Fiber is not present	2
10. Wt. of Filter Paper & Sand(after drying)= 3.1	3.1
11. Wt. of Filter Paper(after drying)= 3	3
12. Wt. of Sand & Beaker(after drying)= 239.1	239.1
13. cc of Sand= 11	11
14. Wt. of Graduated Cylinder with Sand= 54	54
15. Wt. of Graduated Cylinder= 39.62	39.62
16. There is not SHELL in the Sand	2

SOLUBLE FRACTION ANALYSIS OF SAMPLE #:CAHA 1A m04

CO2 Gain = 36 %
(CO2 in mix/amount needed to convert all Ca(OH) to CaCO2)
Fines = 2 %
(Wt. of FINES/Wt. of LIME)

Wt. of FINES = 9.000001E-02 grams
Wt. of SAND = 14.6 grams
Wt. of Ca(OH)2 = 4.7 grams

% FINES by wt. = 0 %
% SAND by wt. = 75 %
% Ca(OH)2 by wt. = 24 %

Parts/volume of SAND = 57
Parts/volume of LIME = 27

DATA

Sample #: CAHA 1A m005

Sample Location: Interior of lantern drum - South elevation

	INPUT
1. Sample Character: SOFT	2
2. Wt. of Beaker(grams)= 195.25	195.25
3. Wt. of Sample(grams)= 17.84	17.84
4. Barometric Pressure(mm)= 768	768
5. Temperature(C)= 25.5	25.5
6. CO2 Released(Liters)= .77	.77
7. Filtrate Color-GREEN/YELLOW	2
8. Fines Color-TAN	1
9. Hair or Fiber is not present	2
10. Wt. of Filter Paper & Sand(after drying)= 4.53	4.53
11. Wt. of Filter Paper(after drying)= 3.32	3.32
12. Wt. of Sand & Beaker(after drying)= 201.29	201.29
13. cc of Sand= 4.2	4.2
14. Wt. of Graduated Cylinder with Sand= 46.28	46.28
15. Wt. of Graduated Cylinder= 40.45	40.45
16. There is not SHELL in the Sand	2

SOLUBLE FRACTION ANALYSIS OF SAMPLE #:CAHA 1A m005

CO2 Gain = 24 %
(CO2 in mix/amount needed to convert all Ca(OH) to CaCO2)
Fines = 11 %
(Wt. of FINES/Wt. of LIME)

Wt. of FINES = 1.21 grams
Wt. of SAND = 6.03 grams
Wt. of Ca(OH)2 = 9.76 grams

% FINES by wt. = 7 %
% SAND by wt. = 35 %
% Ca(OH)2 by wt. = 57 %

Parts/volume of NATURAL CEMENT = 34
Parts/volume of SAND = 25
Parts/volume of LIME = 26

DATA
Sample #: CAHA 1A m006

Sample Location: Parging on the interior of drum - S elevation

	INPUT
1. Sample Character: HARD	1
2. Wt. of Beaker(grams)= 224.45	224.45
3. Wt. of Sample(grams)= 20.39	20.39
4. Barometric Pressure(mm)= 768	768
5. Temperature(C)= 25.5	25.5
6. CO2 Released(Liters)= 1.81	1.81
7. Filtrate Color-AMBER	1
8. Fines Color-TAN	1
9. Hair or Fiber is not present	2
10. Wt. of Filter Paper & Sand(after drying)= 4.83	4.83
11. Wt. of Filter Paper(after drying)= 2.81	2.81
12. Wt. of Sand & Beaker(after drying)= 230.37	230.37
13. cc of Sand= 4.3	4.3
14. Wt. of Graduated Cylinder with Sand= 46.33	46.33
15. Wt. of Graduated Cylinder= 40.45	40.45
16. There is not SHELL in the Sand	2

SOLUBLE FRACTION ANALYSIS OF SAMPLE #:CAHA 1A m006

CO2 Gain = 52 %
(CO2 in mix/amount needed to convert all Ca(OH) to CaCO2)
Fines = 16 %
(Wt. of FINES/Wt. of LIME)

Wt. of FINES = 2.02 grams
Wt. of SAND = 5.91 grams
Wt. of Ca(OH)2 = 10.51 grams

% FINES by wt. = 10 %
% SAND by wt. = 32 %
% Ca(OH)2 by wt. = 57 %

Parts/volume of NATURAL CEMENT = 43
Parts/volume of SAND = 23
Parts/volume of LIME = 19

DATA

Sample #: CAHA 1A m007

Sample Location: Gunite on west exterior at base

	INPUT
1. Sample Character: HARD	1
2. Wt. of Beaker(grams)= 219.81	219.81
3. Wt. of Sample(grams)= 20.48	20.48
4. Barometric Pressure(mm)= 768	768
5. Temperature(C)= 25.5	25.5
6. CO2 Released(Liters)= .58	.58
7. Filtrate Color-GREEN/YELLOW	2
8. Fines Color-GRAY	2
9. Hair or Fiber is not present	2
10. Wt. of Filter Paper & Sand(after drying)= 4.03	4.03
11. Wt. of Filter Paper(after drying)= 3.06	3.06
12. Wt. of Sand & Beaker(after drying)= 233.49	233.49
13. cc of Sand= 8.899999	8.899999
14. Wt. of Graduated Cylinder with Sand= 54.01	54.01
15. Wt. of Graduated Cylinder= 40.45	40.45
16. There is not SHELL in the Sand	2

SOLUBLE FRACTION ANALYSIS OF SAMPLE #:CAHA 1A m007

CO2 Gain = 33 %
(CO2 in mix/amount needed to convert all Ca(OH) to CaCO2)
Fines = 15 %
(Wt. of FINES/Wt. of LIME)

Wt. of FINES = .97 grams
Wt. of SAND = 13.68 grams
Wt. of Ca(OH)2 = 5.2 grams

% FINES by wt. = 4 %
% SAND by wt. = 69 %
% Ca(OH)2 by wt. = 26 %

Parts/volume of PORTLAND CEMENT = 17
Parts/volume of SAND = 45
Parts/volume of LIME = 9